

1. Family 89915862 (US2023357084 AA)

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Title (EP3954668 A1)

[EN] TWO STEP CARBONATION HARDENING OF HYDRAULIC CEMENT BASED CONCRETE

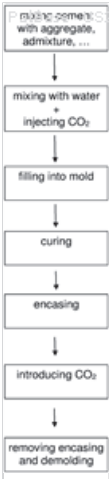
Abstract (EP3954668 A1)

[EN] Method for manufacturing concrete parts comprising the steps:- providing a hydraulic cement and aggregate- mixing the cement and aggregate with water to provide a fresh concrete- introducing CO<sub>2</sub> into the fresh concrete in an amount resulting in a carbonation degree of less than 5 wt.- percent of the total carbonatable Ca and Mg phases which are calculated as  $0.785 \times (\text{CaO} - 0.56 \text{ CaCO}_3 - 0.7 \text{ SO}_3) + 1.091 \times (\text{MgO} - 0.479 \text{ MgCO}_3)$  for a first carbonation step- curing the fresh concrete until at least 15 wt.- percent of the calcium aluminates are hydrated to provide a green concrete part- subjecting the green concrete part to CO<sub>2</sub> in an amount resulting in a carbonation degree of more than 10 wt.- percent for a final carbonation step, and- storing the part for 0.5 hours to 28 days for further hydration of not-yet carbonated, not-yet hydrated cement to provide the concrete part. and concrete parts obtainable with the method.

1st Main Claim (EP3954668 A1)

[EN] 1. A method for manufacturing concrete parts comprising the steps:

- - providing a hydraulic cement and aggregate
- - mixing the cement and aggregate with water to provide a fresh concrete
- - introducing CO<sub>2</sub> into the fresh concrete in an amount resulting in a carbonation degree of less than 5 wt.- percent of the total carbonatable Ca and Mg phases which are calculated as  $0.785 \times (\text{CaO} - 0.56 \text{ CaCO}_3 - 0.7 \text{ SO}_3) + 1.091 \times (\text{MgO} - 0.479 \text{ MgCO}_3)$  for a first carbonation step
- - curing the fresh concrete until at least 15 wt.- percent of the calcium aluminates are hydrated to provide a green concrete part
- - subjecting the green concrete part to CO<sub>2</sub> in an amount resulting in a carbonation degree of more than 10 wt.- percent for a final carbonation step, and
- - storing the part for 0.5 hours to 28 days for further hydration of not-yet carbonated, not-yet hydrated cement to provide the concrete part.



Assignees: HEIDELBERGCEMENT AG; HCONNECT 2 GMBH

## 2. Family 76077307 (WO19190163 A1)

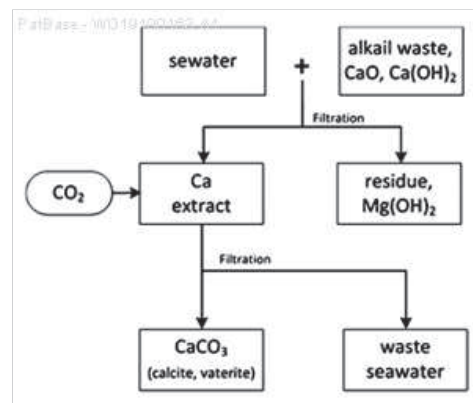
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### Title

[EN] METHOD FOR MANUFACTURING HIGH-PURITY VATERITE-TYPE AND CALCITE-TYPE CALCIUM CARBONATE BY USING INDIRECT CARBONATION OF SEAWATER

### Abstract

[EN] The present invention relates to a method for manufacturing high-purity vaterite-type or calcite-type calcium carbonate by using indirect carbonation of seawater, wherein: calcium of alkaline industrial byproducts (CKD and PSA), CaO, and Ca(OH)<sub>2</sub> is eluted using seawater as a solvent, so that calcium can be eluted with high efficiency using magnesium contained in seawater; the purity of calcium carbonate can be increased by using the alkaline industrial byproducts to precipitate magnesium in seawater, which disturbs the production of high-purity calcium carbonate; and vaterite-type and calcite-type calcium carbonate having high purity of 99.9 percent or higher can be economically manufactured by utilizing seawater instead of a high-cost solvent.



### 1st Main Claim

[MT] (I) water 50 ml indirect carbonation reaction material, mixed in a ratio of 1.0 to 1.8 g per 10.0 g and stirred to prepare a magnesium (Mg) that exists in the water, indirect carbonation reaction is precipitated, and calcium (Ca) is present in the raw material is dissolved in the solution to prepare a calcium eluted

calcium; (ii) allowing the eluent to remove the precipitate;

(iii) wherein the magnesium magnesium calcium is removed by injecting the carbon dioxide in the eluent and (vaterite)- and calcite (calcite) outer light distribution typeto obtain a calcium carbonate (CaCO<sub>3</sub>); and

(iv) the batter light type and calcite-type calcium carbonate (CaCO<sub>3</sub>), washed with water, to increase the amount to 99 percent purity; characterized in that it comprises a carbonated water of high purity using indirect light type and the manufacturing method of the calcite-type calcium carbonate

**Assignees:** KOREA MARITIME UNIV IND ACAD; KOREA MARITIME UNIV IND ACADEMIC COOPERATION FOUNDATION; KOREA MARITIME AND OCEAN UNIV IND ACADEMIC COOPERATION CENTER

3. Family 45061465 (KR100950099 B1)

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**Title**  
[EN] MANUFACTURING METHOD OF RECYCLED AGGREGATES USING REACTION OF RAPID CARBONATION

**Abstract**  
[EN] PURPOSE: A method for producing a recycled aggregate is provided to charge air gap of cement with calcium carbonate and improve the quality of recycled aggregate. CONSTITUTION: A method for producing a recycled aggregate comprises: a step of adding one or more mixture selected from thick aggregate of 5-25 mm, thin recycled aggregate of 0.01-5mm, or recycled aggregate of 0.01-40 mm into a closed chamber; a step of stirring the recycled aggregates; and a step of reacting at -10-100 degrees centigrade, 2-7 pressure while supplying 6-100 percent of carbon dioxide for 5-30 minutes.

**1st Main Claim**  
[MT] 1. Stage piling 0.01~5mm size size of concrete for recycled coarse aggregate, fine aggregate, or 0.01~40mm of concrete for recycled recycled aggregate size of any one of or a mixture of two or more within a closed chamber

while stirring and then, recycled aggregate, 2 to 7 atmospheres pressure in the -10~100 °C temperature is supplied to the carbon dioxide in a concentration of 60 to 30 minutes,

the reaction in the reaction of the reaction, the water content of the recycled aggregate, recycled aggregate 1-3% dry is maintained to promote carbonation reaction according to the production method, by using the

attached or contained in concrete mortar prior to the reaction with 70% or more in the CACO3, Ca(OH)2)

is 7.5 to 10 in the ph of the recycled aggregate after reaction for producing a recycled aggregate, recycled aggregate promote carbonation reaction using the production method.

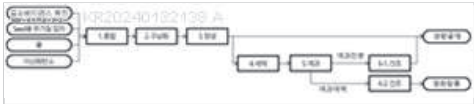
**Assignees:** KOREA INST CONSTRUCTION TECH; KOREA INST OF CIVIL ENGINEERING AND BUILDING TECHNOLOGY KICT



4. Family 104272919 (KR20240132138 A)

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**Title**  
[EN] CHLORIDE BYPASS SYSTEM DUST RESOURCEIZATION METHOD



**Abstract**  
[MT] The present invention relates to a method for autobasification of chlorine bypass dust containing heavy metals and comprising calcium oxide (Cao) and potassium chloride (KCl) as main components. The present invention provides a chlorine bypass dust processing method , comprising the steps of : " ( a ) preparing a neutralized mixture having chlorine bypass dust , inorganic particles , water and carbon dioxide to obtain aggregated nuclei ; ( b ) spheroidizing the neutralized mixture ; and ( c ) curing the pellets to produce a light weight aggregate .

**1st Main Claim**  
[MT] 1. A method for treating chlorine bypass dust dust , comprising the steps of : ( a ) preparing a neutralization mixture containing chlorine bypass dust , inorganic particles , water and carbon dioxide to spheroidize the neutralization mixture ; and ( b ) culturing the neutralized mixture ; and ( c ) curing the pellets to produce a light weight aggregate .

**Assignees:** ASIA CEMENT CO LTD

## 5. Family 28140519 (US2001054253 AA)

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### Title (EP1142629 B1)

[EN] METHOD OF REDUCING DISCHARGED CARBON DIOXIDE

### Abstract

[EN] It is an object of the invention to effectively absorb and remove CO<sub>2</sub> in an exhaust gas generated during an industrial process for reducing an amount of exhausting CO<sub>2</sub> into the atmospheric air. The exhaust gas containing CO<sub>2</sub> is blown into the agglomerate of solid particles containing CaO and/or Ca(OH)<sub>2</sub> to contact CO<sub>2</sub> to the agglomerate for fixing CO<sub>2</sub> in the exhaust gas as CaCO<sub>3</sub>, thereby to reduce the CO<sub>2</sub> concentration in the exhaust gas. Preferably, the solid particles contain water, and more preferably, the solid particles contain surface adhesive water.

### 1st Main Claim (EP1142629 B1)

[EN] 1. A method for reducing an exhaust carbon dioxide comprising the steps of:

- preparing agglomerates of solid particles containing at least one compound selected from the group consisting of CaO and Ca(OH)<sub>2</sub>;
- contacting an exhaust gas containing CO<sub>2</sub> with the agglomerates of the solid particles in a reaction chamber, the solid particles having a film of adhesive water on the outer surface of the solid particles; and
- fixing CO<sub>2</sub> in the exhaust gas as CaCO<sub>3</sub> in the solid particles to reduce CO<sub>2</sub> in the exhaust gas.



**Assignees:** NIPPON KOKAN KK; NKK CORP; JFE STEEL CORP; KATO MAKOTO; TANABE HARUYOSHI; TAKAHASHI TATSUHITO; ISOO TSUNEO; NIPPON KOKAN K K; JFE HOLDINGS INC

6. Family 102966385 (WO24118573 A1)

[View in PatBase](#)

**Title**  
[EN] VATERITE SYNTHESIS VIA PORTLANDITE CARBONATION

**Abstract**  
[EN] The present disclosure relates to methods of producing stabilized vaterite by carbonating portlandite or other alkaline calcium bearing feedstocks. In particular, the present methods comprise: (i) combining Ca(OH)<sub>2</sub> with an additive to form a reactant mixture; (ii) carbonating the reactant mixture with a CO<sub>2</sub> source to form a CaCO<sub>3</sub> product; and (iii) adding a stabilizing agent to Step (ii). The stabilized vaterite produced in accordance with the present methods may be useful in production of calcium carbonate cements.

**1st Main Claim**  
[EN] 1. A method of producing stabilized vaterite, comprising: (i) combining an alkaline calcium source with an additive to form a reactant mixture;(ii) carbonating the reactant mixture with a CO<sub>2</sub> source to form a solid CaCO<sub>3</sub> product comprising vaterite; and (iii) adding a stabilizing agent to the solid CaCO<sub>3</sub> product of step (ii) thereby producing the stabilized vaterite.

**Assignees:** THE UNIV OF CALIFORNIA; UNIV CALIFORNIA



## 7. Family 56472580 (US8728428 BA)

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**Title (EP2969953 B1)**

## [EN] RECOVERING A CAUSTIC SOLUTION VIA CALCIUM CARBONATE CRYSTAL AGGREGATES

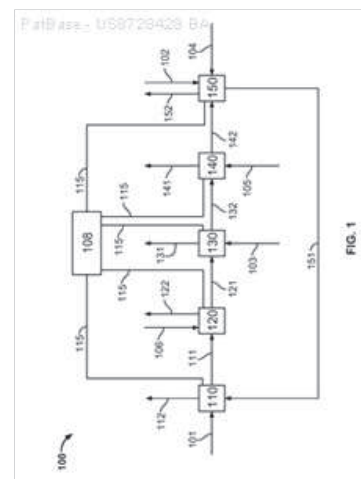
## Abstract

[EN] Techniques for converting a portion of a carbonate to hydroxide include receiving an alkaline carbonate solution that includes between 0.1M (moles per liter of solution) to 4.0M hydroxide and between 0.1M to 4.1M carbonate; reacting, in a slaking process, quicklime (CaO) and a low carbonate content fluid to yield a slurry of primarily slaked lime (Ca(OH)<sub>2</sub>); and reacting the Ca(OH)<sub>2</sub> slurry and the alkaline carbonate solution to grow calcium carbonate (CaCO<sub>3</sub>) crystal aggregates of 0.0005 mm<sup>3</sup> to 5 mm<sup>3</sup> in volume in a fluidized-bed reactive crystallizer.

### 1st Main Claim (EP2969953 B1)

[EN] 1. A method for recovering a caustic solution from a carbonate solution, the method comprising:

- receiving an alkaline carbonate solution that comprises between 0.1M (moles per liter of solution) to 4.0M hydroxide and between 0.1M to 4.1M carbonate;
- reacting, in a slaking process, quicklime (CaO) and a low carbonate content fluid to yield a slurry of primarily slaked lime (Ca(OH)<sub>2</sub>);
- reacting the Ca(OH)<sub>2</sub> slurry and the alkaline carbonate solution to grow calcium carbonate (CaCO<sub>3</sub>) crystal aggregates of 0.0005 mm<sup>3</sup> to 5 mm<sup>3</sup> in volume in a fluidized-bed reactive crystallizer;
- conditioning the CaCO<sub>3</sub> crystal aggregates; and
- calcining the conditioned CaCO<sub>3</sub> crystal aggregates to yield CaO and carbon dioxide (CO<sub>2</sub>).



**Assignees:** KEITH DAVID WILLIAM; CARBON ENGINEERING LTD PARTNERSHIP; CARBON ENGINEERING LP; CARBON ENG LTD PARTNERSHIP; CARBON ENG LTD

## 8. Family 74868213 (US2019194074 AA)

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### Title (EP3720831 B1)

[EN] METHOD FOR ENHANCEMENT OF MECHANICAL STRENGTH AND CO<sub>2</sub> STORAGE IN CEMENTITIOUS PRODUCTS

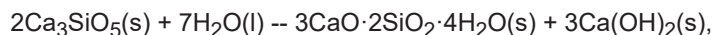
### Abstract

[EN] A method for curing cementitious articles includes flowing dry steam and carbon dioxide (CO<sub>2</sub>) simultaneously into a curing chamber containing a cementitious article. A relative humidity within the curing chamber may be between about 50 percent and about 70 percent and a temperature within the curing chamber may be between about 50 degrees centigrade and about 70 degrees centigrade. A dry steam and CO<sub>2</sub> mixture with a CO<sub>2</sub> concentration between 2.5 vol percent and 40 vol percent is provided in the curing chamber and the cementitious article is cured for a duration between about 4 hours and 16 hours. Cementitious products cured with the method may have a CO<sub>2</sub> uptake of greater than 15 wt percent and a mechanical strength at least 10 percent greater than a cementitious product cured only in dry steam or CO<sub>2</sub>.

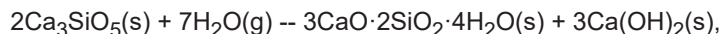
### 1st Main Claim (EP3720831 B1)

[EN] 1. A method for curing cementitious articles, the method comprising:

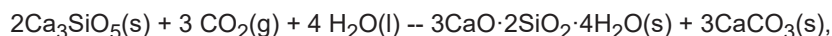
- providing a cementitious article formed from a mixture of a cement binder, aggregate, and water, the cement binder comprising Ca<sub>3</sub>SiO<sub>5</sub>;
- placing the cementitious article in a curing chamber;
- maintaining a curing relative humidity between about 40 percent and about 80 percent within the curing chamber;
- maintaining a curing temperature between about 50 degrees centigrade and about 80 degrees centigrade within the curing chamber;
- curing the cementitious article by flowing a mixture of dry steam and CO<sub>2</sub> into the curing chamber while maintaining the curing relative humidity and the curing temperature for a duration between about 4 hours and about 24 hours, wherein
  - a concentration of CO<sub>2</sub> in the mixture of dry steam and CO<sub>2</sub> is between about 2.5 percent and about 20.0 percent, by volume,
  - Ca(OH)<sub>2</sub> is formed by at least one of the reactions



and

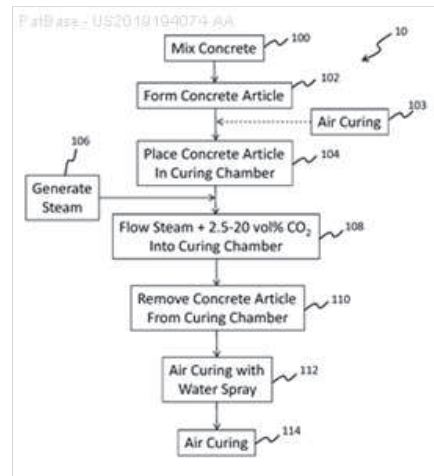


- CO<sub>2</sub> from the mixture of dry steam and CO<sub>2</sub> reacts with the cementitious article to form CaCO<sub>3</sub> in the cementitious article by at least one of the reactions



- and Ca(OH)<sub>2</sub>(s) + CO<sub>2</sub>(g) → CaCO<sub>3</sub>(s) + H<sub>2</sub>O(l), and
- the cured cementitious article comprises a CO<sub>2</sub> uptake equal to or greater than 15 percent, by weight.

**Assignees:** SAUDI ARABIAN OIL CO; ARAMCO SERVICES CO



## 9. Family 100177240 (US2025091962 AA)

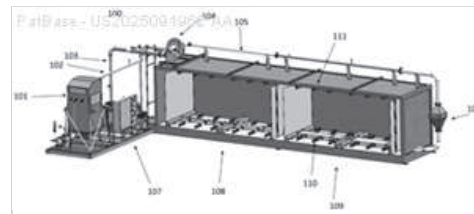
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### Title

[EN] ACTIVE CURING SYSTEMS AND METHODS FOR CONCRETE MANUFACTURING BY CARBON DIOXIDE SEQUESTRATION

### Abstract

[EN] Provided herein are active flow-through carbonation curing systems useful for contacting carbon dioxide (CO<sub>2</sub>) gas streams with concrete materials under ambient pressure. This contacting causes a carbonation reaction in which CO<sub>2</sub> forms materials, such as, but not limited to, calcium carbonate (CaCO<sub>3</sub>). The methods include, but are not limited to, contacting a conditioned flue gas containing CO<sub>2</sub> inside of a carbonation chamber with green bodies or concrete components in which flue gas properties such as temperature, relative humidity, flow rate, and flow direction, are self-adjusted during the curing process based on a self-sensing instrumentation system inside a curing chamber and carbonation kinetic regression model. This system improves CO<sub>2</sub> capture efficiency and material performance while reducing processing energy.



### 1st Main Claim

[EN] **1.** A process comprising:  
flowing a CO<sub>2</sub>-containing gas from a gas conditioning apparatus into a carbonation chamber comprising at least one green body;  
measuring, in real-time, temperature, relative humidity, CO<sub>2</sub> concentration, gas flow rate, gas flow direction, or a combination thereof, in the carbonation chamber to provide a measurement;  
inputting the measurement into a model to determine the extent of carbonation of the at least one green body;  
sending a control signal to the gas conditioning apparatus while flowing the CO<sub>2</sub>-containing gas to:  
actively condition the CO<sub>2</sub>-containing gas based on the extent of carbonation; and  
effect a multi-step carbonation process.

**Assignees:** THE UNIV OF CALIFORNIA; CARBONBUILT INC; UNIV CALIFORNIA; CHRISTOFIDES PANAGIOTIS D; SIMONETTI DANTE; PRENTICE DALE P

10. Family 44604504 (KR100935467 B1)

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Title

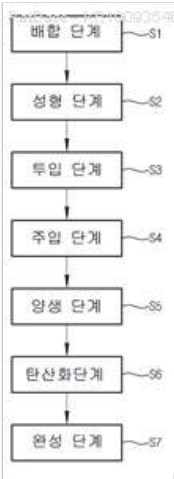
[EN] VEGETATION BLOCK FOR CONCRETE AND MANUFACTURING METHOD THEREOF

Abstract

[EN] PURPOSE: A concrete vegetation block and a manufacturing method thereof are provided to manufacture a concrete vegetation block suitable for plant growth by lowering pH to 7.5~10. CONSTITUTION: A manufacturing method for a concrete vegetation block is as follows. A shaped cement concrete block is cured. The cured cement concrete block is placed in a chamber filled with water. The chamber in which the cement concrete block is placed in is closed. A specific pressure is maintained by injecting CO2 into the chamber so that the C/Ca mol ratio in which the Ca of the cement concrete block and the C of the CO2 are reacted maintains a 0.1~10 reaction. A concrete vegetation block is formed by lowering pH to 7.5~10 by reacting the Ca(OH)2 of the cement concrete block with CO2. The concrete vegetation block is discharged using air pressure.

1st Main Claim

[MT] 1. Inlet and an outlet for discharging after processing within a closed chamber having blended cement, aggregate or cement concrete block forming a water before or after curing and then curing in the chamber into the water, cement concrete blocks of calcium (Ca) and C/ca carbon dioxide by reaction of carbon (C), the molar ratio is more preferably 0.1 to 10 is supplied to the carbon dioxide so that the temperature inside the chamber, the chamber internal humidity 30 ~ 100 20 ~ 100 °C, carbon dioxide (CO2), carbon dioxide (CO2) gas pressure 1 ~ 40kg/cm2, pressure to 120 bungan reacted reaction time 10 seconds cement concrete blocks included), Calcium Hydroxide (Calcium carbonate (CACO3)the cement concrete carbonation of the block is equal to or less than 10, and is lowered ph compressive strength vegetation blocks that improves the performance of the concrete.



**Assignees:** KOREA INST CONSTRUCTION TECH; KI SUNG CO LTD; KOREA INST OF CIVIL ENGINEERING AND BUILDING TECHNOLOGY KICT

11. Family 103819262 (US2024294439 AA)

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Title

[EN] USE OF BRINE AND NATURAL POZZOLANS IN A METHOD OF MAKING COMPOSITIONS TO PROMOTE MARINE-LIFE

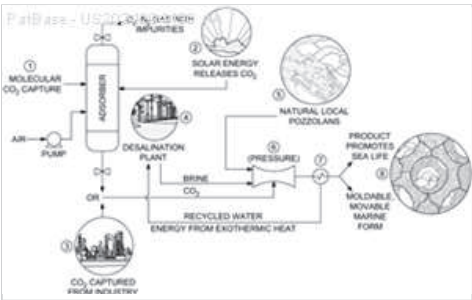
Abstract

[EN] The present disclosure relates to methods that transform high salinity brine into a non-toxic, CO<sub>2</sub>-absorbing cementitious aggregate composition and a lower salinity water component which can each be recycled to the desalination facility, further processed to produce fresh water, and/or added to a body of water and without harming the local flora and fauna. The present disclosure provides methods comprising steps of: (a) combining (i) a high salinity brine, (ii) CO<sub>2</sub>, and (iii) a pozzolan and/or a latently hydraulic material; and (b) permitting the combination obtained in step (a) to persist under conditions sufficient to transform the combination into a cementitious aggregate composition and a reduced salinity water component. In some case, an activator, as disclosed herein, is added to the combination. The present disclosure further a cementitious aggregate compositions and shaped cementitious compositions, each obtained by herein-disclosed methods.

1st Main Claim

[EN] 1. A method comprising steps of: combining (i) a high salinity brine, (ii) CO<sub>2</sub>, and (iii) a pozzolan and/or a latently hydraulic material; and permitting the combination obtained in step (a) to persist under conditions sufficient to transform the combination into a cementitious aggregate composition and a reduced salinity water component.

Assignees: PARTANNA GLOBAL INC

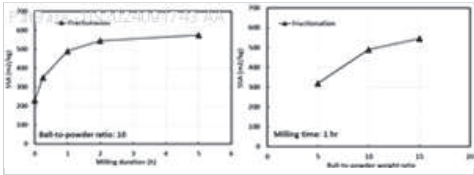


12. Family 94915720 (US2024091743 AA)

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**Title**  
[EN] METHODS FOR REACTIVATING PASSIVATED MINERAL RESIDUES

**Abstract**  
[EN] The instant disclosure sets forth a process for re-activating a mineral residue. The process includes providing a mineral residue, which includes a core and a shell around the core. In certain examples, the core comprises calcium (Ca), magnesium (Mg), or a combination thereof. The Ca and Mg is not present as elemental Ca or Mg but rather as a compound of Ca or of Mg, such as but not limited to Ca(OH)<sub>2</sub> or Mg(OH)<sub>2</sub>. In certain examples, the shell comprises an oxide, a hydroxide, a carbonate, a silicate, a sulfite, a sulfate, a chloride, a nitrate, or nitrite, of calcium (Ca) or of magnesium (Mg), or a combination thereof. The process includes (a) fractionating the mineral residue; (b) contacting the mineral residue with an acid and fractionating the mineral residue; or (c) contacting the mineral residue with a base and fractionating the mineral residue. As a result, the mineral residue's core is exposed. In some examples, the shell is passivating and inhibits the Ca or Mg, or both, in the core from reacting with carbon dioxide (CO<sub>2</sub>). By exposing the core as described herein, a mineral residue's reactivity with carbon dioxide is increased.



**1st Main Claim**  
[EN] 1. A process for re-activating a mineral residue, comprising:  
providing a mineral residue, wherein the mineral residue comprises a core and a shell around the core;  
wherein the core comprises a hydroxide or oxide of calcium (Ca), magnesium (Mg), or combinations thereof and wherein the shell comprises a member selected from the group consisting of an oxide, a hydroxide, a carbonate, a silicate, a sulfite, a sulfate, a chloride, a nitrate, or nitrite, of Ca or of magnesium (Mg), and a combination thereof; and either:  
(a) fractionating the mineral residue;  
(b) contacting the mineral residue with an acid and fractionating the mineral residue; or  
(c) contacting the mineral residue with a base and fractionating the mineral residue;  
to provide reactivated mineral material;  
wherein fractionating the mineral residue comprises grinding the mineral residue or milling the mineral residue; and  
wherein the core is exposed after steps (a), (b), or (c).

**Assignees:** CARBONBUILT INC; UNIV CALIFORNIA; CARBONBUILT

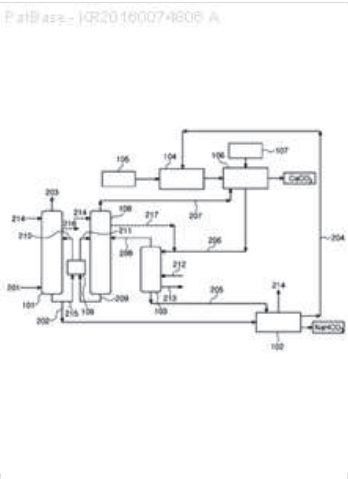
13. Family 62755264 (KR20160074806 A)

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**Title**  
[EN] METHOD AND APPARATUS FOR CAPTURING AND RESOURCING CARBON DIOXIDE FROM FLUE GAS CONTAINING CARBON DIOXIDE

**Abstract**  
[EN] The present invention relates to a method and an apparatus for capturing carbon dioxide from carbon dioxide-containing exhaust gas and recycling the same. More specifically, the present invention relates to a method and an apparatus for capturing carbon dioxide from carbon dioxide-containing exhaust gas and recycling the same, which includes an absorption tower, a steam separator, a sodium bicarbonate reactor, and a carbonatizator, thereby recycling captured carbon dioxide without supplying additional steam energy to the steam separator.

**1st Main Claim**  
[MT] 1. Step of the carbon dioxide-containing off-gas is supplied to the absorption tower, by supplying ammonia to the absorber, absorbing the carbon dioxide contained in the exhaust gas; Supplying the reactor with sodium bicarbonate and water separator and discharging the ammonia is absorbed in the carbon dioxide; Forming the  $\text{NH}_4\text{Cl}$  and  $\text{NaHCO}_3$  By  $\text{NaCl}$  and the reaction of the carbon dioxide is supplied from the ammonia absorption tower with concentrated sodium bicarbonate in the reactor; By supplying  $\text{NH}_4\text{Cl}$  formed by the sodium bicarbonate reactor with leaching reactor to react with the calcium compound  $\text{Ca}^{2+}$  to elute,  $\text{Ca}^{2+}$ ,  $\text{NH}_4^+$ ,  $\text{Cl}^-$  and  $\text{OH}^-$  to form a mixture of  $\text{sup}^>$ ; Decomposing the carbon dioxide is absorbed in the ammonia separator with aqueous ammonia and carbon dioxide, the carbon dioxide fed to the carbonation reactor; In the carbonation reactor,  $\text{Ca}^{2+}$  supplied from the dissolution reactor,  $\text{NH}_4^+$ ,  $\text{Cl}^-$  and  $\text{OH}^-$ ; Carbon dioxide supplied from the separator; And reacting the  $\text{NaOH}$ ; Forming a  $\text{CaCO}_3$  in the carbonation reactor;  $\text{NH}_4^+$ ,  $\text{Cl}^-$  supplied from the carbonation reactor - ,  $\text{Na}^+$  step of transferring with concentrated Tower.; And applying steam from the concentrated Tower  $\text{CO}_2$ ,  $\text{NH}_3$ ,  $\text{H}_2\text{O}$  and form the  $\text{NaCl}$ , the  $\text{CO}_2$  containing carbon dioxide, comprising a; ,  $\text{NH}_3$  and  $\text{H}_2$  supplying a O a separator, and supplying the  $\text{NaCl}$  with sodium bicarbonate reactor carbon dioxide from the flue-gas method for collecting and recycling.



**Assignees:** RES INST IND SCIENCE AND TECH; RESEARCH INST OF INDUSTRIAL SCIENCE AND TECHNOLOGY

## 14. Family 68029751 (CN107522217 A)

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### Title

[EN] PRODUCTION METHOD OF COMMON LIGHT CALCIUM CARBONATE

### Abstract

[EN] The invention discloses a production method of common light calcium carbonate, and belongs to the field of a production method of calcium carbonate. In a production process, limestone is taken as a main raw material, and requirements on auxiliary raw materials of water and fuel are higher; the limestone and the fuel are calcined to obtain lime and carbon dioxide, a digestion reaction is performed on the lime and the water to obtain calcium hydroxide emulsion, and a carbonization reaction is performed on the carbon dioxide and the calcium hydroxide emulsion to obtain the light calcium carbonate. According to the production method, the problem that the particle size and the viscosity of a product in the production process are difficult in control can be solved, continuous production can be realized by using conventional equipment, the product is good and stable in quality, and the whiteness of the calcium carbonate produced by the production method reaches 95-97 degrees.

### 1st Main Claim

[MT] 1. A kind of ordinary light calcium carbonate production process, characterized in that: Comprising the steps of

1) raw material preparation:

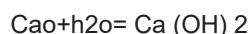
Limestone: Chemical composition by weight: Cao?54%, MGO 1.0%, SIO2?1 ?1.5%, Mn 0.006%, Fe2O3?1 ?0.1% and impurities? 0.2%; Physical properties requirements: Dense block, no recrystallization, porosity?1%, density: 2.65 to 2.80 g/cm<sup>3</sup>, Mohs hardness and compressive strength?3?117.6mpa; Into the kiln limestone crushing to a particle size of 80 ~ 150mm; For clay or clay-containing ores, need to re-group after crushing ore washing to remove dirt and impurities;

Water: Suspension?20 mg / liter, transparency?30 cm, hydrochloric acid insoluble matter (SIO2)?10 mg / L, magnesium oxide (MGO)?100 mg / L, iron oxide (Fe2O3)?10 mg / L;

Fuel: Coke, anthracite and bituminous coal in one or more of the mixture;

2) the calcined, kiln gas washing: Particle size of 80 - 150mm limestone blocks raw materials and the degree of 20-30mm fuel by the cloth into the feeding lime kiln and lime kiln bottom bubbling air, calcined lime and limestone at high temperatures decompose into CO<sub>2</sub>exhaust gas; Stone gray ash machine by vibration unloading and separation of ash, sent to digestion stage workshop; Co<sub>2</sub>exhaust gas heat exchanger after cooling into the cyclone dust collector, spray dust removal, washing tower wash dust, sulfide gas and then into the gas-water separator water mist, after purification the lime kiln gas, which is sent to the carbon chemical segment;

3) digestive, pulp: From lime calcination steps sent to the quicklime by crushing machine, with the bucket elevator through the hopper, feeder, adding lime digestion machine, in digestion machine within the process water into CA (OH) 2 emulsion, lime digestion process of chemical reaction formula is as follows:



digestion reaction, after slag flows into thick slurry tank, in the thick slurry pond, the reaction was continued for coarse slag slurry by pumping into a spin liquid Cleaner to clean up the mortar insoluble ash slag after purification into fine, fine slurry sizing slurry pump, to the carbonation inter-vehicle;

4) carbonation, enrichment: Lime kiln exhaust gas fan compressed to 0.049Mpa, through the oil separator into the carbonation tower; In the carbonation tower Ca (OH) 2 emulsion with gas containing CO<sub>2</sub> carbonation reaction CaCO<sub>3</sub>carbonation reaction is as follows:



when the reaction solution PH value dropped to 7-8, marks the end of the reaction is nearing completion, carbide cooked pulp by vibrating sieve slag enriched enriched enriched, backward into the pool after the concentrated slurry dewatering, drying section;

5) dehydration, drying: By the enriched pool sent to the slurry dewatering machine dehydration, dehydrated cake moisture content of 30% crushed into the dryer for drying, the final moisture content of the material and, It;0.3% dryer uses oil as the heating medium, 250 degrees centigrade, hot oil guide by a organic heat carrier boiler to provide. Dried by conveyor to the screening, packaging section;

6) screening and packaging: Finished by screening machine screening to qualified particle size, into the automatic packaging machine packaging finished product storage, finished by polypropylene woven bag.

**Assignees:** GUANGXI HUAYANG MINERAL RESOURCES CO LTD

15. Family 108594861 (KR20250098126 A)

[View in PatBase](#)

Title

[EN] MANUFACTURING METHOD OF CARBONATED WASTE CONCRETE POWDER AND MANUFACTURING METHOD OF MORTAR

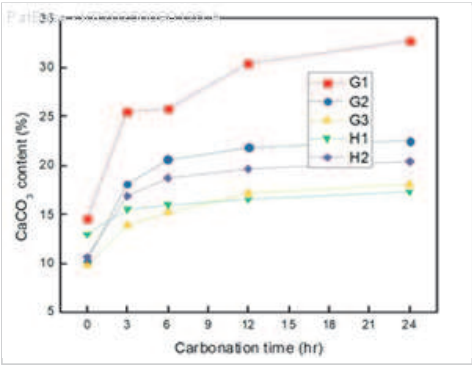
Abstract

[MT] The present invention relates to a method for producing carbonized waste concrete powder, which comprises the steps of preparing waste concrete powder obtained by crushing waste concrete, a step of mixing the waste concrete powder with water (H<sub>2</sub>O), a step of injecting carbon dioxide (CO<sub>2</sub>) while stirring the mixture of the waste concrete powder and the water (H<sub>2</sub>O) to carbonize the waste concrete powder so that Ca(OH)<sub>2</sub> contained in the waste concrete powder is converted into CaCO<sub>3</sub>, and a step of selectively separating the carbonated waste concrete powder, and a method for producing mortar using the same. According to the present invention, not only is it economically feasible to recycle waste concrete, which is construction waste, but also environmental pollution problems can be solved by reducing construction waste, and environmental pollution can be suppressed by using waste, and when carbonized waste concrete powder is used as fine aggregate by partially replacing silica sand, it can contribute to increasing the initial strength and watertightness of mortar and reducing the porosity and pore size of mortar.

1st Main Claim

[MT] A step for preparing waste concrete powder obtained by crushing waste concrete;  
A step of mixing the above waste concrete powder and water (H<sub>2</sub>O);  
A step of injecting carbon dioxide (CO<sub>2</sub>) while stirring the mixture of the waste concrete powder and the water (H<sub>2</sub>O) to carbonate the waste concrete powder so that Ca(OH)<sub>2</sub> contained in the waste concrete powder is converted into CaCO<sub>3</sub>; and  
A method for producing carbonated waste concrete powder, characterized by including a step of selectively separating carbonated waste concrete powder.

Assignees: KOREA INST OF CERAMIC ENGINEERING AND TECHNOLOGY



16. Family 108218346 (KR20250078688 A)

[View in PatBase](#)

**Title**  
[EN] CARBON DIOXIDE REACTION HARDENING CONCRETE MANUFACTURING METHOD

**Abstract**  
[MT] The present invention relates to a method for manufacturing carbon dioxide reaction-cured concrete.  
The present invention relates to a method for manufacturing a carbon dioxide reaction-cured concrete, comprising the steps of: providing a concrete article formed from a mixture of a concrete binder, aggregate, and water, wherein the concrete binder comprises  $\text{Ca}_3\text{SiO}_5$ ; curing the concrete article in air for about 1 hour to about 4 hours; placing the concrete article in a curing chamber; maintaining a curing relative humidity within the curing chamber at about 40 percent to about 80 percent; maintaining a curing temperature within the curing chamber at about 50 degrees centigrade to about 80 degrees centigrade; curing the concrete article by flowing a mixture of dry steam and  $\text{CO}_2$  into the curing chamber while maintaining the curing relative humidity and the curing temperature for a period of about 4 hours to about 24 hours; and after curing the concrete article in the curing chamber, air-curing the concrete article and spraying water onto the concrete article.

**1st Main Claim**

[MT] In a method for manufacturing carbon dioxide reaction-hardened concrete,  
A step of providing a concrete article formed from a mixture of a concrete binder, aggregate and water, wherein the concrete binder comprises  $\text{Ca}_3\text{SiO}_5$ ;  
A step of hardening the above concrete product in the air for about 1 hour to about 4 hours;  
A step of placing the above concrete product in a curing chamber;  
A step of maintaining the curing relative humidity within the curing chamber at about 40 percent to about 80 percent;  
A step of maintaining the curing temperature at about 50 degrees centigrade to about 80 degrees centigrade within the curing chamber;  
A step of hardening the concrete article by flowing a mixture of dry steam and  $\text{CO}_2$  into the hardening chamber while maintaining the above curing relative humidity and the above curing temperature for a period of about 4 hours to about 24 hours;  
A manufacturing method comprising the steps of air-curing the concrete article and spraying water on the concrete article after curing the concrete article in the curing chamber.



## 17. Family 30418233 (US6200381 BA)

[View in PatBase](#)

### Title (EP0865415 B1)

[EN] A SETTABLE COMPOSITION AND USES THEREFOR

### Abstract (EP0865415 B1)

[EN] A dry powdered flowable cement composition contains calcium carbonate and a partially decarbonated magnesium carbonate. A slurry of the composition will set hard with various organic fillers including waste products and toxic waste. The composition can be slurried with contaminated water such as sea water, mineral laden ground water and muddy water. A high percentage of filler can be added while still having an acceptable set.

### 1st Main Claim (EP0865415 B1)

[EN] 1. A settable binder composition including a mixture of a calcium, carbonate, a magnesium carbonate and a caustic magnesium oxide, the mixture selected from the group consisting of:

- (a) a naturally-occurring dolomite, wherein the dolomite has been heated at a temperature within the range of 500 degrees centigrade to 800 degrees centigrade to cause preferential decarbonisation of magnesium carbonate by liberating carbon dioxide, whereby between 2 percent to 50 percent of the carbon dioxide is retained within the magnesium carbonate without substantially decarbonising the calcium carbonate, resulting in a mixture of magnesium oxide, magnesium carbonate and calcium carbonate ( $\text{MgO}$ ,  $\text{MgCO}_3$  and  $\text{CaCO}_3$ ); and
- (b) a synthetic blend that has been formed by mixing calcium carbonate with preformed caustic magnesium oxide, the preformed caustic magnesium oxide having been prepared by heating magnesium carbonate to 500 degrees centigrade to 800 degrees centigrade to partially drive off carbon dioxide whereby between 2 percent to 50 percent of the carbon dioxide is retained within the magnesium carbonate, and wherein the calcium carbonate has retained substantially all of its carbon dioxide, resulting in a mixture of magnesium oxide, magnesium carbonate and calcium carbonate ( $\text{MgO}$ ,  $\text{MgCO}_3$  and  $\text{CaCO}_3$ ),

the settable binder composition being **characterised in that** it further includes a carbonation additive to produce a source of carbonation during the setting process wherein the carbonation additive includes a polycarboxylic acid.

**Assignees:** DOLOMATRIX INTERNAT LTD; DOLOMATRIX INT LTD; PERICLASE PTY LTD; PERICLASSE PTY LTD; RECHICHI DINO

18. Family 56901349 (CN103922369 A)

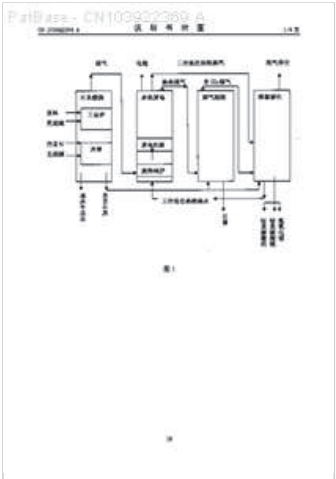
[View in PatBase](#)

Title

[EN] PROCESS OF PRODUCING MAGNESIUM CARBONATE-SERIES PRODUCTS BY DOLomite LIME SMOKE GAS DESULFURIZATION CARBON-DROP POWER GENERATION

Abstract

[EN] The invention relates to a process of producing magnesium carbonate-series products by dolomite lime smoke gas desulfurization carbon-drop power generation. Dolomite lime smoke gas desulfurization is carried out, smoke gas carbon dioxide is used for carbonizing dolomite lime milk for dropping carbon, kiln gas thermal pollution is transformed into electric energy for satisfying most of power consumption of the system; secondary low-level heat energy steam drying system products which are light magnesium carbonate, magnesium hydroxide and light calcium carbonate are exhausted after generating power; tertiary hot water with low-level heat energy obtained by drying products is used for supplying heat and returning to a power-generating waste heat boiler; and a desulfurization product is used for preparing gypsum to realize zero emission of the waste. The process disclosed by the invention belongs to the technical field of coal smoke gas control, utilizes a method that system magnesium hydroxide is directly in double decomposition with heavy-magnesium water formed by dolomite lime carbon-drop to produce light magnesium carbonate, so that novel magnesium salt production innovation is initiated, and therefore, a novel development direction is pointed for combining modern fuel coal industry with magnesium salt chemical engineering, powerful technical support is provided, and especially outlet is pointed for industrial survival which takes fire coals and mining resources as advantages.



1st Main Claim

[MT] 1 A Baiyun lime for flue gas desulfurization drop preparing magnesium carbonate carbon power generation technology products, including four units: the first unit is smoke generation and dolomitic lime preparation section (hereinafter referred to lime calcining): The task of the unit by coal-fired industrial furnace combustion and mixed in a lime kiln plus anthracite, white clouds dolomite lime and sulfur oxides obtained SOx and carbon dioxide CO2 in the furnace or flue gas and coal-fired industrial kilns furnace output of finished or semi-finished products; coal-fired industrial furnace finished or semi-finished products for sale or subsequent processing technology, dolomite lime kiln part to get sent to the third unit (FGD) desulfurization, part sent to the fourth unit (carbonized lowering carbon) carbonization, the rest can be sold merchandise; furnace gas feeding the second unit (cogeneration) for waste heat boilers or waste heat boiler to produce electricity and steam (also known as the secondary low heat steam); the second unit is part of the power generation using waste heat: The role of the section is absorbed by the first unit heat furnace gas and condensate references fourth unit (three low heat hot water) waste heat utilization, output power required for system power, steam (secondary low heat steam) generated The fourth unit for drying products, exhaust furnace gas desulfurization unit to send a third; third part of the flue gas desulfurization unit is: First, that part of the task will be implemented with the first unit dolomite, calcium and magnesium chloride solution separation, separated magnesium hydroxide pulp removal sent a second unit formed sulfur oxides in the flue gas desulfurization solution of magnesium sulfate; second is to use the separated calcium chloride solution was precipitated calcium sulfate dihydrate obtained magnesium sulfate solution; the third is to provide hydrogen magnesium precipitation for the fourth unit directly generates magnesium (magnesium carbonate) heavy precipitation reaction of magnesium with water; Fourth excess magnesium hydroxide send the fourth unit dried and crushed preparation of magnesium hydroxide products; fourth unit is down Carbon carbonized part, is lightweight magnesium carbonate, calcium carbonate preparation section: First, the role of this part of the first unit sent clouds dolomite lime solution digested into mortar, and the third furnace gas desulfurization unit after carbonization, dolomite magnesium hydroxide slurry absorption furnace gas carbon dioxide into the heavy water into the liquid magnesium hydroxide, calcium carbonate into the solid phase into a furnace gas into a purge gas emptying; the second is the weight of water and calcium carbonate, magnesium solid-liquid separation, with the second unit generates a secondary low heat steam dried and pulverized to obtain calcium carbonate precipitated calcium carbonate products; third is the completion of the conversion reaction of basic magnesium carbonate, magnesium hydroxide precipitate will direct the third part of the heavy magnesium Water produced by the reaction of basic magnesium carbonate, with a second unit generates a secondary low heat steam dried and pulverized to obtain a lightweight magnesium products.

Assignees: PENG ZHENCHAO; HAN MOXIAN

## 19. Family 33212670 (US2006182163 AA)

[View in PatBase](#)

### Title (EP2329567 A1)

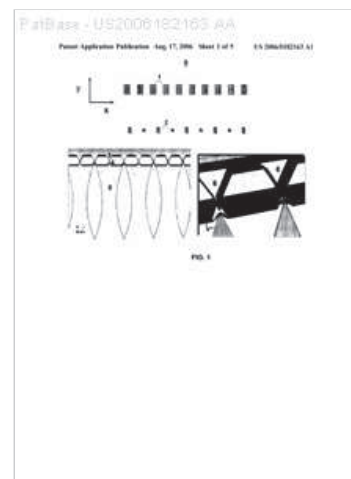
[EN] GAS LIQUID CONTACTOR AND EFFLUENT CLEANING SYSTEM AND METHOD

### Abstract (EP2329567 A1)

[EN] The invention relates to a gas liquid contactor and effluent cleaning system and method and more particularly to an array of nozzles configured to produce uniformly spaced flat liquid jets shaped to minimize disruption from a gas. An embodiment of the invention is directed towards a gas liquid contactor module including a liquid inlet and outlet and a gas inlet and outlet. An array of nozzles is in communication with the liquid inlet and the gas inlet. The array of nozzles is configured to produce uniformly spaced flat liquid jets shaped to minimize disruption from a gas flow and maximize gas flow and liquid flow interactions while rapidly replenishing the liquid.

### 1st Main Claim (EP2329567 A1)

[EN] 1. A gas liquid contactor module, comprising: a liquid inlet; a gas inlet; a gas outlet; an array of nozzles in communication with the liquid inlet and the gas inlet, wherein the array of nozzles is configured to produce uniformly spaced flat liquid jets shaped to minimize disruption from a gas; a gas liquid separator capable of allowing liquid to pass through while substantially preventing gas from passing through; and a liquid outlet in fluid communication with the gas liquid separator.



**Assignees:** NEUMANN SYSTEMS GROUP INC; NIZAMOV BORIS R; NEUMANN DAVID KURT; MCDERMOTT WILLIAM E; TOBIAS JASON A; AWTRY ANDREW R; HOBBS KEITH R; HENSHAW THOMAS LEE; BRASSEUR JASON K; MILLER NICHOLAS J; COURTRIGHT JEFFREY L; ANDERSON JEREMY L; NEUMANN INFORMATION SYSTEMS IN; MCDERMOTT WILLIAM EDWARD

20. Family 43535615 (WO10130712 A1)

[View in PatBase](#)

Title (EP2429970 A1)

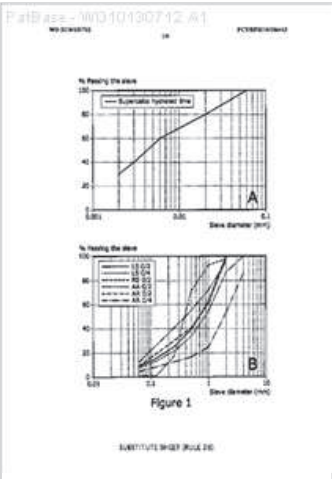
[EN] AUTOGENOUS SETTING OF NON-HYDRAULIC LIME MORTARS BY MEANS OF MICROBIAL CARBONATE PRODUCTION

Abstract (EP2429970 A1)

[EN] The present invention relates to the usage of micro-organisms to accelerate carbonation and to increase the compressive strength of non-hydraulic lime mortars. The micro-organisms of the present invention metabolize nutrients within the mortars in order to produce CO<sub>2</sub> which results in accelerated CaCO<sub>3</sub> formation and hence increased strength of the mortar. The invention further encompasses non-hydraulic lime mortars comprising micro-organisms and relates to a process to fabricate such lime mortars.

1st Main Claim (EP2429970 A1)

[EN] 1. Use of micro-organisms for accelerating carbonation of non-hydraulic lime mortars resulting in an increase in the compressive strength of said non-hydraulic lime mortars of at least 1.2 times compared to a reference non-hydraulic lime mortar, and wherein said compressive strength is measured at a specific time point after completion of the fabrication of said mortars.



Assignees: UNIV GENT; DE BELIE NELE; DE MUYNCK WILLEM; VERSTRAETE WILLY

## 21. Family 88322256 (CN113698228 A)

[View in PatBase](#)

### Title

[EN] PERVIOUS CONCRETE USING WHEAT STRAW ASH AS AGGREGATE AND PREPARATION METHOD THEREOF

### Abstract

[EN] The invention relates to the technical field of pervious concrete, and discloses pervious concrete using wheat straw ash as aggregate and a preparation method thereof, the pervious concrete using wheat straw ash as aggregate comprises the following raw material components by mass: 1.2-3.0 parts of cement, 1.0-2.5 parts of recycled crushed aggregate, 1.0-3.0 parts of a foaming agent, 1.0-2.8 parts of water and 1.0-3.5 parts of wheat straw ash. According to the invention, the wheat straw ash is added and carbon dioxide generated by combusting the wheat straw ash is introduced into a mixing tank, and the recycled crushed aggregate is added with water to react to form calcium carbonate, so that the compression resistance, fracture resistance and air pollution indexes of the concrete are improved, and the concrete is suitable for wide popularization and application.

### 1st Main Claim

[MT] 1. A water permeable concrete utilizing wheat straw ash as aggregate, characterized in that its feedstock components and its mass proportions are:

Cement (1.2~ 3.0), recovered crushed aggregate (1.0~ 2.5), foaming agent (1.0~ 3.0), water (1.0~ 2.8) and wheat straw ash (1.0~ 3.5).

**Assignees:** QINGHAI COLLEGE OF ARCHITECTURAL TECH

## 22. Family 51707130 (CN102614755 A)

[View in PatBase](#)

### Title

[EN] METHOD FOR COLLECTION, UTILIZATION AND DESULPHURATION OF LOW-CONCENTRATION CARBON DIOXIDE

### Abstract

[EN] The invention is a method for collection, utilization and desulphuration of low-concentration carbon dioxide in the field of energy saving and emission reduction. The method uses dolomitic lime (or lime) as the moulding material of a gelling agent to collect low-concentration SO<sub>2</sub> and CO<sub>2</sub>, and sequesters the SO<sub>2</sub> and CO<sub>2</sub> in the moulding material so as to make them become the component parts of products. By taking accurate measurement of the mole ratio between CO<sub>2</sub> and SO<sub>2</sub> in dedusted flue gas as the prerequisite, a permeable material is selected and a suitable temperature is controlled. The reaction time of the moulding material in the flue gas is determined based on the above condition, and then exhausted gases of CO<sub>2</sub> and SO<sub>2</sub> can be obtained. And multiple early-strength products produced from dolomitic lime (or lime) can be obtained. The method of the invention can be used for emission reduction of CO<sub>2</sub> in coal-fired power plants and further desulphuration before emptying of flue gas, and can make comprehensive use of solid emissions so as to obtain products thereof.

### 1st Main Claim

[MT] CN 1. The present invention discloses a low concentration of carbon dioxide capture, utilization and sulfur removal methods, its technical characteristics is Baiyun ash (or lime) as a gelling agent forming a solid material, to capture the low concentration of carbon dioxide, low concentrations of sulfur dioxide, and directly into magnesium carbonate, calcium (or calcium carbonate) rigid gas-based, calcium sulfate dihydrate, supplemented clouds hydraulic ash (or lime) product, and whereby carbon dioxide, sulfur dioxide depleted flue gas.

**Assignees:** TIANBAO HAN; HAN TIANBAO

## 23. Family 43000301 (US2009065435 AA)

[View in PatBase](#)

### Title

[EN] MODIFIED BIOGENIC SILICA AND METHOD FOR PURIFYING A LIQUID

### Abstract

[EN] Biogenic silica is produced by combusting a biogenic source material such as rice hulls to give rich hull ash (RHA), and the combusted biogenic silica may be subsequently treated to improve the filtration or adsorption properties thereof e.g. by changing the surface charge, the surface tension, the surface area, the average pore size, the pore size distribution, particle size distribution, and/or the permeability thereof. Such biogenic silica is useful to remove a species, such as an impurity, from a fluid to purify the fluid and/or to recover the species therefrom. RHA may be used to remove species including organic, inorganic or microbial particulates, surfactants, metal ions, non-metallic anions, organic compounds, color bodies, odor-producing species, chlorinated compound, pigment, free fatty acids, phospholipids, peroxides, oil and/or grease different from the non-aqueous fluid, algae, bacteria, and combinations thereof.

### 1st Main Claim

[EN] **1.** A method for removing a species from a fluid to give a purified liquid comprising: producing biogenic silica by combustion of a biogenic source; treating the biogenic silica by a treatment selected from the group consisting of: chemically treating the biogenic silica with a chemical selected from the group consisting of an alkali, an oxidation agent, an acid, a dehydration agent, an enzyme, a microbial material, a salt solution, and mixtures thereof; physically treating the biogenic silica by a process selected from the group consisting of: contacting the biogenic silica with steam, nitrogen, carbon dioxide and combinations thereof; washing the biogenic silica with a liquid selected from the group consisting of water, an acid and mixtures thereof; and both; size reduction by a method selected from the group consisting of crushing, grinding, classification, screening, dry particle agglomeration, and combinations thereof; blending the biogenic silica with a material selected from the group consisting of a cementitious material,  $\text{Ca}(\text{OH})_2$ ,  $\text{CaCl}_2$ ,  $\text{CaCO}_3$ , lime, soda ash, an electrolyte, a polyelectrolyte, a coagulant, a flocculant, calcium silicate, aluminum silicate, magnesium silicate, chabazite zeolites, clinoptilolite zeolites, expanded perlite, diatomaceous earth, cellulous, kenaf fiber, ion oxides, an enzyme, microbial material, and combinations thereof; and combinations of chemically treating, physically treating and blending; where the treatment improves filtration and/or adsorption by the biogenic silica, contacting a fluid containing the species with the treated biogenic silica, where the species is selected from the group consisting of organic, inorganic or microbial particulates, surfactants, non-metallic anions, metallic ions, dissolved total suspended solids (TSS), total dissolved solids (TDS), color bodies, odor-producing species, chlorinated compound, pigment, free fatty acids, phospholipids, peroxides, oil and/or grease different from the non-aqueous fluid, algae, bacteria, and combinations thereof; removing the species from the fluid by both filtration and adsorption; and recovering the fluid to greater purity.



**Assignees:** POWELL INTELLECTUAL PROPERTY H; POWELL INTELLECTUAL PROPERTY HOLDINGS LLC

## 24. Family 92266997 (CN114713015 A)

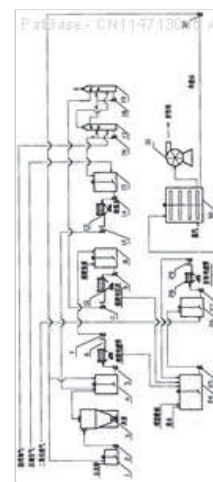
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### Title

[EN] METHOD AND SYSTEM FOR REGENERATING AND CIRCULATING AMMONIA BY-PRODUCT ACTIVE CALCIUM THROUGH AMMONIA-CALCIUM DESULFURIZATION

### Abstract

[EN] The invention discloses a method and a system for regenerating and circulating ammonia by-product active calcium through ammonia-calcium desulfurization, and belongs to the technical field of ammonia desulfurization. According to the method, ultra-clean emission is realized by washing and recycling flue gas after ammonia-process two-stage sectional desulfurization, a relatively pure ammonium sulfate solution is obtained by aeration purification of a desulfurization solution, refined calcium hydroxide slurry and calcium-process desulfurization regeneration cycle ammonia and precipitated calcium sulfate gypsum are adopted, and  $\text{Ca} < 2 + \text{NH}_4^+$  ions in the regeneration cycle ammonia are precipitated into calcium carbonate and new ammonia water is formed by adopting ammonium bicarbonate; calcium hydroxide which is not reacted in gypsum sediment is converted into calcium carbonate through carbonation modification, a high-quality and high-added-value calcium sulfate-calcium carbonate binary system active calcium product is obtained through modification drying, steam condensate water and gas washing liquid recycled through gas washing are all returned to a system for use, no waste residues or waste water is generated, and the method is suitable for grafting modification of various desulfurization systems.



### 1st Main Claim

[MT] 1. A process for the regeneration of cyclic ammonia by ammonia calcium desulfur to produce active calcium, characterized by comprising the following steps:

Step 1: Two stage fractionated desulfur using the ammonia method: flue gas enters the primary desulfur column in advance and the secondary desulfur column is absorbed by the desulfur liquid, and is evacuated from the secondary desulfur column or after further purification, the desulfur liquid is reverse-passed into the secondary desulfur column and the primary desulfur column absorb  $\text{SO}_2$  and  $\text{SO}_3$  in flue gas, and flue gas is taken from the lower part of the desulfur column in reverse spray absorption with the upper part of the desulfur column, The primary desulfur control the  $\text{pH}=4-6$  of the desulfur finishing solution is advantageous for improving the conversion rate of  $\text{NH}_3$ ; the secondary desulfur control the  $\text{pH}=5-7$  of the secondary desulfur finishing solution is advantageous for improving the removal rate of sulfur; the secondary desulfur finishing solution is supplied to the primary desulfur for use; and the primary desulfur finishing solution is used for purification in other steps, equilibrium regeneration and recycling;

Step 2: Aeration purification desulfur liquid: The secondary desulfur finishing liquid in step 1 is injected into an aeration oxidizer, the aeration oxidation is carried out with compressed air, the ammonium sulfite formed in the desulfur process is oxidized to an ammonium sulfate solution, and impurity particles such as fly ash, VOC organic matter, and the like in the desulfur finishing liquid are filtered off by filtration to obtain a relatively clean ammonium sulfate solution;

Step 3: Refining calcium hydroxide slurry: Select high quality lime with high  $\text{CaO}$  content, high coherency, high activity and low impurities as raw materials, condense hydrated lime in a lime reactor with fresh water or system steam, digest  $\text{CaO}$  into  $\text{Ca}(\text{OH})_2$  slurry, and separate ash from spin off;

Step 4: Calcium desulfur regeneration of circulating ammonia with precipitated calcium sulfate gypsum: refined milk of lime and purer ammonium sulfate solution obtained after aeration purification of step 2 are slurried with fresh water or system steam condensate water in a reaction equivalent mixing ratio of  $\text{Ca}(\text{OH})_2$  higher than  $(\text{NH}_4)_2\text{SO}_4$ , Reacting  $\text{NH}_4^+$  ions in  $(\text{NH}_4)_2\text{SO}_4$  with  $\text{OH}^-$  ions in  $\text{Ca}(\text{OH})_2$  to regenerate aqueous ammonia ( $\text{NH}_4\text{OH}$ ) for recycling desulfur, precipitating  $\text{Ca}^{2+}$  ions in  $\text{Ca}(\text{OH})_2$  with  $\text{SO}_4^{2-}$  ions in  $(\text{NH}_4)_2\text{SO}_4$  to generate  $\text{CaSO}_4$ , An aqueous ammonia mixed slurry of  $\text{CaSO}_4$  with  $\text{Ca}(\text{OH})_2$  is formed, after separation by filtration, a calcium sulfate cake is obtained to be used, an aqueous ammonia solution containing  $\text{Ca}^{2+}$  ions formed by slight dissolution of calcium sulfate is obtained, and then the  $\text{Ca}^{2+}$  ions are precipitated into calcium carbonate and new aqueous ammonia is formed, Can act to prevent fouling disadvantages of  $\text{Ca}^{2+}$  ions from entering the desulfur system and loss of supplemental system ammonia, achieve ammonia balance, and regenerate purer recycled ammonia back to the desulfur system after further secondary filtration separations, calcium carbonate cake is ready for use;

Step 5: Carbonation of modified co-production active calcium product: The filter cake of  $\text{CaSO}_4$  with  $\text{Ca}(\text{OH})_2$  obtained from the primary filtration separation of step 5 and the  $\text{CaCO}_3$  filter cake obtained from the secondary filtration separation are mixed, formulated into a moderate slurry in the preferential order of use of the active calcium filtration filtrate, fresh water, the surfactant sodium stearate being moderately added in proportion to the total amount of slurry solids content, Formulating and stirring homogeneously followed by bubbling carbon dioxide gas for carbonation, converting concomitant calcium hydroxide to calcium carbonate, forming a stable calcium sulfate-calcium carbonate binary mixed slurry. after separation by filtration washing, the active calcium cake washing water returns to the compounding slurry of this step, the cake is an active calcium cake, and after oven-drying comminution, an active calcium product is obtained.

**Assignees:** XINGTAI RUNTIAN ENVIRONMENTAL PROTECTION TECH CO LTD

## 25. Family 95984385 (IN202331007739 A)

[View in PatBase](#)

### Title

[EN] LONG TERM SALT RESISTANT CONCRETE

### Abstract

[EN] The present invention relates to a Salt attack which is a major challenge in concrete durability in coastal climate as well as in cold countries. The air moisture in coastal climate contains very high level of sodium chloride (NaCl). When this NaCl enters concrete surface, the Ca (OH)<sub>2</sub> among the hydration products, which is highly unstable, reacts with it giving rise to a number of chemical reactions to decay the surface by salt crystallization, volume expansion, surface scaling, and strength reduction etc. In the existing product or process, different types of concrete admixtures, chemicals and some new techniques are being adopted to cover or protect concrete from salt attack. However, it is not sufficient to provide complete solution due to various disadvantages such as cost of chemicals, impracticable methodology and difficulty in handling. the use of natural raw materials.

### 1st Main Claim

[EN] 1. A process for replacement of cement for protecting concrete from salt attack including: a) carbonated fly ash

## 26. Family 62803698 (US2016340247 AA)

[View in PatBase](#)

### Title

[EN] RAPID SETTING MATERIAL FOR IMPROVED PROCESSING AND PERFORMANCE OF CARBONATING METAL SILICATE CEMENT

### Abstract

[EN] Cementitious compositions and methods for producing the cementitious compositions are described herein. The methods can include mixing a compound of the general formula  $\text{MaSi}_b\text{XcOd}$ ,  $\text{MaSi}_b\text{XcOd}(\text{OH})_e$ ,  $\text{MaSi}_b\text{Xc}(\text{OH})_e$ , or  $\text{MaSi}_b\text{Xc}(\text{OH})_e \cdot (\text{H}_2\text{O})_f$ , wherein M comprises a metal that can react with carbon dioxide in a carbonation reaction to form a carbonate, Si forms an oxide during the carbonation reaction, X is an element other than M or Si, a, b, d, e, and f are greater than zero, and c is zero or greater, with a rapid setting hydraulic cement to produce a cementitious mixture. The methods can further include hydrating the cementitious mixture and carbonating the cementitious mixture. Carbonating the cementitious mixture can occur simultaneously with hydrating the cementitious mixture or subsequent to hydrating the cementitious mixture. In some embodiments, the non-hydraulic cement can comprise wollastonite. The hydraulic cement can be in an amount of from 5 wt percent to 80 wt percent of the cementitious composition.

### 1st Main Claim

[EN] 1. A method for producing a cementitious composition comprising:

(i) mixing

a compound of the general formula  $\text{M}_a\text{Si}_b\text{X}_c\text{O}_d$ ,  $\text{M}_a\text{Si}_b\text{X}_c\text{O}_d(\text{OH})_e$ ,  $\text{M}_a\text{Si}_b\text{X}_c(\text{OH})_e$ , or  $\text{M}_a\text{Si}_b\text{X}_c(\text{OH})_e \cdot (\text{H}_2\text{O})_f$ , wherein M comprises a metal that can react with carbon dioxide in a carbonation reaction to form a carbonate, Si forms an oxide during the carbonation reaction, X is an element other than M or Si, a, b, d, e, and f are greater than zero, and c is zero or greater with a rapid setting hydraulic cement to produce a cementitious mixture;

(ii) hydrating the cementitious mixture; and

(iii) carbonating the cementitious mixture.

**Assignees:** BORAL IP HOLDINGS AUSTRALIA PTY LTD; HILL RUSSELL L; KUMAR AMITABHA

## 27. Family 80677323 (US2020271316 AA)

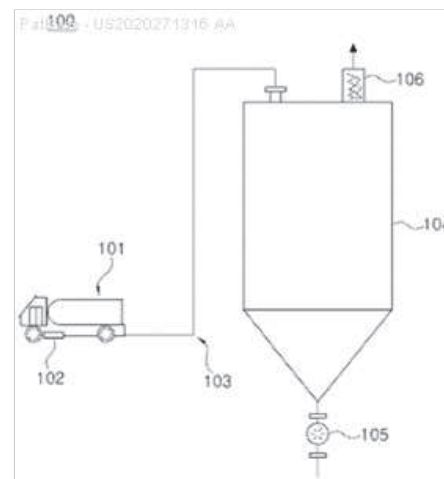
[View in PatBase](#)

### Title

[EN] APPARATUS FOR RECYCLING FLY ASH HAVING QUANTUM ENERGY GENERATOR

### Abstract

[EN] An apparatus for recycling fly ash has a quantum energy generator therein. The apparatus recycles fly ash generated as the combustion waste from the burning of coal in thermal power plants, into construction materials such as cement substitutes, environment-friendly cover materials, etc. Unburned pulverized coal is removed while generating carbon monoxide (CO) or carbon dioxide (CO<sub>2</sub>) through a combustion reaction, in which the unburned pulverized coal of the fly ash contacts the thermal electrons discharged during a thermal decomposition process at a high temperature, the negative electrodes of the thermal decomposition part, which are heated at a high temperature of 500 degrees centigrade, which is an ignition point of the unburned pulverized coal, or higher, and a high-voltage discharge electrode of an electrochemical reaction part, then heated at 500 degrees centigrade or higher, and then naturally burned under an oxygen atmosphere (oxygen or ionized oxygen ions in air contained in the fly ash).



### 1st Main Claim

[EN] 1. An apparatus for recycling fly ash having a quantum energy generator therein, the apparatus comprising:  
 a first reservoir installed at a rear end of a boiler of a thermal power plant and configured to transport fly ash discharged from an electric dust collector by using a tank lorry, transfer the fly ash into a blower attached to a vehicle body, and feed and store the fly ash into a storage tank through a feeding pipe;  
 a feeder connected to the storage tank and configured to feed high-pressure air generated from a blower installed at one side of a feeding pipe and open a rotary valve installed at a lower part of the storage tank to feed the fly ash stored in the first reservoir, and configured to drive a driving motor to rotate a screw connected with a motor by a shaft in order to discharge the fly ash through a discharge port connected to a thermal decomposition part;  
 wherein:  
 the thermal decomposition part includes:  
 a quantum energy generator including a first heating member, a second heating member and power suppliers;  
 a negative electrode including a first negative electrode, a second negative electrode and power suppliers; and  
 a positive electrode including a first positive electrode, a second positive electrode and power suppliers; and  
 a steam feeder including a steam generator, a feeding conduit, a burner, a chamber, an electromagnetic valve and a spray nozzle  
 or including a steam generator, a power supplier, a conducting wire, a high-frequency induction heating coil, an electromagnetic valve and a spray nozzle,  
 the thermal decomposition part is configured to:  
 discharge thermal electrons from surfaces of the heating members and the negative electrodes by heating the heating members and the negative electrodes at a high temperature of 500 degrees centigrade or higher by supplying DC power to a plurality of heating members of the quantum energy generator and the negative electrodes from DC power suppliers,  
 accelerate by electrical attraction the thermal electrons discharged from the surfaces of the plurality of heating members of the quantum energy generator and the negative electrodes, which are heated by giving a potential difference between DC power suppliers for the plurality of heating members of the quantum energy generator and DC power suppliers for the negative electrodes, and between DC power suppliers for negative electrodes and DC power suppliers for positive electrodes  
 primarily remove unburned pulverized coal while generating carbon monoxide (CO) or carbon dioxide (CO<sub>2</sub>) through a combustion reaction, in which the unburned pulverized coal out of the fly ash comes into contact with the surfaces of the negative electrodes heated at a high temperature of 500 degrees centigrade, which is an ignition point of carbon (C), or higher so that the unburned pulverized coal is naturally burned under an oxygen atmosphere, (oxygen in air contained in the fly ash), in a process of increasing a number of elastic collisions with fly ash particles passing through a fluid passage formed between the negative electrodes and the positive electrodes by extending retention time of the thermal electrons discharged from the surfaces of the heating members and the negative electrodes by a magnetic field generated at an angle of 90 degrees with respect to a direction of current flow by supplying power to the plurality of heating members of the quantum energy generator, which are wound in opposite directions to each other, from the DC power suppliers,  
 primarily remove a glassy membrane coated on the fly ash particles while generating carbonates such as calcium carbonate (CaCO<sub>3</sub>), sodium carbonate (Na<sub>2</sub>CO<sub>3</sub>), magnesium carbonate (MgCO<sub>3</sub>), potassium carbonate (K<sub>2</sub>CO<sub>3</sub>) and barium carbonate by allowing the carbon dioxide (CO<sub>2</sub>) generated in the process of removing the unburned pulverized coal to react with main components of the glassy membrane coated on the fly ash particles, which include calcium oxide (CaO), sodium oxide (Na<sub>2</sub>O), magnesium oxide (MgO), potassium oxide (K<sub>2</sub>O) and barium oxide (BaO), or  
 remove the glassy membrane by spraying superheated steam generated from a steam feeder onto the fly ash introduced through the spray nozzle in an environment in which the magnetic field is generated from the first and second heating members, quantum energy generated in a zero magnetic field state caused by an extinguishment of the magnetic field is irradiated, and the thermal electrons discharged from the heated negative electrodes are accelerated in a direction of the positive electrodes by electrical attraction, thereby allowing the steam and the fly ash particles to come into contact with each other or to be mixed with each other while causing a hydration reaction, so that main components of the glassy membrane coated on the surface of the fly ash particles, which include silicon dioxide (SiO<sub>2</sub>), calcium oxide (CaO), sodium oxide (Na<sub>2</sub>O), magnesium oxide (MgO), potassium oxide (K<sub>2</sub>O) and barium oxide (BaO) are converted into basic materials including silicon hydroxide (Si(OH)<sub>4</sub>), calcium hydroxide (Ca(OH)<sub>2</sub>), sodium hydroxide (NaOH), barium hydroxide (Ba(OH)<sub>2</sub>), magnesium hydroxide (Mg(OH)<sub>2</sub>) and aluminum hydroxide (Al(OH)<sub>3</sub>);

an electrochemical reaction includes:

a housing,

a high-voltage discharge unit,

a quantum energy generator,

a dedusting unit, and

a compressed air feeder, in which a discharge electrode and a ground electrode of a discharge unit, which is provided therein with a plurality of heating members of the quantum energy generator wound in opposite directions from each other and insulated from each other, are installed inside a housing to face each other, each one side of the discharge electrode and the ground electrode is connected to a shaft and passes through the housing so as to be connected to a driving motor installed in an external holder, power suppliers supply power to the heating members of the quantum energy generator installed inside the discharge electrode and the ground electrode while being insulated from each other to generate heat while forming a magnetic field at an angle of 90 degrees centigrade with respect to a direction of current flow to heat the discharge electrode and the ground electrode at 500 degrees centigrade, which is an ignition temperature of unburned pulverized coal, or more,

the motor connected to the discharge electrode and the ground electrode by the shaft is driven, so that the discharge electrode and the ground electrode are rotated while engaging with each other in opposite directions at a predetermined interval, outside air is absorbed and pressurized in an air feeder, so that the fed air is sprayed onto the discharge electrode and the ground electrode through a spray nozzle installed above the discharge electrode and the ground electrode while being spaced apart from the discharge electrode and the ground electrode, thereby mixing the fly ash particles and the sprayed air to give an air void between the fly ash particles (a distance between particles), a high voltage generated from a high-voltage generator is supplied to the discharge electrode and the ground electrode through a conducting wire to form a high electric field energy (5 eV-5 KeV) band between the two electrodes, which is larger than a work function (eV)(1.1 eV-5.0 eV) of main components of a glassy membrane, which include silicon dioxide ( $\text{SiO}_2$ ), calcium oxide ( $\text{CaO}$ ), sodium oxide ( $\text{Na}_2\text{O}$ ), magnesium oxide ( $\text{MgO}$ ), potassium oxide ( $\text{K}_2\text{O}$ ) and barium oxide ( $\text{BaO}$ ), air which is produced by absorbing and pressurizing the outside air in the compressed air feeder is sprayed through the spray nozzle onto the fly ash introduced between the two electrodes, and

so that the fly ash and the air are mixed together to give the air void (gap) between the fly ash particles to facilitate an elastic collision between the thermal electrons and spherical (ball-shaped) fly ash particles, the fly ash particles are subject to the elastic collision with charged particles including electrons or ions, and thermal electrons discharged during a discharge process in the high electric field energy band formed between the two electrodes, a magnetic field generated when power is supplied to the heating members of the quantum energy generator extends a retention time of the charged particles including electrons or ions and thermal electrons in the two electrodes, magnetic fields generated in opposite directions to each other in a structure, in which the heating members are wound in opposite directions to each other, are overlapped and extinguished so that the quantum energy generated in a zero energy state is irradiated to activate the charged particles including the electrons or ions and thermal electrons and to increase a number and intensity of elastic collisions with the fly ash particles, unburned carbon, which is not removed by the thermal decomposition part, comes into contact with the surfaces of the two electrodes heated at a high temperature, and is heated at a temperature of 500 degrees centigrade or more, so that the unburned carbon is naturally burned under an oxygen atmosphere (oxygen or ionized oxygen ions in air contained in the fly ash), and becomes the unburned pulverized coal while generating carbon monoxide ( $\text{CO}$ ) or carbon dioxide ( $\text{CO}_2$ ) through the combustion reaction, the combustion reaction is progressed by spark or flame generated between the discharge electrode and the ground electrode during the discharge operation to generate carbon monoxide ( $\text{CO}$ ) or carbon dioxide ( $\text{CO}_2$ ) so that the unburned pulverized coal is removed or secondarily removed due to the combustion

reaction caused by a natural ignition under an oxygen atmosphere and the combustion reaction by an ignition source generated by a discharge reaction, the carbon dioxide ( $\text{CO}_2$ ), which is generated in the secondary removal process for the unburned pulverized coal, reacts with the main components of the glassy membrane coated on the fly ash particles, which are not removed by the elastic collision between the fly ash particles and charged particles including electrons or ions and thermal electrons in a high electric field area formed between the charged electrodes, including calcium oxide ( $\text{CaO}$ ), sodium oxide ( $\text{Na}_2\text{O}$ ), magnesium oxide ( $\text{MgO}$ ), potassium oxide ( $\text{K}_2\text{O}$ ) and barium oxide ( $\text{BaO}$ ) in a high electric field energy band, so that calcium oxide ( $\text{CaO}$ ) is converted into calcium carbonate ( $\text{CaCO}_3$ ), sodium oxide ( $\text{Na}_2\text{O}$ ) is converted into sodium carbonate ( $\text{Na}_2\text{CO}_3$ ), magnesium oxide ( $\text{MgO}$ ) is converted into magnesium carbonate ( $\text{MgCO}_3$ ), potassium oxide ( $\text{K}_2\text{O}$ ) is converted into potassium carbonate ( $\text{K}_2\text{CO}_3$ ), and barium oxide ( $\text{BaO}$ ) is converted into barium carbonate ( $\text{BaCO}_3$ ), thereby removing again the glassy membrane, and a motor connected by a shaft with a brush rotating in opposite direction to the discharge electrode and the ground electrode is driven to eliminate the fly ash particles attached onto the discharge electrode and the ground electrode;

a second reservoir connected to the electrochemical reaction part and configured to feed the fly ash processed in the electrochemical reaction part into a storage tank while feeding high-pressure air generated from a blower installed at one side of a discharge pipe to the discharge pipe and by driving a driving motor to rotate a screw shaft connected with a motor through a shaft; and

a control panel configured to supply and shut off power of the first storage pool, the feeder, the thermal decomposition part, the electrochemical reaction part and the second storage pool.

**Assignees:** EUNHAE ENC CO LTD; UNHAE ENC CO LTD; UNHAE ENCCO LTD

28. Family 107282248 (WO25063613 A1)

[View in PatBase](#)

Title

[EN] ADMIXTURE FOR ENHANCING MINERAL CARBONATION OF CONCRETE, AND CONCRETE MINERAL CARBONATION METHOD USING SAME

Abstract

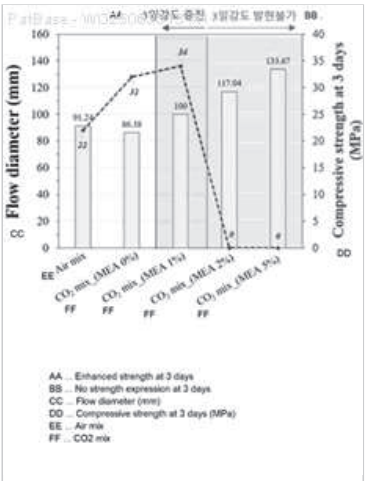
[EN] The present invention relates to an admixture for enhancing the mineral carbonation of concrete, and a concrete mineral carbonation method using same. The admixture for enhancing the mineral carbonation of concrete, of the present invention, is a first agent, which comprises cement, an aggregate and water, and a second agent, which is composed of an alkanolamine-based compound, that are sequentially injected during in-situ CO<sub>2</sub> mixing, wherein the alkanolamine-based compound captures and dissociates CO<sub>2</sub> and stably induces CaCO<sub>3</sub> precipitation, and thus can maximize CO<sub>2</sub> mineralization and storage, wherein the injection timepoint and amount of the alkanolamine-based compound are optimized in the concrete mineral carbonization method, maximizing the CO<sub>2</sub> adsorption amount in a mixing step, and the rate of hydration is controlled such that fluidity is ensured and sufficient compressive strength is expressed, and thus the present invention can be applied to cement-based construction materials such as mortar/remitar/ready-mix concrete/concrete secondary products.

1st Main Claim

[MT] First and second components containing cement, aggregate and water;

An admixture for promoting mineral carbonation of concrete, comprising a second agent composed of an alkanolamine compound, which is sequentially added during the in -*situ* CO<sub>2</sub> mixing process.

**Assignees:** SEOUL NATIONAL UNIV R AND DB FOUNDATION; SEOUL NAT UNIV R AND DB FOUNDATION; INDUSTRIAL ACADEMIC COOPERATION GROUP SEOUL NATIONAL UNIV



## 29. Family 92515856 (IN202221019099 A)

[View in PatBase](#)

### Title

[EN] A MECHANICAL PROPERTIES OF CONCRETE WITH FINE AND COARSE RECYCLED AGGREGATES

### Abstract

[EN] The mechanical properties of concrete with fine and coarse recycled aggregates comprising to mechanical properties of concrete with fine and coarse recycled aggregate manufacturing method for recovering and reproduce a high-quality fine aggregate component from concrete waste generated at a construction site or the like and more particularly present invention to relates to a method for reclaiming aggregate from concrete waste material and a system therefor, in which are capable of separating high quality aggregate such as a gravel, crushed stones and sand from concrete waste material produced in construction sites to reclaim the same. The Mixed concrete manufacturing method using recycled coarse aggregate and recycled fine aggregate comprising a concrete incorporating wastes from demolished concrete after applying different methods of treatment consisting; abrasion, cement slurry and chemical treatments abrasion treatment comprising method, in which coarse recycled aggregate were placed inside abrasion machine and its using horizontal and vertical members.

### 1st Main Claim

[EN] 1] A mechanical properties of concrete with fine and coarse recycled aggregates comprising a method, in which: a) the circulating coarse aggregate of 5 to 25 mm in length, the circulating aggregate of zero.01 to five mm in size, or the circulating combination of zero.01 to 40 mm in length or a aggregate of or extra thereof, is added into a closed chamber, b) while stirring the circulating aggregate, the reaction turned into completed for 5 to 30 minutes whilst supplying carbon dioxide with a concentration of 60 to a hundred percent under a temperature of - 10 to a hundred C. And a pressure of 2 to 7 atmospheres. c) the response is to apply the expanded carbonation response by way of the dry circulating mixture production technique to hold the moisture content material of the recycled aggregate at 1 to three percent, d) this neutralizes Ca (OH) 2 contained within the mortar adhering to or contained within the concrete to 70 percent or more of CaCO<sub>3</sub> before the reaction. e) method for generating circulating combination the use of extended carbonation reaction for producing circulating aggregate pH 7. Five ~ 10 after the response

### 30. Family 51698135 (CN102617098 A)

[View in PatBase](#)

**Title**

[EN] Three production methods of dolomitic lime brick

**Abstract**

[EN] The invention relates to three production methods of a dolomitic lime brick, which is a novel building material. The three methods all solve the difficult problem of brickmaking without soil. Dolomitic lime brick is the product having the lowest energy consumption and needing the shortest time from moulding to carbon sequestration and early strength in present brickmaking technologies. In order to realize the above technical problem, only the mole ratio of carbon dioxide in dust-free flue gas needs to be detected accurately. Maintaining carbon dioxide and dolomitic lime at a mole ratio of not less than 2.2:1 can well achieve early strength and moulding of the dolomitic lime brick. The chemical reaction principles are: (1)  $2\text{CO}_2 + \text{Ca}(\text{OH})_2 \cdot \text{Mg}(\text{OH})_2 = \text{CaCO}_3 \cdot \text{MgCO}_3 + 2\text{H}_2\text{O}$ ; and (2)  $2\text{CO}_2 + \text{Ca}(\text{OH})_2 \cdot \text{MgO} = \text{CaCO}_3 \cdot \text{MgCO}_3 + \text{H}_2\text{O}$ . Meanwhile, the dolomitic lime brick has better strength and lower cost than lime bricks produced at the present stage, is mainly used for bricks in the construction industry, and simultaneously provides another good approach for emission reduction of carbon dioxide.

**1st Main Claim**

[MT] CN of the technical disclosure of the three production methods 1. Huizhuan Baiyun Baiyun gray as cement material, ash or sand for the cement components, sand, slag, straw, construction or demolition formed inorganic solid waste as aggregate.

After

**Assignees:** XIUFENG HAN



## 31. Family 78822168 (KR102106467 B1)

[View in PatBase](#)

### Title

[EN] MORTAR COMPOSITION COMPRISING WASTE STON POWDER FOR REPAIRING AND RESTORING THE SURFACE OF CONCRETE STRUCTURES AND THE REPAIRING AND RESTORING CONSTRUCTION METHOD USING THEROF

### Abstract

[EN] The present invention relates to a concrete section recovery mortar composition using waste stone powder and a concrete section recovery construction method using the same, and more specifically, to a concrete section recovery mortar composition using waste stone powder, which comprises: 40 to 50 parts by weight of cement clinker powder which does not contain gypsum; 40 to 50 parts by weight of silica sand 6; 10 to 20 parts by weight of waste stone powder; 10 to 20 parts by weight of blast furnace slag powder; 5 to 10 parts by weight of bottom ash powder; 5 to 10 parts by weight of slaked lime powder; 5 to 10 parts by weight of a re-emulsification type powder resin; and 5 to 10 parts by weight of a cellulose ether-based thickener, so as to improve initial strength and water resist by adhesion strength and fast-hardness to concrete. Thus, the concrete section recovery mortar composition using waste stone powder has an excellent effect of swiftly recovering concrete sections degraded due to corrosion and neutralization. The present invention also relates to a concrete section recovery construction method using the concrete section recovery mortar composition.

### 1st Main Claim

[MT] 1. Gypsum powder that does not include cement clinker spend 40 to 50 parts by weight of silica sand of 40 to 50 parts by weight, 6 parts by weight of a powder powder 10 to 20% blast furnace slag, bottom ash powder powder 10-20 parts by weight, 5 to 10 parts by weight, 5 to 10 parts by weight of calcium hydroxide powder 5-10 parts by weight of the stake jaeyu resin powder, cellulose ether-based thickening agent 5 to 10 parts by weight, including corrosion and deterioration of the concrete section by neutralization by quickly, the tailings minutes for recovery of fine powder is generated in the manufacturing process of a powdered stone dust and sludge 6-10um as 2.6g/cm<sup>3</sup> average particle size, characterized in that the density of the tailings minutes powder used environmentally friendly concrete cross-sectional repair mortar composition

**Assignees:** HOEUN CONSTRUCTION LTD

## 32. Family 104747120 (KR102714022 B1)

[View in PatBase](#)

### Title

[EN] POWDER COMPOSITION FOR RUST PREVENTION OF REBAR CONCRETE AND CONCRETE COMPOSITION FOR RUST PREVENTION INCLUDING THE SAME

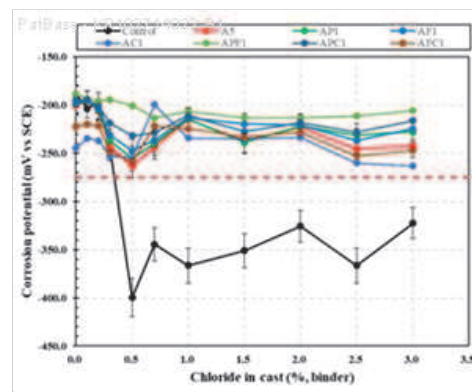
### Abstract

[MT] The present invention relates to a powder composition for steel root concrete rust prevention and a concrete composition for rust prevention, and more particularly, to a powder composition for steel root rust prevention by preventing oxidation of steel root inside concrete by air, moisture or salt. The present invention relates to a powder composition for rust preventing iron concrete, which can be effectively applied in particular in salt regions or corrosive environments and the like, and to a concrete composition for rust preventing comprising the same.

### 1st Main Claim

[MT] 1. A concrete composition for rust prevention characterized in that it comprises 1 to 10 parts by weight of a powder composition for rust prevention of iron root concrete, 10 to 300 parts by weight of an aggregate and 2 to 5 parts by weight of a polycarboxylate-based liquid high-performance plasticizer based on 100 parts by weight of cement, wherein the composition for steel root concrete rust prevention composition comprises 30 to 60 % by weight of alumina, characterized in that said cement usually contains pottle cement (OPC) and eco-friendly cement (EC) respectively in a weight ratio of 100:1-100, said eco-friendly cement (EC) comprises 100 parts by weight of blast fine powder, 5-30 parts by weight of non-monomilled silica fume, 5-30 parts by weight of calcium oxide and 1-10 parts by weight of formate, Wet gypsum is further included in a range of 0.1 to 8 parts by weight based on 100 parts by weight of the blast furnace slag fine powder, and residual moisture in the wet gypsum is reacted with the calcium oxide  $\text{Ca}(\text{OH})_2$  And  $\text{Ca}(\text{OH})$  formed above<sub>2</sub>By weight of the wet gypsum is stimulated to the fine powder of the blast furnace slag, wherein the wet gypsum is calcium sulfate alpha hemihydrate and has a water content of 5 to 30 % by weight, and  $\text{Ca}(\text{OH})$  formed by reacting the residual moisture contained in the wet gypsum with the calcium oxide<sub>2</sub>Is  $\text{CaCO}_3$  by a carbonation process<sub>3</sub>Wherein the carbonation process reacts the calcium oxide with residual moisture present in the wet gypsum by injecting carbon dioxide gas under pressure to react and causing  $\text{Ca}(\text{OH})_2$ Producing and which is again by a carbon dioxide injection process<sub>3</sub>Characterized in that said eco-friendly cement (EC) further comprises slaked lime, said slaked lime being equal to  $\text{Ca}(\text{OH})_2$ By weight of  $\text{Ca}(\text{OH})$  formed by the reaction between said calcium oxide and the residual moisture of wet gypsum<sub>2</sub>A concrete composition for rust preventive, characterized in that the effect of stimulating the blast pulverized powder is caused to undergo a synergistic action by mixing the slags as the effect of stimulating the pulverized powder due to carbonation is insufficient.

**Assignees:** DONGSU ECO TECH CO LTD



33. Family 14353832 (JP9059050 A2)

[View in PatBase](#)

Title

[EN] PRODUCTION OF MIXING MATERIAL FOR CEMENT

Abstract

[EN] PROBLEM TO BE SOLVED: To convert fine particles of Ca(OH)<sub>2</sub> to fine particles of CaCO<sub>3</sub> by grinding concrete scrap, removing rough aggregate and bringing the remaining fine particles into contact with a specific gas to reuse as a mixing material for cement. SOLUTION: Concrete scrap is crushed and the rough aggregates are removed. The remaining particles, preferably having Blaine specific surface area of greater than or equal to2000cm<sup>2</sup>/g, more preferably greater than or equal to3000cm<sup>2</sup>/g are brought into contact with a gas containing greater than or equal to1 percent, preferably greater than or equal to5 percent, more preferably 10 percent of CO<sub>2</sub> (e.g.: an exhaust gas of cement plant) preferably at greater than or equal to100 deg.C.

1st Main Claim

[MT] 1. concrete waste, pulverized, was obtained by removing coarse aggregate granular material gas containing carbon dioxide is brought into contact with the 1 percent or more, characterized in that method of manufacturing a cement admixture

Assignees: CHICHIBU ONODA CEMENT CORP

PatBase - JP9059050 A2		圧縮強度 7日 (N/mm <sup>2</sup> )		
混合率		3日	7日	28日
0%		15.0	27.5	42.0
原粉	5%	14.0	24.5	38.0
	10%	11.0	21.0	32.0
処理粉末*	5%	15.0	27.0	41.5
	10%	14.5	26.5	40.5

\* 処理条件: ガス温度40℃、二酸化炭素濃度10%  
処理時間1日

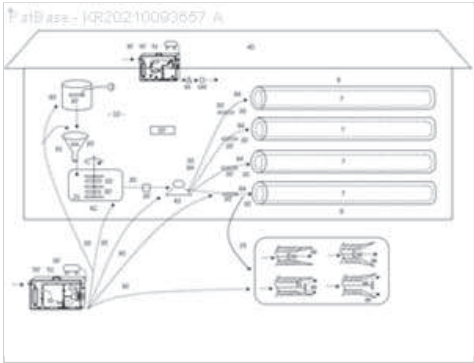
34. Family 86226935 (KR20210093657 A)

[View in PatBase](#)

**Title**  
[EN] FUNCTIONAL MATERIAL STRUCTURE EQUIPMENT METHOD

**Abstract**  
[EN] The present invention relates to: a) a functional group having functions such as magnetization, vibration, excitation, and ozone treatment; b) a functional agent with functions such as purification, green, phyton, and earthquake resistance; c) equipment, devices, substances, and materials equipped with the above; d) cement, mortar, ready-mixed concrete, ascon, a binder, asphalt, paste, plaster, and concrete manufactured, purified, sterilized, disinfected, fluidized, etc. according to the above; e) materials, construction materials, buildings, facilities, and structures from which the above items are used; and f) manufacture, composition, construction, construction method, and purification method, etc. thereof.

**1st Main Claim**  
[MT] 1. a rotor mounted on a stator, the rotational axis of the rotor, the rotating shaft, the rotating body mounted on the mobile communication device, wherein the case and surrounding the one or more double to case mounted on one or more of the stator, with the Magnetizer consisting of one or more of ozone (ozone with magnetization; a vibration or hollow body and the magnetizer is embedded in the rear end of the hollow body or venturi tube, with associated with the vibrator, ozone, compressor with magnetization consisting of one or more; b) the vibration vibration with ozone (ozone, with the group device (器機), device, apparatus, machines, devices, equipment, facilities, equipment, tubes, pipes, reservoir, the pumps, the hoses, hopper, mixer, injector, injector nozzle, rod, pouring, curing, manufacturing equipment, construction equipment, one of the system characterized in that the functional equipment equipment



**Assignees:** CHUNG HA IK; CHUNG YONG JIN; KOREA IND TECH INST; CHUNG YONG HOON

## 35. Family 65706947 (US2019071367 AA)

[View in PatBase](#)

### Title (EP3398917 B1)

[EN] CALCIUM NITRATE AS ADDITIVE IN STEEL REINFORCED CONCRETE HAVING AN ELEVATED RESISTANCE TOWARDS CARBONATION

### Abstract

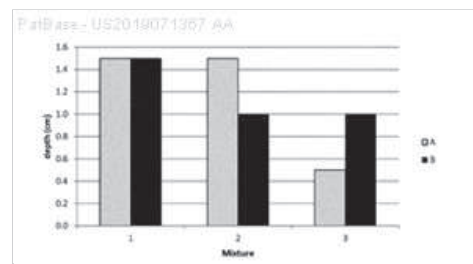
[EN] The invention relates to the use of calcium nitrate to reduce the pore size distribution of a hardened cementitious composition, preferably, a hardened concrete composition, wherein the cementitious (concrete) composition comprises between 1 weight percent to 4 weight percent of calcium nitrate of the cement content of the cementitious composition, depending on the type of cement. This results in a reduced permeability for the set cementitious (concrete) composition for carbon dioxide (CO<sub>2</sub>) and thus an elevated resistance towards carbonation. The invention furthermore relates to a method for producing such a hardened cementitious (concrete) composition and a pourable and curable (wet) concrete composition. The invention also relates to a steel reinforced concrete solid having an elevated resistance towards carbonation and a method for producing a steel reinforced concrete solid having an elevated resistance towards carbonation.

### 1st Main Claim (EP3398917 B1)

[EN] 1. Pourable and curable concrete composition, comprising per m<sup>3</sup> cured concrete

- - between 300 and 500 kg cement;
- - between 150 and 300 kg water;
- - between 1.500 and 1.800 kg aggregate; and
- - between 1 weight percent to 4 weight percent of the cement content of the concrete composition, depending on the type of cement, of calcium nitrate.

**Assignees:** YARA INT ASA



## 36. Family 97866410 (KR20230093962 A)

[View in PatBase](#)

### Title

[EN] BINDER COMPOSITION USING CARBONATED GYPSUM

### Abstract

[EN] The present invention relates to a binder composition using carbonated gypsum as a stimulant. The present invention provides a binder composition which comprises 10 to 3,000 parts by weight of blast furnace slag fine powder with respect to 100 parts by weight of carbonated gypsum, which is produced by mixing water in petroleum coke desulfurized gypsum for a hydration reaction and then capturing carbon dioxide to perform a mineral carbonation reaction. After carbon dioxide is captured by using petroleum coke desulfurized gypsum, the final by-product thereof can be used as a stimulant for blast furnace slag fine powder to increase the activity thereof, to replace ordinary Portland cement type 1, which is the most widely used in construction work, or minimize the amount of use thereof.

### 1st Main Claim

[MT] A binder composition comprising 1. 100 parts by weight of a carbonated gypsum and 10 to 3,000 parts by weight of a fine powder of a blast furnace slag , wherein the carbonated gypsum is produced by mixing water into a petroleum coke desulfurized gypsum to perform a hydration reaction , and then collecting carbon dioxide therein .

**Assignees:** MUN GYOUNG JU

37. Family 95721293 (US2024262743 AA)

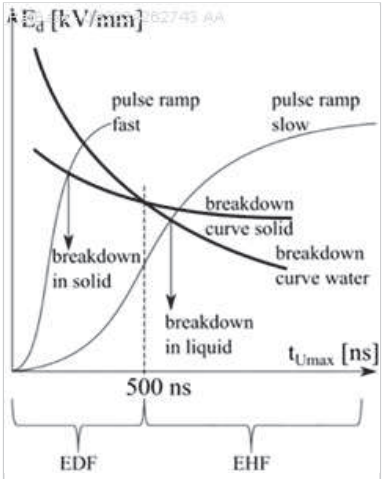
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**Title (EP4377277 B1)**  
[EN] SEPARATION OF HARDENED CONCRETE PASTE FROM AGGREGATE

**Abstract**  
[EN] A method for separating hydrated concrete paste from aggregate includes the steps of providing a feedstock comprising waste concrete with a D10 greater than or equal to 0.1 mm and a D90 less than or equal to 100 mm, passing the feedstock, a water containing liquid and carbon dioxide into a fragmentation vessel, where the wet feedstock is subjected to electric-pulse fragmentation, withdrawing fragmented solid material from the fragmentation vessel, separating the fragmented solid material from admixed liquid phase, separating the fragmented solid material into a fine fraction with a maximum particle size of 250 micro m to provide the carbonated recycled concrete paste and a coarse fraction, recycling the coarse fraction into the fragmentation vessel and/or discharging the coarse fraction as clean aggregate, use of the recycled concrete paste obtained thereby as supplementary cementitious material or filler.

**1st Main Claim (EP4377277 B1)**  
[EN] 1. Method for manufacturing carbonated recycled concrete paste and clean aggregate comprising the following steps:

- - providing a feedstock comprising waste concrete with a D<sub>10</sub> greater than or equal to 0.1 mm and a D<sub>90</sub> less than or equal to 100 mm
- - passing the feedstock, a water containing liquid and carbon dioxide in an amount providing a concentration of at least 0.1 wt.-percent carbon dioxide in the liquid into a fragmentation vessel, where the wet feedstock is subjected to electric-pulse fragmentation,
- - withdrawing fragmented solid material from the fragmentation vessel,
- - separating the fragmented solid material from admixed liquid phase,
- - separating the fragmented solid material into a fine fraction with a maximum particle size of 250 micrometres to provide the carbonated recycled concrete paste and a coarse fraction,
- - recycling the coarse fraction into the fragmentation vessel and/or discharging the coarse fraction as clean aggregate.



**Assignees:** HEIDELBERG MAT AG; HEIDELBERGCEMENT AG; HCONNECT 2 GMBH

## 38. Family 44577045 (KR200427038 Y1)

[View in PatBase](#)

### Title

[EN] SYSTEM FOR CONTROLLING THE QUALITY OF WATER REAL-TIME FOR REDUCING PIPE CORROSION IN A WATER SUPPLY PIPE

### Abstract

[MT] The idea which it sees is regarding the side food reduction real-time medulla control device of the constant earthenware coffin in order for about under using the water service veterinarian CCPP quotient which flows with the waterworks observation to correspond in erosion shield condition, it could be controlled a process control facility from the essence control process. The idea which it sees immediately before water service possibility flowing with a waterworks observation, in order to correspond in CCPP conditions which are demanded, various chemicals commitment phase and the essence control process previously leaflet total namely cohesion process of the essence control process last the chemicals control becomes accomplished from phase previously the filtration plant which is a section. First in order to correspond in CCPP conditions which are demanded with leaflet joint seal smallness lime and carbonic acid gas commitment, about under controlling the smallness lime which is a calcium longitude product beauty care does a calcium longitude low-end solubility quality because from underwater and the particles which are minute remain and a possibility of doing turbidity the mortar there is. Like this American annual income sleeping field passed cohesion process after precipitation process, company filtration and activated carbon process and the turbidity problem was naturally solved all. And in compliance with smallness lime pouring the scandal pH about under rising the carbonic acid gas about under pouring pH was under controlling because it will be able to decrease the cohesion effect in compliance with cohesion me. The calcium longitude which is controlled like this was without maintained until immediately before waterworks observation flowing change all. From phase previously the filtration plant in order to correspond in CCPP conditions, in the below-mentioned hazard last pH and alkali degree the place where it is under controlling, turbidity problem the mortar soda ash and the carbonic acid gas which it does not do it was under using. Constant earthenware coffin, smallness lime, carbonic acid gas, soda ash, calcium longitude and alkali, pH, the essence process, caustic soda and side food quotient (CCPP)

### 1st Main Claim

[MT] 1. Flow of raw water, pH / temperature, calcium hardness and alkalinity measurements of each water quality measurement means for measuring 1, coagulation process before lime ( $\text{Ca}(\text{OH})_2$ ) and carbon dioxide ( $\text{CO}_2$ ) and Joe Part 1 by injecting drugs that regulate calcium hardness and pH with the first means of drug delivery, the first drug Article slaked lime ( $\text{Ca}(\text{OH})_2$ ) and carbon dioxide ( $\text{CO}_2$ ) after injection of pH, calcium hardness and turbidity measurements of the second to measure the water quality measurement means and, activated after the filtration process from the incoming wastewater flow, pH / temperature and alkalinity measurements of each water quality measurement means for measuring a third, before Clearwell In the process of soda ash ( $\text{Na}_2\text{CO}_3$ ) and carbon dioxide ( $\text{CO}_2$ ) by a second drug injection Joe adjustment of pH and alkalinity and a second means of drug delivery, the second drug Joe soda ash ( $\text{Na}_2\text{CO}_3$ ) and carbon dioxide ( $\text{CO}_2$ ) after injection of pH, calcium hardness, alkalinity, turbidity and TDS measurements of each water quality measurement means for measuring IV, calcium hardness, alkalinity and pH for the target value The first water quality measures set in the flow, pH / temperature, calcium hardness, alkalinity, each receives a measure of lime to adjust the target value ( $\text{Ca}(\text{OH})_2$ ) and carbon dioxide ( $\text{CO}_2$ ) the operation of the quantitative dosage of the first control signal transmission means of drug delivery, and alkalinity, and pH on the water quality target setting and the third measures the flow rate, pH / temperature and alkalinity for each measurement to adjust the target value received and soda ash ( $\text{Na}_2\text{CO}_3$ ) and carbon dioxide ( $\text{CO}_2$ ) of the Quantitative dosage and drug delivery by applying a second control signal transmission means, monitoring controls and, the monitor is connected to the controller through the communication cable, data input and output control program through surveillance programs and the monitoring controller Real-time measurement data acquisition and control of data transmission monitoring and control server to control the behavior of water management that includes real-time quality control system of the busikjeogamyong.

39. Family 86624553 (US11492296 BA)

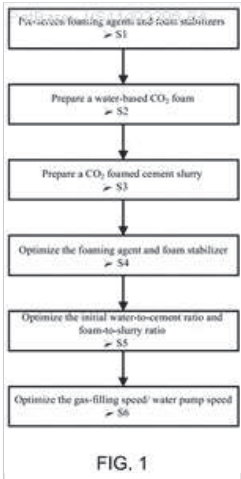
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**Title**  
[EN] CARBONIZATION-BASED LIGHTWEIGHT CO<sub>2</sub> FOAMED CEMENT-BASED MATERIAL, AND OPTIMIZED PREPARATION METHOD AND USE THEREOF

**Abstract**  
[EN] The present invention discloses an optimized preparation method of a carbonization-based lightweight CO<sub>2</sub> foamed cement-based material, and belongs to the field of geotechnical engineering materials. The preparation method includes: step S1: pre-screening existing common cement-based foaming agents and foam stabilizers; step S2: preparing a water-based carbon dioxide foam; step S3: preparing a cement slurry, and mixing the water-based carbon dioxide foam with the cement slurry to prepare a lightweight CO<sub>2</sub> foamed cement-based material; step S4: selecting foaming agents of different types and different concentrations and foam stabilizers of different types and different concentrations to prepare slurries, subjecting the slurries to slurry performance tests, and selecting the optimal ones; step S5: optimizing initial water-to-cement ratio and foam-to-slurry ratio parameters; and step S6: optimizing a gas-filling volume parameter (water pump speed).

**1st Main Claim**  
[EN] 1. A carbonization-based lightweight CO<sub>2</sub> foamed cement-based material, comprising the following components: a teasaponin foaming agent with a concentration of 4 g/L, a sodium dodecylbenzenesulfonate foam stabilizer with a concentration of 5 g/L, a water-based carbon dioxide foam, and a cement slurry, wherein a foam-to-slurry volume ratio of the water-based carbon dioxide foam to the cement slurry is 4.5:1; a water-to-cement mass ratio of the cement slurry is 1:2.4; and a speed of a water pump to produce the water-based carbon dioxide foam is 70 r/s.

**Assignees:** HOHAI UNIV; UNIV HOHAI



## 40. Family 76996572 (CN110590260 A)

[View in PatBase](#)

### Title

[EN] METHOD FOR IMPROVING PERFORMANCES OF RECYCLED CONCRETE BY UTILIZING CARBON DIOXIDE

### Abstract

[EN] An objective of the invention is to provide a method for improving performances of recycled concrete by utilizing carbon dioxide. The method comprises the following steps: mixing  $\text{Ca}(\text{OH})_2$  powder rich in calcium with water so as to form a calcium hydroxide solution; then introducing carbon dioxide gas into the calcium hydroxide solution until the calcium hydroxide solution is completely carbonized, then adding cement, mixing the cement with the solution produced in the first step under stirring for 60 s, then adding recycled coarse aggregate, carrying out stirring for 60 s, pouring sands and natural coarse aggregate, and carrying out complete mixing under stirring for 120 s so as to obtain a concrete mixture. The recycled concrete prepared by using the method provided by the invention is improved in compressive strength and flexural strength to a certain extent; meanwhile, the method can fix carbon dioxide in the atmosphere. The method provided by the invention provides a direction for promotion and application of  $\text{CO}_2$  and recycled aggregates, expands the application range of the  $\text{CO}_2$  and the recycled aggregates, has important theoretical value and significant economic benefits and environmental protection benefits, and has great significance for development of concrete.

### 1st Main Claim

[MT] 1. A method using carbon dioxide recycled concrete performance improvement method, characterized by comprising the steps of:

Step one, the rich in calcium  $\text{Ca}(\text{OH})_2$  powder mixed with water into calcium hydroxide solution. Then, to this solution with carbon dioxide gas until the solution is completely carbonized;

Step two, the cement is added and the first step in the production of mixing 60s;

Step three, adding recycled coarse aggregate stirring 60s, then poured into sand and natural coarse aggregate, stir to obtain concrete mix 120s.

**Assignees:** UNIV HUNAN; HUNAN UNIV

41. Family 72961335 (CN109250941 A)

[View in PatBase](#)

Title

[EN] RECYCLED AGGREGATE CONCRETE SPECIAL-PURPOSE COMPOSITE ADDITIVE

Abstract

[EN] The invention discloses a recycled aggregate concrete special-purpose composite additive. According to the recycled aggregate concrete special-purpose composite additive, high purity carbon dioxide gas is introduced into a Ca(OH)<sub>2</sub> solution for carbonization, before reaction, a modification agent CTAB is added, recycled aggregate concrete mixed ratio design is carried out; nanometer CaCO<sub>3</sub> and lightcalcium carbonate powder are mixed, and a water reducer is added. The beneficial effects are that: the recycled aggregate concrete special-purpose composite additive is capable of improving the mechanical properties of recycled aggregate concrete, and especially the early stage mechanical properties.

1st Main Claim

[MT] 1. A recycled aggregate and complex admixture special concrete, characterized by the following steps:

Step 1: Preparation of nano calcium carbonate;

In the Ca (OH)<sub>2</sub> solution to pass into the high purity carbon dioxide gas through the carbonization, the reaction starts before adding modifying agent CTAB, after the reaction stirring, drying, high-speed grinder grinding, sifting;

Step 2: Recycled aggregate concrete mix design;

- (1) determine the recycled coarse aggregate substitution rate  $\lambda_g$ ;
- (2) determine recycled coarse aggregate concrete strength standard deviation  $\sigma$ , according to current industry standard "recycled aggregate concrete application of technical regulations of (JGJ/T240-2011) prescribed value;
- (3) recycled coarse aggregate concrete strength to determine:  $F_{rg} = f_{cu,k} + 1.645\sigma$ , where the design strength of concrete  $f_{cu}$ , k;
- (4) recycled coarse aggregate concrete strength of the relationship between absolute water glue mass ratio:  $A \cdot b = A_{fce} [c / (w + m_{rg} f_{rg} \omega_a)]$ ; Wherein A, B is an ordinary concrete linear regression coefficient;  $F_{fce}$  cementitious material strength, unit N · m<sup>-2</sup>; C is the amount of cementitious material, unit kg · m<sup>-3</sup>; W is an ordinary concrete water consumption, unit kg · m<sup>-3</sup>;  $m_{rg}$  of recycled coarse aggregate amount, unit kg · m<sup>-3</sup>;  $\omega_a$  of recycled coarse aggregate water absorption, expressed as a decimal;
- (5) in order to ensure mix slump control in the range of engineering specific needs, the need for ordinary concrete mix with water to adjust the amount of water adjusted to W;
- (6) based on ordinary concrete mix with water W, and according to the state of use of recycled coarse aggregate and recycled coarse aggregate concrete mixture effective to determine the amount of water;  $w_{g0}$
- (7) 1m<sup>3</sup> recycled coarse aggregate concrete amount of cementitious material:

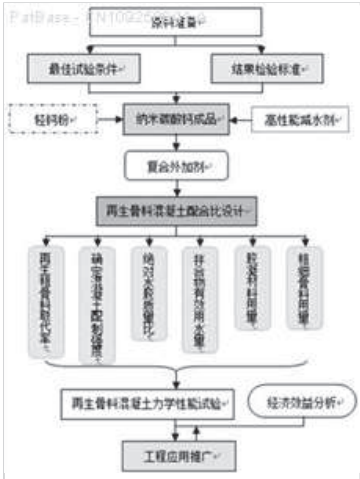
PatBase

$$m_{bg} = \frac{W_{g0} + m_{Rg} \omega_a}{W_{Rg} / C} ;$$

Wherein,  $W_{Rg}$  of recycled coarse aggregate concrete mixture of the absolute amount of water;

- (8) the technical indicators, according to the recycled coarse aggregate concrete mix of performance and construction requirements to determine the rate of sand;
- (9) in ordinary concrete with the ratio of the amount of coarse and fine aggregate basis, according to the recycled coarse aggregate substitution rate  $\lambda_g$  has been determined to calculate the amount of recycled coarse aggregate;

Perception in the calculation with the ratio calculated on the basis of trial mix, water-cement ratio is preferably remains unchanged,



by adjusting the mix other parameters to make the recycled coarse aggregate concrete mix design and performance to meet the construction requirements, and then correction calculation with the ratio of recycled coarse aggregate concrete proposed trial mix mix ratio;

In (11) recycled coarse aggregate concrete mix ratio of trial mix basis, according to the determined water gel mass ratio adjusted water and admixture amount, other parameters should be adjusted accordingly, to determine the final recycled coarse aggregate concrete mix ratio.

Step 3: Complex admixture composition;

Nano-CACO 3 and light calcium powder mixed, plus water reducing agent.

**Assignees:** QINGDAO HAOTIAN GREEN BUILDING TECH CO LTD

42. Family 13686959 (JP2000143305 A2)

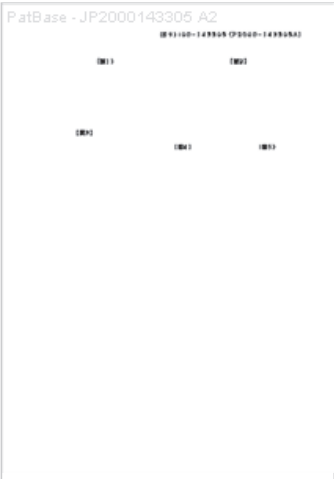
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**Title**  
[EN] BUILDING STONE TO BE SUNK IN WATER AND PRODUCTION OF THE SAME STONE

**Abstract**  
[EN] PROBLEM TO BE SOLVED: To provide building stone suitable for materials to be sunk in the water so as to form a seaweed bed. SOLUTION: When this building stone to be sunk in the water is made from slag from a steel-manufacturing process as a principal raw material, the slag as a principal raw material comprises at least one kind selected from a group consisting of granule slag, coarse grain-form one and small aggregated one, and raw materials for the stone are made to consolidate and to be aggregated by CaCO<sub>3</sub> formed through carbonation reaction as a binder. At least the part of the external surface of the stone has a fusible silica-including layer having 10-90 weight percent fusible silica content.

**1st Main Claim**  
[MT] 1. 沈設 a stone and water main ingredient manufacturing process steel slag generated in the slag, granulated slag powder, wherein the coarse granular slag, consisting of one or more small lumps of slag, said slag CaCO<sub>3</sub> was produced by the carbonation reaction the main raw material for stone material Will be solidified as a binder, a massive stone was added, at least some areas of the exterior masonry, soluble silica沈設 stone and a water layer having a blend of soluble silica content of 10 ~ 90wt percent.

**Assignees:** NIPPON KOKAN KK



## 43. Family 103400889 (WO24145256 A1)

[View in PatBase](#)

### Title

[EN] PROCESSES FOR USING REACTIVE LIME AND/OR MAGNESIA-CONTAINING MATERIALS IN CONCRETE BY LOW TEMPERATURE AND LOW-PRESSURE HYDROTHERMAL DENSIFICATION PROCESSES AND RELATED COMPOSITIONS AND APPARATUS

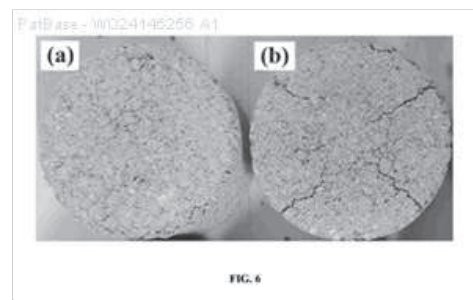
### Abstract

[EN] Set forth herein are processes and reagents for using concrete mixtures to make concrete in which the concrete mixture includes reactive CaO or reactive MgO and hardens via hydrothermal densification process comprising hydration and carbonation reactions. In hydrothermal densification process water in the form of vapor, liquid, or steam and CO<sub>2</sub> in the form of gaseous or liquid or a combination thereof are enforced in concrete pore space to form hydrated calcium carbonates (HCC) and/or hydrated magnesium carbonates and other hydration products to densify concrete microstructure. Certain processes and reagents are useful for adjusting the initial porosity of a concrete mixture. Certain processes and reagents are useful for regulating the rate of microstructure development of concrete during curing. Certain processes and reagents are useful for adjusting the initial porosity of a concrete mixture and also useful for regulating the rate of microstructure development of concrete during curing. The instant disclosure provides pathways for the utilization of lime/magnesia-containing industrial solid waste that otherwise cannot be generally used for concrete applications.

### 1st Main Claim

[EN] 1. A process for making concrete, wherein the process comprises: providing a concrete mixture comprising reactive CaO-containing materials, reactive MgO-containing materials, or a combination thereof; adjusting the porosity, the microstructure, or both the porosity and the microstructure of the concrete mixture; and solidifying the concrete mixture by a hydrothermal densification process in a single stage or in a multistage process by contacting the concrete mixture with a CCh-containing gas and H<sub>2</sub>O.

**Assignees:** CARBONBUILT; CHEUNG MARCUS; SHARIFI NASER POURAKBAR

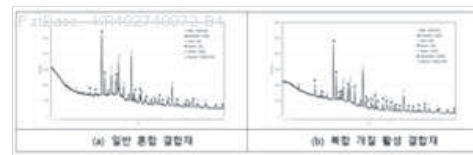


## 44. Family 104666532 (KR102710972 B1)

[View in PatBase](#)

### Title

[EN] STRENGTH IMPROVEMENT SOLIDIFICATION COMPOSITION USING COMPOSITE REFORMING ACTIVE BINDER OBTAINED THROUGH PULVERIZATION OF INDUSTRIAL BY-PRODUCTS AND GROUND SOLIDIFICATION METHOD USING THE SAME



### Abstract

[MT] The present invention relates to a strength-improving solidifying composition utilizing a composite modified active binder obtained through an ungrinding treatment of industrial by-products and to a method of ground solidification using the same. The environment can be improved by minimizing the amount of cement usage, instead by mixing and using a slag fine powder and fly ash, and by using a composite modified active binder obtained through a non-grinding treatment of industrial by-products to enhance the reactivity of the slag fine powder and fly ash, thereby enhancing resource circulation effects by recycling waste resources, and reducing the amount of cement use. The present invention relates to a solidifying material composition and a method of ground solidification using the same. The strength-improving solidifying material according to the present invention combines circulating fluidized bed boiler ash and wet grinding aids resulting from the desulfurization process of a power plant to minimize the use of cement and further use pozzolanic materials such as blast furnace slag fines and fly ash which are industrial by-products, so that the required strength is less likely to be expressed as compared to cement and thus overcome the drawbacks of the blast furnace slag fines and fly ash which are difficult. A method for improving physical characteristics, and at the same time, by forming a raw material and subjecting it to grinding treatment in a pulverizing apparatus to form a composite modified active binder composed of fine powder, and mixing it with cement, thereby improving the physical characteristics. By using wet gypsum, whose utility is dropped due to residual moisture, to remove residual moisture by using the reaction of the wet gypsum with calcium oxide in the circulating fluidized bed boiler ash, it is possible to increase the utility as a powder and to exert an environmentally friendly function through resource recirculation, as well as reducing the amount of cement usage, there is less heavy metal elution and environmental friendly effect.

### 1st Main Claim

[MT] A strength-improving type solidifying composition comprising 10 to 25 parts by weight of a cement powder and 75 to 90 parts by weight of a composite reforming active binder, wherein the composite reforming active binder is formed by mixing fly ash, wet gypsum to form a mixed raw material by mixing fly ash, blast furnace slag fine powder and grinding aid which is then subjected to grinding treatment in ungrinding equipment to form a pulverizing process<sup>2</sup>G, residual moisture in the wet gypsum reacted with calcium oxide (Cao) of the circulating fluidized bed boiler ash to  $\text{Ca}(\text{OH})_2$  and  $\text{Ca}(\text{OH})$  formed above<sup>2</sup>By weight of the wet gypsum is stimulated on the surfaces of the blast furnace slag fine powder and fly ash to enhance reactivity, characterized in that the wet gypsum is calcium sulfate alpha hemihydrate and has a water content of 5 to 30 wt%, and the residual moisture contained in the wet gypsum is reacted with the calcium oxide in the circulating fluidized bed boiler ( $\text{CaOH})_2$  is  $\text{CaCO}_3$  by a carbonation process<sup>3</sup>Wherein the carbonation process reacts carbon dioxide gas under pressure and reacts with the residual moisture present in the wet gypsum and Cao present in the circulating fluidized bed boiler ash to first  $\text{Ca}(\text{OH})_2$  Producing and which is again by a carbon dioxide injection process<sup>3</sup> $\text{CaCO}_3$  formed by the carbonation process<sup>3</sup>Characterized in that the circulating fluidized bed boiler ash comprises at least 30% calite analyzed by XRD analysis, and in that the circulating fluidized bed boiler ash is  $\text{CaSO}_4$ Wherein the solidifying composition further comprises 10 to 30 parts by weight of a calcium hydroxide component raw material, and the calcium hydroxide component raw material is  $\text{Ca}(\text{OH})_2$ By weight of  $\text{Ca}(\text{OH})$  formed by the reaction between the circulating fluidized bed boiler ash and the residual moisture of wet gypsum<sup>2</sup>Wherein said calcium hydroxide component raw material is mixed with said calcium hydroxide component raw material so that the effect of stimulating blast fine powder and fly ash produces a synergistic action due to the lack of effect of stimulating blast fine powder and fly ash due to carbonization.

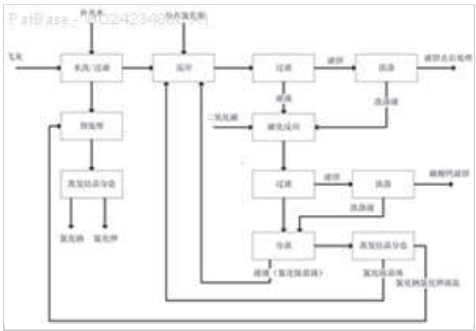
**Assignees:** POSHITEC CO LTD; YEKANG CO LTD

45. Family 105358691 (WO24234888 A1)

[View in PatBase](#)

**Title**  
[EN] REDUCTION AND RECYCLING TREATMENT METHOD FOR WASTE INCINERATION FLY ASH

**Abstract**  
[EN] Disclosed in the present invention is a reduction and recycling treatment method for waste incineration fly ash. Reduction and harmless treatment of fly ash is achieved by means of a process of washing with water, washing with ammonium chloride, and mother liquor partial evaporation crystallization for salt separation. First, hazardous chloride ions and a soluble salt are washed out from fly ash by washing with water, so that the content of sodium chloride and potassium chloride impurities in an ammonium chloride solution is controlled to be within a reasonable range; then, ammonium chloride reacts with calcium hydroxide in the fly ash to generate calcium chloride, so that the fly ash is reduced by about 40-50 percent; and subsequent partial evaporation crystallization for salt separation ensures a balance between the mass and concentration of an ammonium chloride mother liquor, ensuring the long-term stable operation of a system. In addition, according to the method in the present invention, different calcium carbonates can also be prepared, including ordinary calcium carbonate, light calcium carbonate and even nanoscale calcium carbonate, so that a fly ash recycling byproduct calcium carbonate product line is enriched, the byproduct benefits are increased, and the production costs are effectively reduced.



**1st Main Claim**

[MT] A waste incineration fly ash reduction resource treatment method, characterized by comprising the steps of:

Step one, washing the fly ash with water and filtering to obtain a first filter cake and a first filtrate;

Step two, the first filter cake obtained in step one is placed in a reactor, and the chlorinate ammonium mother liquor is added to the reactor and the reaction is carried out at an end pH of 8-12.2 to obtain the reaction product;

Step three, filtering the reaction product obtained in step two to obtain a second filter cake and a second filtrate, washing the second filter cake with water to obtain a first wash liquor, and mixing the second filtrate with the first wash liquor to obtain a first mixture liquor;

Step four, starting from the first mixed liquor obtained in step three, carrying out a reaction to prepare calcium carbonate;

Step five, filtering the reaction product obtained in step four to obtain a third filtrate and a third filter cake, washing the third filter cake with water to obtain calcium carbonate and a second wash liquor, mixing the second wash liquor with the third filtrate to obtain a second mixture liquor;

Step six, the second mixture is split, a portion of the second mixture is subjected to evaporation crystallization to separate the salt to obtain ammonium chlorinate crystals, and the ammonium chlorinate crystals are dissolved in the remaining second mixture to prepare an ammonium chlorinate solution, by controlling the amount of the second mixture used to evaporate the crystalline salt, The concentration and quality of the chlorinate ammonium solution prepared is substantially the same as the concentration and quality of the chlorinate ammonium mother liquor added in step two, The chlorinate ammonium solution prepared is added to the reactor of step two for recycling.

**Assignees:** LI XIAOQING; TONG QIANG

## 46. Family 104734797 (WO24197364 A1)

[View in PatBase](#)

### Title

[EN] MATRICES AND PROCESS FOR MITIGATING CARBON DIOXIDE (CO<sub>2</sub>) AND OTHER GREENHOUSE GASES USING CALCIUM PHOSPHATES COMPOSITIONS AND APATITES VIA PHYSISORPTION AND PHOTOCATALYSIS

### Abstract

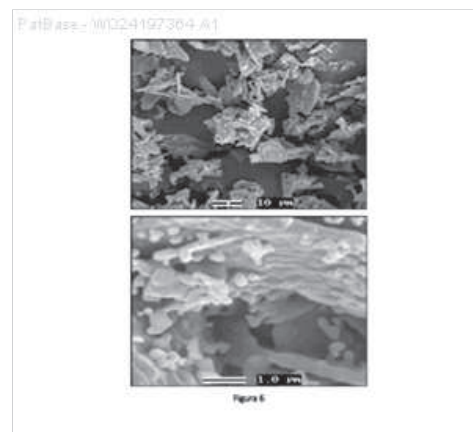
[EN] The present invention patent relates to porous matrices with high surface area, made of calcium phosphates and free hydroxyl sites for mitigating and photocatalyzing carbon dioxide. The subject matter relates to five main phases: Hydroxyapatite or Ca<sub>10</sub>(PO<sub>4</sub>)<sub>6</sub>(OH)<sub>2</sub>; monetite - Ca(PO<sub>3</sub>OH); calcium hydroxide - Ca(OH)<sub>2</sub>; or beta-tricalcium phosphate - Ca<sub>9</sub>(PO<sub>4</sub>)<sub>6</sub>, forming binary microstructures such as biphasic calcium phosphate (HA and 0-TCP) and amorphous calcium phosphate that were optimized for capturing/immobilizing the GHGs and photoreduction with UV radiation.

These constituents induce photocatalysis of carbon dioxide, transforming same into oxygen gas (O<sub>2</sub>) and elemental carbon (graphenes). Aside from having great adsorptive capacity, these matrices are chemically stable, wherein the microstructure thereof does not undergo significant alterations when the photocatalytic process is induced. Calcinated and non-calcinated calcium phosphates are suggested in this patent as excellent CO<sub>2</sub> adsorbents via balanced adsorption by pressure and/or temperature (Pressure Swing Adsorption - PSA, Temperature Swing Adsorption - TSA).

### 1st Main Claim

[MT] 1/3 REIVINDICACOES 1) POROUS MATRICES OF CALCIUM PHOSPHATE FOR MITIGACAO And FOTOCATALISE OF carbon diOXIDO And OTHER GREENHOUSE GASES BY MEANS OF ADSORPTIVE PROCESS, characterized in that it comprises matrices containing up to five major phases between non-calcined and calcined samples, which alone and/or in associacao between them, Added to their purposely created isomerisms, they have an adsorption capacity of CO<sub>2</sub> and other GHGs of about 140 times to 500 times of their mass weight, which are: Hydroxyapatite or HA - Ca<sub>10</sub>(PO<sub>4</sub>)<sub>6</sub>(OH)<sub>2</sub>; A monetita - Ca(PO<sub>3</sub>OH); the calcium hydroxide - Ca(OH)<sub>2</sub>; Beta tricalcium phosphate - ca<sub>9</sub>(PO<sub>4</sub>)<sub>6</sub>Forming binary microstructures such as biphasic calcium phosphate (ha and -tcp) and amorphous calcium phosphate. 2) POROUS MATRICES OF CALCIUM PHOSPHATE FOR Migracao And FOTOCATALISE OF carbon dioxide And OTHER GREENHOUSE GASES BY MEANS OF ADSORPTIVE PROCESS, according to claim 1, characterized in that when using non-calcined samples, 3 (three) major phases are applied: Calcium hydroxide (20 to 60 percent), hydroxyapatite (10 to 40 percent) and the monetite (10 to 40 percent), plus a fourth minor phase, amorphous calcium phosphate (ACP), of the order of 5 to 20 percent. 3) POROUS MATRICES OF CALCIUM PHOSPHATE FOR MITIGACAO And FOTOCATALISE OF carbon diOXIDO And OTHER GREENHOUSE GASES BY MEANS OF ADSORPTIVE PROCESS, according to claim 1, characterized by use in chimneys (steel, cement, thermoelectrics), exhaust of automotive vehicles, Space cabins and/or other dry environments rich in CO<sub>2</sub> at temperatures between 273 and 323 K, with the presence of UV radiation. 2/3 4) POROUS MATRICES OF CALCIUM PHOSPHATE FOR Migracao And FOTOCATALISE OF carbon diOXIDO And OTHER GREENHOUSE GASES BY MEANS OF ADSORPTIVE PROCESS, according to claim 1, characterized by having a surface area of 30 m.<sup>2</sup>/g to 300m<sup>2</sup>/g. 5) POSE MATRICES OF CALCIUM PHOSPHATE FOR Migracao And FOTOCATALISE OF carbon dioxide And OTHER GREENHOUSE GASES BY MEANS OF ADSORPTIVE PROCESS according to claim 1, characterized by the adsorption capacity of 140 to 1000 grams of CO<sub>2</sub> per gram of material. 6) POROUS MATRICES OF CALCIUM PHOSPHATE FOR MIGRACAO AND FOTOCATALISE OF CARBON DIOXIDO AND OTHER GREENHOUSE GASES BY MEANS OF ADSORPTIVE PROCESS ACCORDING TO CLAIM 1, Characterized by having mean matrix particle diameter ranging from 10 micro m to 75 micro m 7) POROUS MATRICES OF CALCIUM PHOSPHATE FOR carbon dioxide and phosphorus free from PHOSPHORUS ADSORPTION ACCORDING to claim 1, characterized by the ability of calcium phosphates to be regenerated by up to three times without this reducing significantly the adsorptive and/or photocatalytic capacity. 8) CARBON DIOXIDO AND OTHER GREENHOUSE GASES MITIGACAO PROCESS And FOTOCATALISE By MEANS OF AN ADSORPTIVE PROCESS, characterized in that fluidized beds, fixed bed or sleeve filters are used, To increase the effective surface contact area of calcium phosphate matrices with carbon dioxide molecules, other GHGs and/or dioxins and furans. 3/3 9) CARBON DIOXIDO AND OTHER GREENHOUSE GASES BY MEANS OF ADSORPTIVE PROCESS, characterized in that the surface physico-chemical phenomena of decomposition of the EEGs can preferably be carried out dry with uncalcined calcium phosphates, with moisture between 10 and 60 percent, and/or with calcined calcium phosphates for gases with a moisture content exceeding 60 percent. 10) MITIGACAO AND FOTOCATALISE PROCESS OF CARBON DIOXIDO And OTHER GREENHOUSE GASES BY MEANS OF ADSORPTIVE PROCESS, characterized in that it generates effluents from photocalise in the following products: Molecular oxygen (O.<sub>2</sub>) And nanostructured elemental carbon (C) in the form of graphenic materials, after treatment for removal of particulate materials (ash) and/or sulfur (S).

**Assignees:** NICODEMOS DA SILVA SIDNEY; PEIXOTO PINHEIRO SILVA IVETE



## 47. Family 44003489 (US2009283016 AA)

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### Title (EP2303793 B1)

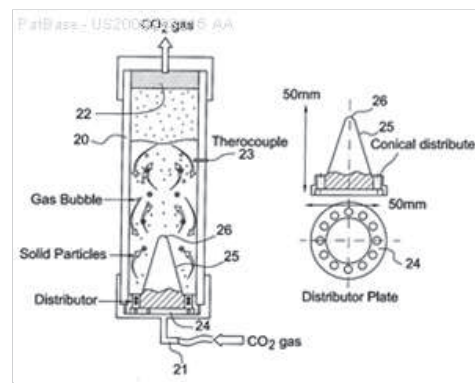
[EN] METHOD FOR TREATING PARTICULATE MATERIAL

### Abstract

[EN] A method for treating cement kiln dust containing alkaline metal salts includes the steps of hydration (formation of calcium hydroxide), dehydration i.e. drying, fractionation by sieving and carbonation (reaction of the fractionated moistened cement kiln dust) with CO<sub>2</sub> gas in a fluidized bed reactor.

### 1st Main Claim (EP2303793 B1)

[EN] 1. A method for treating cement kiln dust (CKD) containing alkaline metal salts, which method comprises (1) a hydration step to produce hydrated CKD, (2) a drying step which reduces the moisture content of the hydrated CKD to less than 20 percent by weight, and (3) a carbonation step, wherein the carbonation step is carried out in a fluidized bed reactor, wherein if the hydrated CKD resulting from step (2) comprises particles greater than 10mm in size at their widest point the method further comprises a fractionating step between steps (2) and (3), which fractionating step involves removing particles greater than 10mm in size at their widest point.



**Assignees:** UNITED ARAB EMIRATES UNIVERSITY; UNITED ARAB EMIRATES UNIV; UNIV UNITED ARAB EMIRATES; EL GAMAL MAISA MABROUK; MOHAMED ABDEL MOHSEN ONSY; UNITED ARAB EMIRATES UNIVERSIT

48. Family 13686955 (JP2000143303 A2)

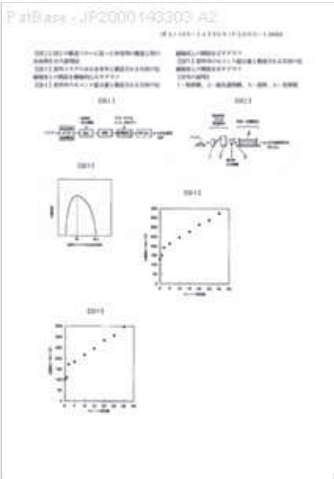
[View in PatBase](#)

**Title**  
[EN] BUILDING STONE TO BE SUNK IN WATER AND PRODUCTION OF THE SAME STONE

**Abstract**  
[EN] PROBLEM TO BE SOLVED: To provide artificial building stone suitable for materials to be sunk in the water so as to form a seaweed bed. SOLUTION: When this building stone to be sunk in the water is made from a mixture, as a raw material, of slag from a steel-manufacturing process as a principal raw material with an additive, the slag comprises at least one kind selected from a group consisting of granule slag, coarse grain-form one and small aggregated one, and at least part of the additive comprises cement. The mixture of the slag with the additive is made to consolidate and to be aggregated by CaCO<sub>3</sub> formed through carbonation reaction as a binder.

**1st Main Claim**  
[MT] 1. The main raw material steel slag generated in the manufacturing process, a stone 沈設 water as a raw material and additive mixtures of this primary material, granulated slag and slag powder above the main raw material, crude granulated slag, consisting of one or more small lumps of slag, cement made from at least part of said additive, CaCO<sub>3</sub> generated by the carbonation reaction was a mixture of slag and said additive Will be solidified as a binder, and a stone water 沈設 that lumping.

**Assignees:** NIPPON KOKAN KK



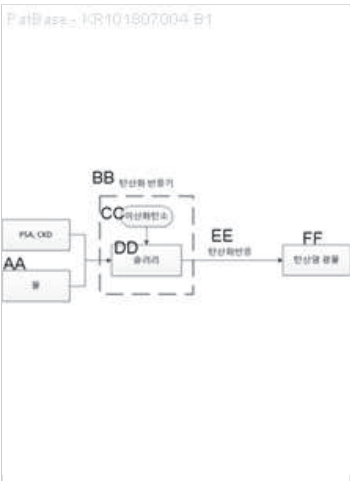
49. Family 67754996 (KR101807004 B1)

[View in PatBase](#)

**Title**  
[EN] STORAGE METHOD FOR CARBON DIOXIDE USING DIRECT MINERAL CARBONATION OF PAPER SLUDGE ASH OR CEMENT KILN DUST

**Abstract**  
[EN] The present invention relates to a carbon dioxide storage method using direct carbonation of cement kiln dust or paper sludge ash (PSA). To this end, the carbon dioxide storage method comprises the following steps: (1) mixing water and PSA together and then inserting the same into a continuous reactor so as to produce slurry; (2) eluting out calcium by stirring slurry in the reactor, injecting carbon dioxide gas into the reactor, and carrying out a mineral carbonation reaction so as to produce carbonate mineral; and (3) collecting the produced carbonate mineral.

**1st Main Claim**  
[MT] 1. (1) continuous type reactor in paper sludge ash (PSA) solid-liquid ratio of water and 1/10~1/2 / mℓ, added and mixed; (2) for producing a slurry by stirring the slurry in the reactor then eluted calcium carbon dioxide gas into the reactor at a flow rate of 0.1 to 1.0 ℓ / min (slurry) 0.5 L reaction by injecting a mineral acid to produce a sikimeuroseo carbonate minerals, the carbonation reaction directly; and (3) recovering the carbonate minerals, carbonate minerals; comprises a, number of times the above (2), and the atmospheric pressure at a temperature range of 4 to 30, wherein the slurry comprises from 3 to 30 minutes stirring, 10 to 60 minutes of the injection of carbon dioxide gas (1) to (3), made in a continuous flow method is in the form of calcite (calcite) carbonate mineralsand calcium carbonate (CACO3) is calculated according to equation 1, the carbonation reaction directly the amount of carbon dioxide by the carbon dioxide of 100 to 110 kg, Co2/ton PSA directly characterized in that the carbon dioxide storage method using carbonate: <equation 1> (however, wherein WFis entered at the weight of mineral carbonation reaction after the solid CFis mineral carbonation reaction After CACO3 and MGCO3 content (%); Wliis entered at the carbonation reaction the industrial by-products of the mineralmineral carbonation reaction weight CACO3 and MGCO3 CI before a MWCO2molar mass of carbon dioxide content (%); and a (g/mol); MWC3 molar mass (CACO3.)



**Assignees:** KOREA MARITIME UNIV IND ACADEMIC COOPERATION FOUNDATION; KOREA MARITIME AND OCEAN UNIV IND ACADEMIC COOPERATION CENTER

50. Family 108282541 (CN120097686 A)

[View in PatBase](#)

Title

[MT] A PULP-COATED RECYCLED AGGREGATE BASED ON TEA STEM CELLULOSE AND TEA SAPONIN AND ITS LOW-ALKALI ECOLOGICAL PREPARATION PROCESS

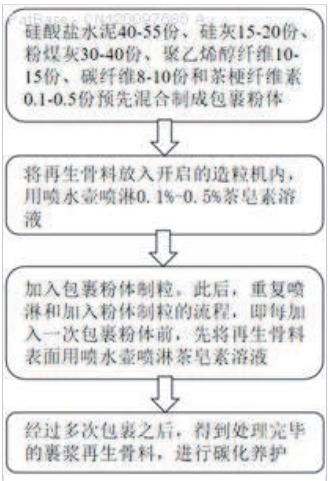
Abstract

[MT] [0001] The present invention discloses a pulp-coated recycled aggregate based on tea stem cellulose and tea saponin and a low-alkali ecological preparation process thereof. The present invention uses tea stem resource classification treatment, adopts acid hydrolysis method to prepare tea stem cellulose and ethanol immersion method to purify tea saponin, and synergistically applies them to the surface modification system of recycled aggregate. By weight, the raw materials of the coating slurry mainly include 50 parts of ordinary Portland cement, 20 parts of silica fume, 30 parts of fly ash, 10 parts of polyvinyl alcohol fiber, 10 parts of carbon fiber and 0.3 parts of tea stem cellulose. Through the wet pulp coating process of a granulator, a dense interface layer is formed on the surface of the recycled aggregate, and the surface activity of tea saponin is used to strengthen the interface bonding between the tea stem cellulose and the cement matrix. Combined with the carbonization curing process, the cement hydration product  $\text{Ca(OH)}_2$  is promoted to react with  $\text{CO}_2$  to generate  $\text{CaCO}_3$ , significantly reducing the pH value of the system and realizing low-alkali regulation. The modified pulp-coated recycled aggregate not only has better mechanical properties, but also has improved durability, and can replace natural aggregate to prepare high-performance concrete. The present invention simultaneously solves the problems of insufficient mechanical properties of recycled aggregates and enrichment of alkaline substances through high-value utilization of discarded tea stalks, and provides an innovative path for the resource utilization of construction solid waste with both low carbon emissions and ecological benefits.

1st Main Claim

[MT] 1. A pulped recycled aggregate based on tea stem cellulose and tea saponin, characterized in that it is composed of the following raw materials in parts by mass: 80-120 parts of recycled aggregate with a particle size of 4.75-9.5 mm, 40-55 parts of cement, 15-20 parts of silica fume, 30-40 parts of fly ash, 10-15 parts of polyvinyl alcohol fiber, 8-10 parts of carbon fiber, 0.1-0.5 parts of tea stem cellulose, 0.01-0.05 parts of tea saponin and water.

Assignees: HOHAI UNIV



## 51. Family 102375035 (KR20240056302 A)

[View in PatBase](#)

### Title

[EN] INORGANIC CURING CEMENT-FREE MINERAL POWDER MANUFACTURED BY HYDRATION AND ALKALINE REACTION AND METHOD FOR MANUFACTURING THE SAME

### Abstract

[EN] The present invention addresses reprocessing issues of industrial byproducts such as blast furnace slag and steel slag, and also partially resolves the shortage of natural aggregates of specific sizes used in cement concrete for building construction or road paving; reduces carbon dioxide emissions by using lower thermal energy compared to conventional artificial aggregate manufacturing methods requiring calcination at temperatures above 1,000 degrees centigrade; enhances durability of mixtures by increasing bonding strength through hydration reactions; and provides a cement-free binder applicable to manufacturing inorganic cured artificial aggregates using industrial byproducts that were previously unrecyclable, as well as a method for preparing the same. The cement-free binder according to the present invention may be prepared by mixing a binder composition comprising blast furnace slag powder, steel slag powder, sodium carbonate ( $\text{Na}_2\text{CO}_3$ ) powder, calcium hydroxide ( $\text{Ca}(\text{OH})_2$ ) powder, calcium carbonate ( $\text{CaCO}_3$ ) powder, and powdered setting retarder with a dilution solution.

### 1st Main Claim

[MT] 1. Blast furnace slag powder, steel slag powder, sodium carbonate ( $\text{Na}_2\text{CO}_3$ ) Powder, calcium hydroxide ( $\text{Ca}(\text{OH})_2$ ) Powder, Calcium Carbonate ( $\text{CaCO}_3$ ) A cement free binder prepared by mixing a binder composition comprising powder and setting retarder powder with a diluent .

**Assignees:** KOREA INST OF CIVIL ENGINEERING AND BUILDING TECH; KOREA INST CIVIL ENG AND BUILDING TECH; KOREA INST OF CIVIL ENGINEERING AND BUILDING TECHNOLOGY KICT



52. Family 95242625 (CN115520887 A)

[View in PatBase](#)

Title

[EN] NOVEL METHOD FOR FIXING CARBON DIOXIDE BY USING CONSTRUCTION WASTE

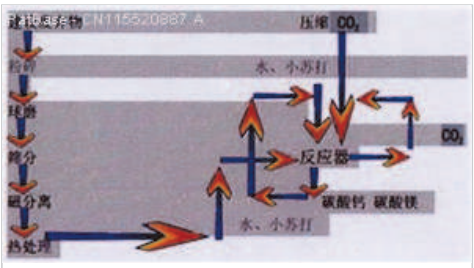
Abstract

[EN] The invention discloses a novel method for fixing carbon dioxide by construction waste, which is technically characterized by comprising the following steps of: crushing, cleaning and grading waste concrete, recycling coarse aggregate in the waste concrete, and generating waste cement particles up to 1/3 (by mass) in the process of recycling the recycled aggregate; waste cement particles as a raw material and CO<sub>2</sub> compressed by a compressor are subjected to a carbonation chemical reaction in a container filled with a proper amount of magnetized water to generate a calcium-rich hydrate, the calcium-rich hydrate is cured in a curing pool to obtain stable CaCO<sub>3</sub>, and calcium carbonate is nontoxic and harmless, can be used as a raw material for producing cement and can also be used for other industrial purposes. And some toxic heavy metals can be fixed and some precious metals can be recovered by carbonating the CO<sub>2</sub> by using the solid wastes, so that the method has better economic benefits.

1st Main Claim

[MT] 1. A method of building waste to fix carbon dioxide, the technical feature of which is comprised of Co.<sub>2</sub>Dissolution-ionization of calcium, magnesium plasma in building waste - precipitation of calcium carbonate or magnesium carbonate.

Assignees: ZHANG YUCHANG



## 53. Family 97822409 (CN116283089 A)

[View in PatBase](#)

### Title

[EN] PREPARATION METHOD OF CARBON SEQUESTRATION REINFORCED RECYCLED AGGREGATE FOR COMMERCIAL MIXING STATION

### Abstract

[EN] The preparation method comprises the following steps: crushing and separating waste concrete beams to obtain recycled concrete aggregate, mixing the aggregate, high-solid-content commercial mixed waste slurry, wet grinding balls, a crystal form regulating agent and water, performing wet grinding, introducing CO<sub>2</sub>, and controlling the temperature through a water cooling device to obtain carbon sequestration reinforced recycled aggregate slurry. 400-750 parts of the slurry, 130-225 parts of cement, 185-295 parts of fly ash and 20-30 parts of water which are weighed are put into a stirring machine to be stirred for 4 min, the evenly stirred raw materials are subjected to compression molding, curing is conducted in a standard curing chamber, and the carbon sequestration reinforced recycled aggregate mortar is obtained. The method is low in cost and low in energy consumption, and a novel efficient CO<sub>2</sub> mineralization utilization method is provided for the commercially mixed waste slurry and the recycled aggregate.

### 1st Main Claim

[MT] 1. A process for preparing carbon-reinforced regenerated aggregate at a commercial mixing station, comprising the steps of:

The method comprises the steps of: A step 1 of crushing a waste concrete beam to separate a regenerated concrete aggregate;

Step 2, take 400-500 parts by weight of the recycled concrete aggregate of Step 1, 80-100 parts of high solids commercial waste pulp mixed with 240-300 parts of wet milling balls, 20-30 parts of form control agent, 180-220 parts of water and wet milling. The wet mill is fed with CO at a concentration of 40 plus or minus 5% at a gas rate of 2.5-3.6 kg/h into the vertical agitation mill<sub>2</sub>Carbonization is carried out and the reaction temperature is controlled by a water cooling device until the slurry pH = 7.3 to 7.6, the CO flow is stopped<sub>2</sub>The wet milling was continued for 0.5 h to remove the wet milling balls to obtain the desired slurry;

Step 3, take 400-750 parts of slurry, 130-225 parts of cement, 185-295 parts of fly ash, 20-30 parts of water into the mixer at low speed for 2 to 4 minutes, high speed for 2 to 4 minutes; then pouring into test pieces to get mixed mortar;

Step 4, the mixed mortar obtained in Step 3 is maintained in a constant temperature and humidity standard maintenance room, resulting in carbon-reinforced regenerated aggregate mortar.

**Assignees:** UNIV HUBEI TECHNOLOGY; HUBEI UNIV OF TECHNOLOGY

## 54. Family 90884659 (CN114314588 A)

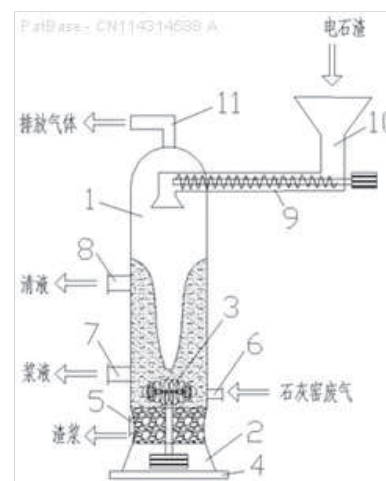
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### Title

[EN] METHOD FOR SEALING AND RECYCLING CO<sub>2</sub> IN WASTE GAS GENERATED IN LIME PRODUCTION OF LIME KILN

### Abstract

[EN] The invention discloses a method for sealing and recycling CO<sub>2</sub> in waste gas generated in lime production of a lime kiln. The method comprises the steps of construction of pretreatment equipment, feeding of carbide slag, pretreatment of the waste gas, storage of reaction slurry, sealing reaction, recycling of the slurry and the like. Aiming at dual environmental pollution caused by a large amount of carbide slag waste and lime kiln carbon emission in a factory, the carbide slag and CO<sub>2</sub> in tail gas of the lime kiln are violently reacted at high temperature and high pressure to form thick slurry with a large amount of bubbles, so that the effects of sealing and storing CO<sub>2</sub> in the waste gas and removing sulfur are achieved; according to the invention, CO<sub>2</sub> is sealed in viscous carbide slag slurry, after sealing for more than one month, a more viscous paste is formed, the paste mainly contains calcium carbonate, and is subjected to carbon powder ball pressing, roasting and decomposition to prepare ultrafine active calcium oxide, so that joint recycling of carbide slag and CO<sub>2</sub> is realized, an absorption platform is provided for carbide slag treatment and CO<sub>2</sub> recycling in the field, and the method is suitable for industrial production. And the method is easy to process, low in cost and suitable for popularization.



### 1st Main Claim

[MT] 1. A method of sequestration and recycling of CO<sub>2</sub> in offgas for lime kiln production, characterized in that it comprises the following steps:

S1. construction of a pre-treatment apparatus: constructing a pressure-resistant and cylindrical mixing tower (1), a closed motor chamber (2) is provided below the mixing tower (1), a motor is provided within the motor chamber (2), the motor driving shaft extends vertically upward and to a mid-lower position within the mixing tower (1) and is connected with vortex paddles (3), the bottom wall of the motor chamber (2) is provided with a mounting base (4), and the mounting base (4) is a thick flange, and is installed in the workshop by means of ground bolts;

A slag discharge port (5), an offgas inlet port (6), a slurry outlet port (7) and a purge outlet port (8) are arranged sequentially from bottom to top, and a slag discharge port (5) is arranged at the bottom of the side wall of the mixing column (1) for discharging insoluble precipitated slag, The supernatant outlet (8) is provided at a position offset in the middle of the side wall of the mixing column (1) for discharging the supernatant liquid, the exhaust gas inlet (6) is the same height as the vortex finder (3), and the slurry outlet (7) is slightly higher than the exhaust gas inlet (6) for discharging the slurry suspended in the middle layer; and

The top of the side wall of said mixing column (1) is embedded in an extruder (9), the outlet at one end of the extruder (9) projects into the mixing column (1) and faces downwards, the outlet at the other end of the extruder (9) faces upwards and communicates with an internal cavity of the breaker (10) for feeding, and the top of said breaker (10) is provided with a feed hopper for crushing of electric stone slag; and

The mixing column (1) is provided with an exhaust port (11) for discharging unreacted exhaust gas;

S2. feed of electros slag: placing electros slag into a crusher (10), and appropriately adding moisture, after crushing and extruding into a mixing tower (1), to a point where the liquid level occupies 2/5 of the volume of the mixing tower (1), closing all outlets of the mixing tower (1) and sealing off the feed hopper of the crusher (10), so that the mixing tower (1) is closed. Turn on the vortex stirring paddle (3), stir well and create a vortex so that the vortex has a highest level higher than the purge outlet (8); the vortex center gradually clears, and the slurry in the vicinity of the inner wall of the mixing column (1) gradually sticks and assumes a suspension shape under centrifugal action, and larger lumps gradually sink down to the bottom of the mixing column (1) and become agitated;

S3. Pre-offgas treatment: the lime kiln offgas having a temperature above 200 degrees centigrade is continuously passed into the offgas inlet (6) by means of a pressurized pump to the system in the mixing column (1) to generate a large number of bubbles, and reacted, and the valve pressure of the offgas inlet (6) is adjusted to be above 2.5 MPa. And controlling the gas pressure in the column through the valve flow of the waste gas inlet (6), controlling the gas pressure in the top of the mixing column (1) to 1.5-2MPa, and controlling the gas temperature in the lower part of the inner side wall of the mixing column (1) to 150-180 degrees centigrade, and reacting for 30-50 min;

When the air pressure at the top of the mixing column (1) exceeds 2 MPa, the exhaust gas inlet (6) is immediately closed, the reaction is stirred for 5 min, and it is observed whether the air pressure in the column drops rapidly, and the exhaust gas inlet (6) is opened as follows, and the intake air is continued, and the intake air is no longer if the air pressure does not drop rapidly;

After the end of the reaction, the vortex finder (3) is stopped, left to stand for 5-10 min, and the gas composition at the top of the test tower is sampled, and if CO<sub>2</sub> is lower than 3%, the exhaust port (11) is opened, the exhaust gas mainly N<sub>2</sub> and H<sub>2</sub>O is discharged, and the pressure is letdown to normal pressure;

S4. Reaction-slurry storage: Step S3 is repeated, and the lime kiln off-gas is treated intermittently, and when the pH of the liquid level skin layer inside the mixing column (1) is lower than 10, the air pressure at the top of the mixing column (1) is maintained at

1.5 – 2MPa, and all inlet ports of the mixing column (1) are closed, At this point, the mixing column (1) has a higher liquid level than the purge outlet (8), the viscosity is higher and the inside is filled with bubbles, and the mixing column (1) is left to age for 20 min, until the mixing column (1) system is layered, the bottom is slag, the top is serum, and the middle is a thick slurry;

Building a storage tank, first opening the purge outlet (8), internal pressure automatically hydraulic the top purge inside the column into the storage tank, then opening the slurry outlet (7), internal pressure automatically presses the slurry inside the column below the level of purge in the storage tank, and standing, Finally opening the slag discharge port (5), and the internal pressure automatically presses the slag inside the column above the interface between the purge liquor and the slurry in the storage tank, which requires uniform movement of the nozzle of the slag transfer pipe, and uniform spreading of the slag to be slag over the slurry, serving to compact the slurry and isolate the slurry;

S5. Retention reaction: Repeat reaction steps S3-S4 until the slurry storage tank is full, capped and stored for more than one month, until the gas-solid-liquid three-phase reaction is consumed in the slurry storage tank, observing the state in the slurry storage tank, and the slag forms a layer of hardboard, and the height thereof is lower than before storage, the slurry below the hardboard forms a superviscous paste, the purge liquor above the hardboard increases and clears, and the pH thereof is detected to fall below 9.5;

S6. Slurry recycling: withdrawing the supernatant of the storage tank, exposing the hard stone plate, tapping the hard stone plate, and catching the crushed stone plate, containing 30-40%  $\text{CaCO}_3$ , with the remainder  $\text{Ca}(\text{OH})_2$  and Si, Fe, Mg and other impurities, and being used as cement clinker after firing;

The paste in the storage tank is detected to have 75-80%  $\text{CaCO}_3$  and 15-20%  $\text{Ca}(\text{OH})_2$ , and the paste is vigorously stirred by adding dry carbon powder to the storage tank, pressing the paste ball into a paste ball, drying the paste ball until the moisture content is less than 2%, and after breaking down the paste ball, placing it in a baking oven at 400 degrees centigrade for 1 h.  $\text{CO}_2$  is produced and  $\text{Ca}(\text{OH})_2$  is consumed until the carbon powder is consumed, the ash is removed by air drying, the remaining powder is examined, wherein the  $\text{CaCO}_3$  content is more than 95% and the particle size is not more than 200 nm, and the material is transported to a lime kiln and fired at 1050 degrees centigrade to obtain ultrafineness active calcium oxide with uniform particle size distribution and particle size is not more than 300 nm.

**Assignees:** ANHUI HUAPLASTIC CO LTD

55. Family 13686957 (JP2000143304 A2)

[View in PatBase](#)

Title

[EN] ARTIFICIAL STONE MADE FROM SLAG AS PRINCIPAL RAW MATERIAL AND PRODUCTION OF THE SAME STONE

Abstract

[EN] PROBLEM TO BE SOLVED: To provide artificial building stone having high strength without adding an industrial product such as cement when producing an artificial stone (a consolidated product) by making slag as a principal raw material become consolidated through carbonation reaction. SOLUTION: When this artificial stone is made from a mixture, as a raw material, of slag from a steel-manufacturing process as a principal raw material with an additive, the slag as a principal raw material comprises at least one kind selected from a group consisting of granule slag, coarse grain-form one and small aggregated one, and at least part of the additive comprises water granulated slag. The mixture of the slag with the additive is made to consolidate and to be aggregated by CaCO<sub>3</sub> formed through carbonation reaction as a binder.

1st Main Claim

[MT] 1. The main raw material steel slag generated in the manufacturing process, and artificial stone made from a mixture of main ingredients and additives, the granulated slag and slag powder are the main raw material, wherein the slag coarse granular consists of one or more small lumps of slag, granulated blast furnace slag fine powder consisting of at least part of said additive, CaCO<sub>3</sub> generated by the carbonation reaction was a mixture of slag and said additive Will be solidified as a binder, characterized in that it has massive, artificial stone and slag main ingredient.

Assignees: NIPPON KOKAN KK



## 56. Family 32280927 (US2008202389 AA)

[View in PatBase](#)

### Title (EP1727775 B1)

[EN] MULTIPLE MODE ACCELERATING AGENT FOR CEMENTITIOUS MATERIALS

### Abstract (EP1727775 B1)

[EN] A multiple mode cement set accelerating agent is provided. The accelerating agent includes a carrier fluid component having accelerator properties and CO<sub>2</sub> gas sequestered in the carrier fluid. The accelerator components of the carrier fluid speed up the cement setting reaction. Additionally, CO<sub>2</sub> gas is released from the carrier fluid during cement hydration to further accelerate the hydration reaction. In certain implementations, the carrier fluid is an alkanolamine solution and the cement set accelerating agent operates through a combination of alkali activation and carbonation. The multiple mode cement cure accelerating agent can be applied to pre-selected regions of green shaped cementitious articles to form partially cured zones in the article prior to curing of the green shaped article.

### 1st Main Claim (EP1727775 B1)

[EN] 1. A method of accelerating cement hydration reactions in an uncured cementitious composite material, comprising:

- incorporating a multiple mode cement set accelerating agent in an uncured cementitious composition, wherein said accelerating agent comprises carbon dioxide reversibly sequestered in a carrier material, wherein the carrier material is capable of accelerating cement hydration reactions;
- releasing the sequestered carbon dioxide from the carrier material; and
- reacting both the carbon dioxide and carrier material with the uncured cementitious composition thereby accelerating the cement hydration reactions therein.

**Assignees:** JAMES HARDIE INT FINANCE BV; JAMES HARDIE INTERNAT FINANCE; JAMES HARDIE INT FINANCE; JAMES HARDIE INTERNAITIONAL FI; HOJAJI HAMID; NAJI BASIL; KUIZENGA MARCUS HENRY

57. Family 76460245 (CN110424203 A)

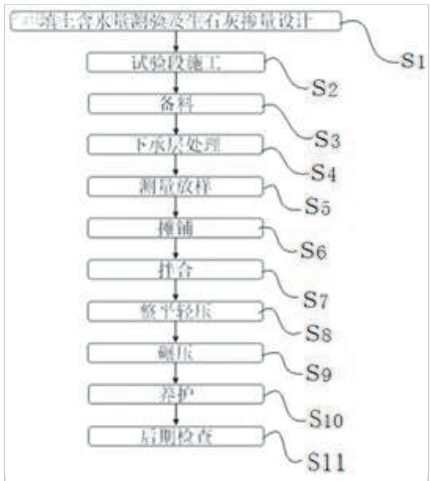
[View in PatBase](#)

Title

[EN] RAINY SEASON WET SOFT ROADBED FILLING CONSTRUCTION METHOD

Abstract

[EN] The invention discloses a rainy season wet soft roadbed filling construction method. The method comprises the following steps of S1, soil filling water content testing and quicklime doping amount design; S2, test section construction; S3, material preparation; S4, lower bearing layer treatment; S5, measurement and lofting; S6, paving; S7, mixing; S8, leveling and light pressing; S9, rolling; S10, maintenance; and S11, later inspection. According to the rainy season wet soft roadbed filling construction method, during the construction, the quality of the subgrade filling can be ensured, the phenomena of subgrade deformation, subgrade bed frost boiling and mud pouring can be reduced, the roadbed construction efficiency can be accelerated, the construction period and cost can be saved, and the construction quality and efficiency of rainy season roadbeds are guaranteed; and meanwhile, the roadbed filling quality is guaranteed, the roadbed filling construction progress is accelerated, the construction site personnel and machinery idling phenomenon is reduced, and the time for waiting for passing along the vehicles is reduced.



1st Main Claim

[MT] 1. A wet rainy season soft roadbed construction method, characterized in that: The method comprises the steps of:

- S1, the moisture content of the backfill quizzes and lime dosage design: Quiz wet soft soil moisture content, and then the wet soft soil compaction and lime chemical reaction principle and field test, measure out different wet soft soil water content is made between hypostomatic lime dosage;
- S2, the Segment Construction test: In accordance with quicklime doping amount design test construction segment, to determine the construction process in the relevant parameters, said parameters including lime and wet soft soil paving thickness, mechanical tonnage and rolled several times;
- S3, preparation: According to each filling road segment roadbed width, thickness and the degree of compaction, to calculate the number and the stacking position, according to the backfill soil moisture and lime dosage design, calculate the required number of lime per square meter of the roadbed;
- S4, bearing layer processing: The bearing layer surface debris cleared first, and then with the grader rainfall caused the mud clear all, and finally with 18 ~ 21T three-wheel compactors for multi-pass rolling back and forth until the bearing layer surface smooth, dense, detect roadbed compactness and strength so as to meet the design requirements;
- S5, measuring stakeout: In the detection of qualified bearing layer surface has a cross-section of every 5m placed on both side edges of the side pile and roadbed, setting indicates the pile, the pile design elevation marked with red paint base layer and each layer loose laying height line;
- S6, paving: The early and late paving paving paving includes two parts;
- S7, mixing: Mix using stabilized soil mixing machine;
- S8, the leveling pressure light: To be lime treatment soil mixing evenly, immediately with preliminary grader leveling, straight section of the screed should be from both sides toward the middle of the screed, curve segment should be from the lateral side to the medial side leveling;
- S9, rolling: When compacted, first, according to the construction test section to determine the relevant parameters were rolling, first with machine in the roadbed full width of the wheel roller rolling, then use light roller rolling order light pressure and leveling consistent order;
- S10, conservation: When the lime treatment earth finish rolling and by compaction detection should be carried out after the moisture conservation, to ensure the structural strength of the layer in a suitable environment to maintain stable growth;
- S11, late check: After the conservation, periodically in accordance with the quality requirements of the degree of compaction, elevation, flatness, the appearance of size measurement inspection, in order to timely repair failed.

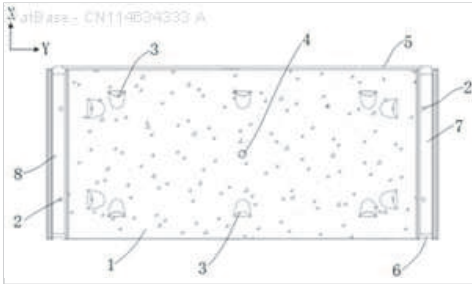
Assignees: YUNNAN CONSTRUCTION AND INVEST HOLDING GROUP CO LTD

58. Family 91941176 (CN114634333 A)

[View in PatBase](#)

**Title**  
[EN] LOW-CARBON CONCRETE DUCT PIECE

**Abstract**  
[EN] The pipe piece comprises a pipe piece body and a reinforcement cage arranged in the pipe piece body, the pipe piece body is made of low-carbon concrete, the low-carbon concrete comprises the following raw materials of a binding material, aggregate, a water reducing agent and water, and the binding material comprises gamma-C2S and cement. A carbonization active cementing material gamma-C2S is added into the low-carbon concrete duct piece, in the service process of the low-carbon concrete duct piece, the gamma-C2S can absorb CO2 for a long time, Ca (OH) 2 in cement and the gamma-C2S generate CaCO3 minerals with CO2, pores of a concrete structure are gradually filled with the minerals, the specific surface area of a concrete material is reduced, and the service life of the low-carbon concrete duct piece is prolonged. Therefore, in the carbonization process, the mechanical property of the concrete structure can be enhanced, harmful ions can be prevented from entering through the compact structure, and the durability of the low-carbon concrete duct piece is improved.



**1st Main Claim**  
[MT] 1. A low carbon concrete tube sheet characterized by comprising a tube body comprising gamma-C2S and cement and a rebar cage disposed within the tube body, the material of the tube body being low carbon concrete comprising raw materials: cementitious material comprising gamma-C2S and cement.

**Assignees:** NINGBO ZHONGQIKOKOU CO LTD

59. Family 102710338 (CN118047555 A)

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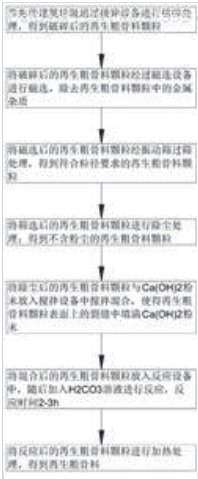
**Title**  
[EN] PROCESS FOR PREPARING RECYCLED COARSE AGGREGATE FROM CONSTRUCTION WASTE

**Abstract**  
[EN] The invention belongs to the technical field of building materials, and particularly relates to a process for preparing recycled coarse aggregate from building waste, which comprises the steps of crushing, magnetic separation for impurity removal, dust removal, mixing and stirring, chemical reaction and heating and drying. According to the method, the recycled coarse aggregate particles and the Ca (OH) 2 powder are firstly mixed, so that cracks are filled with the Ca (OH) 2 powder, then the Ca (OH) 2 powder reacts with the H2CO3 solution to produce the CaCO3 precipitate, the cracks are tamped and repaired through the CaCO3 precipitate, the compressive strength of the recycled aggregate particles is improved, and the application range of the recycled aggregate is widened; meanwhile, the water absorption rate of the repaired recycled coarse aggregate is reduced, so that the situation that the splitting strength of concrete configured by recycled coarse aggregate particles is reduced and the drying shrinkage is aggravated due to porosity of a microstructure in an interface area possibly caused by a large amount of water loss or too thick water film around the recycled aggregate concrete aggregate is avoided.

**1st Main Claim**

- [MT] 1. A process for preparing recycled coarse aggregate for construction waste, characterized in that the process comprises the steps of:
- S1: First, the construction waste is subjected to crushing treatment by means of crushing equipment to obtain crushed regenerated coarse aggregate particles;
- S2: The regenerated coarse aggregate particles crushed in S1 are subjected to magnetic sorting by a magnetic sorting apparatus to remove metal impurities from the regenerated coarse aggregate particles;
- S3: The regenerated coarse aggregate particles after magnetic selection in S2 are sieved through a vibrating screen to obtain regenerated coarse aggregate particles meeting the particle size requirement;
- S4: The regenerated coarse aggregate particles obtained in S3 are subjected to a dust removing treatment;
- S5: The regenerated coarse aggregate particles obtained in S4 are mixed with Ca(OH)2 powder by stirring in a stirring apparatus so that cracks on the surface of the regenerated coarse aggregate particles are filled with Ca(OH)2 powder;
- S6: The regenerated coarse aggregate particles obtained in S5 are placed in a reaction apparatus, followed by the addition of H2CO3 solution to carry out the reaction for a reaction time of 2-3 h;
- S7 : After the reaction is completed, heat treatment is carried out to obtain regenerated coarse aggregate.

**Assignees:** HEFEI HENGLI BUILDING MAT CO LTD



## 60. Family 95119860 (CN115491746 A)

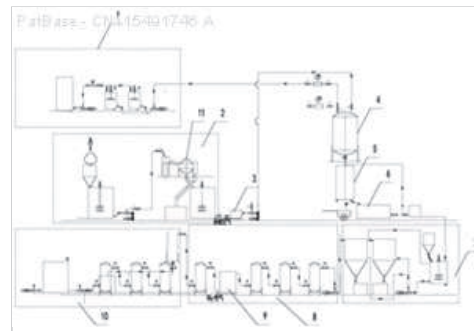
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### Title

[EN] METHOD AND DEVICE FOR PREPARING CALCIUM SULFATE WHISKERS FROM SINTERING FLUE GAS DESULFURIZATION ASH

### Abstract

[EN] The invention relates to a method and a device for preparing calcium sulfate whiskers by using sintering flue gas desulfurization ash. The method comprises the following steps: 1) preparing slurry by using semi-dry desulfurization ash dry powder; 2) converting  $\text{SO}_3 < 2 >$  in the slurry into  $\text{SO}_4 < 2 >$  by adopting an air aeration method; (3) the initial temperature is 45 DEG C, the acidic condition is kept, the slurry is fed into a hydrothermal reaction kettle, the hydrothermal reaction temperature is 60-80 DEG C, and the time is 30-90 min; 4) discharging the slurry into a centrifugal machine for solid-liquid separation, wherein a solid substance is a mixture of  $2\text{H}_2\text{O}$  calcium sulfate and  $1/2\text{H}_2\text{O}$  calcium sulfate; (5) carrying out secondary solid-liquid separation in a centrifugal manner, wherein a solid substance is  $1/2\text{H}_2\text{O}$  calcium sulfate whiskers; and 6) performing a wastewater treatment process on the centrifugally separated solution. According to the method, ions such as  $\text{Cl} < - >$ ,  $\text{Mg} < 2 + >$ ,  $\text{K} < + >$  and  $\text{Na} < + >$  existing in the sintering flue gas semi-dry desulfurization ash are directly utilized, no auxiliary reagent is added, and the calcium sulfate whiskers are generated through one-step acidic hydrothermal reaction of slurry. And the treated wastewater can be reused as supplementary new water.



### 1st Main Claim

[MT] 1. A method for producing sulfuric acid calcium whiskers using sintered flue gas for sulfur ash, comprising the steps of:

The method comprises the steps of: 1) configuring a de-sulfur mortar slurry with a semi-dry de-sulfur ash dry powder at a slurry mass concentration of 15 to 40 Scr;

2) promoting so in the slurry by air aeration  $\text{SO}_3^{2-}$  To  $\text{SO}_4^{2-}$ ;

3) after the initial temperature of the hydrothermal reaction in the reactor reaches 45 degrees centigrade, adding a mineral acid so that the hydrothermal reaction remains acidic at all times, and feeding the slurry from step 2) into the hydrothermal reactor. The hydrothermal reaction temperature was controlled to be 60:80 degrees centigrade and the reaction time was 30:90 minutes;

4) Open the hydrothermal reactor discharge valve and discharge the slurry into a centrifuge to effect solid-liquid separation, the solids after centrifugation being  $2\text{H}_2\text{O}$  sulfuric acid Calcium and  $1/2\text{H}_2\text{O}$  sulfuric acid calcium mixtures;

5) the centrifugally separated solution is passed into the reservoir and cooled to ambient temperature before centrifugally solid-liquid separation to separate the separated solid species  $1/2\text{H}_2\text{O}$  sulfuric acid calcium whiskers, washed dried;

6) the solution after centrifugation is changed to wastewater, which is operated according to the following wastewater treatment process:

A) waste water enters a stirred tank, to which an inorganic base is added, the pH is controlled at 8-9, and Fe is separated by precipitation  $\text{Fe}^{3+}/\text{Fe}^{2+}$  The pH was then adjusted to greater than or equivalent to 12 to isolate mg as a precipitate  $^{2+}$ ;

B) filtration of the supernatant through a filter to remove particulate impurities in the water;

C) reducing Ca in wastewater by aeration  $^{2+}$  And  $\text{mg}^{2+}$  The concentration, in the intermediate wastewater tank, a mixed gas of air and carbon dioxide is introduced to promote CO into the wastewater  $^{2+}$  With  $\text{Ca}^{2+}$  And  $\text{mg}^{2+}$  Binding to produce  $\text{CaCO}_3$  And  $\text{MgCO}_3$ ;

D) performing ion resin exchange to remove harmful ions in water;

E) fresh water collection after treatment.

**Assignees:** ANGANG METAL CONSTRUCTION CO LTD

## 61. Family 98054056 (CN116396018 A)

[View in PatBase](#)

### Title

[EN] METHOD FOR PREPARING NANO-MICRON CRYSTAL NUCLEUS ADDITIVE THROUGH INTEGRATED CARBON SEQUESTRATION OF WASTE SLURRY AND WASTE WATER OF COMMERCIAL MIXING STATION

### Abstract

[EN] The invention provides a method for preparing a nano-micron crystal nucleus additive through integrated carbon sequestration of waste slurry and waste water of a commercial concrete mixing plant, which comprises the following steps: taking waste slurry and waste water of the commercial concrete mixing plant, and diluting the waste slurry by using the commercial mixing waste water to obtain low-solid-content waste slurry and waste water slurry; mixing the waste slurry and waste water slurry, the grinding body and the crystal form regulating agent, performing wet grinding, introducing CO<sub>2</sub>, and controlling the temperature of the slurry through a water cooling device to obtain the nano-micron vaterite type calcium carbonate carbonized crystal nucleus slurry. And putting 100-165 parts of the slurry, 120-200 parts of cement, 60-100 parts of fly ash and 450-900 parts of fine aggregate which are weighed into a stirrer, stirring for 4 minutes, carrying out compression molding on the uniformly stirred raw materials, and curing in a constant-temperature and constant-humidity curing chamber to obtain the early-stage high-strength mortar. The method is low in cost and low in energy consumption, the prepared mortar has the performance advantage of high early strength, and a novel efficient CO<sub>2</sub> mineralization utilization method is provided for commercial mixed waste slurry and waste water.

### 1st Main Claim

[MT] 1. A process for preparing nanometer nucleation additives using integrated carbon sequestration from waste slurry water from a commercial mixing station, comprising the steps of:

Step 1, 100 parts of commercial concrete mixing station waste slurry was mixed and diluted with 450 parts of commercial mixed waste water to obtain low solids waste slurry A;

Step 2, take 120-200 parts of Slurry A in Step 1 with 50-100 parts of grinding body, 10-20 parts of crystal type control agent after wet milling, wet milling process to vertical stirring mill with concentration of 10% to 15%, gas speed 1.3-2.3 kg/h of CO<sub>2</sub> Carbonization is carried out and the temperature is controlled by a water-cooling device until the slurry pH = 7.3 to 7.6, the CO flow is stopped<sub>2</sub> Wet milling was continued for 0.5 h to 1 h to remove the milled body to obtain the desired early strong slurry B;

Step 3, take 100-165 parts of Slurry B in Step 2, 120-200 parts of cement, 60-100 parts of fly ash, 450-900 parts of fine aggregate into the mixer for 2 minutes to 4 minutes at low speed, 2 minutes to 4 minutes at high speed; resulting in mixed mortar;

Step 4, placing the mixed mortar obtained in step 3 into a molding die for press molding;

Step 5, the mortar test pieces obtained in Step 4 are maintained in a constant temperature and humidity chamber, resulting in the early high strength mortar.

**Assignees:** UNIV HUBEI TECHNOLOGY; HUBEI UNIV OF TECHNOLOGY

## 62. Family 82324054 (ID2020SID01753 S1)

[View in PatBase](#)

### Title

[MT] The COMPOSITION OF THE CEMENT PASTE WITH THE LEVEL OF THE ASHES OF THE KITES THAT HIGH (HIGH-VOLUME FLY ASH CEMENT) AND

### Abstract

[MT] The composition of the cement paste with the level of the ashes of a high volume Fly Ash Cement Paste) and Manufacture Invention for activator is related with the composition of the pasta cement from a mixture of Portland cement with the ashes of the kite (fly ash) with the level of high (mapped out their blueprints than or equal to 35 percent) and. Cement with the level of fly ash high that have the potential to be applied as a concrete binder with the durability of high in aggressive environment. This Manufacture Invention for also answer the problem of high carbon dioxide emissions and energy consumption in the production of cement. Fly ash is a waste material that is used as a mixture of cement without experiencing the burning and the grinding, so that the energy consumption, CO2 emissions and the cost of making and can be pressed. Because the fly ash have reaktivitas lower than those with cement, then the activation with a strong alkali thinner and debris  $\text{Ca(OH)}_2$ . Activation methods fly ash done by stirring the fly ash with a alkali thinner. The other a mixed-dry homogenous until then coupled to the mixture fly ash-Na OH solution and stirred form the pasta. The principle of this Manufacture Invention for combining methods to accelerate the reaction of cement hydration and improve the reaction pozolanik fly ash. The Method accelerate hydration cement is done with the substitution of calcium karbonat, while the method to improve the reaction pozzolanik done by mixing fly ash with a Na OH thinner and strengthened by adding  $\text{Ca(OH)}_2$ . The combination of the two steps provides a strong press pasta both at the age or the age of more than 28 days,

## 63. Family 42479767 (CN101230232 A)

[View in PatBase](#)

### Title

[EN] Environmental protection and waste utilization high-performance dual-component aqueous polyurethane waterproofing and decoration paint

### Abstract

[EN] The invention provides an environment-friendly waste recovering high-property dual-constituent water polyurethane waterproofing and decorative paint, which is mainly to introduce the  $\text{Ca}(\text{OH})_2$  in, and to change the  $2\text{R-NCO}$  plus  $\text{H}_2\text{O-R-NHCONH-R}$  plus  $\text{CO}_2$  into  $2\text{R-NCQ}$  plus  $\text{Ca}(\text{OH})_2\text{-R-NHCONH-R}$  plus  $\text{CaCO}_3$ ; thus the problem that the polyurethane paint foams is substantially solved, and nano-grade  $\text{CaCO}_3$  crystal existing in molecular state can be produced, then coal fly ash and  $\text{SiO}_2$  are added in as fillings,  $\text{Ca}(\text{OH})_2$  and the coal fly ash react to produce hydrated calcium silicate gel and hydrated calcium aluminum gel, which can decompose nano-grade crystal in molecular state. The nano-grade crystal can just fill the gas between the solid filling and the polyurethane gel, and then the compactness of the polyurethane paint can be greatly improved, and the strength, the extension rate, the leakage resistance and other performances of the polyurethane paint can be improved greatly.

### 1st Main Claim

[MT] 1, Gao environmental benefits of waste gas performance two-component aqueous polyethylene resin waterproof and decorative coating, characterized in that: the introduction of  $\text{Ca}(\text{OH})_2$ , so that the chemical reaction from the aqueous polyurethane " $2\text{R-NCO}$   $\text{H}_2\text{O}$  and  $\text{R-NHCONH-R}$ " into " $2\text{R-NCQ}$   $\text{Ca}(\text{OH})_2\text{-R-NHCONH-R}$   $\text{CaCO}_3$ " or, from the fundamental solution to the problem of foaming polyurethane coatings to crystal state presence nanoscale  $\text{CaCO}_3$  Shu, can significantly raise the performance of all kinds of Gao waterborne polyurethane coatings.

**Assignees:** YONGQING ZHANG

64. Family 95233184 (CN115521123 A)

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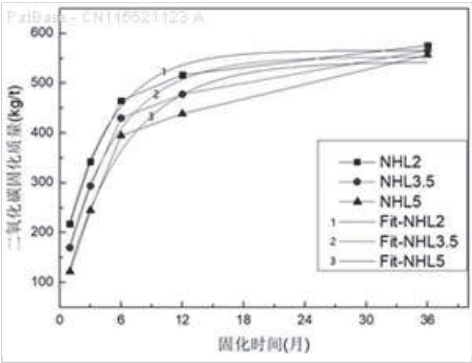
**Title**  
[EN] METHOD FOR CURING CARBON DIOXIDE

**Abstract**  
[EN] The invention provides a method for curing carbon dioxide, which comprises the step of contacting lime mortar with carbon dioxide for carbonization, the lime mortar comprises a binding material, aggregate and water, and the binding material comprises natural hydraulic lime. The method is easy to operate, mild in condition and high in carbonization efficiency, and meanwhile, the mechanical property of the natural hydraulic lime mortar can be improved.

**1st Main Claim**  
[MT] 1. A method of curing carbon dioxide comprising the step of carbonizing a lime mortar in contact with carbon dioxide, and contacting the lime mortar with carbon dioxide to form a mixture of carbon dioxide and carbon dioxide.

Wherein the lime mortar comprises a gelling material, aggregate, and water, the gelling material comprising natural hydraulic lime.

**Assignees:** WANG DONGMIN; LIU ZE



## 65. Family 8723570 (WO9631446 A1)

[View in PatBase](#)

### Title

[EN] A NEW METHOD FOR THE PRODUCTION OF FINE POWDERS

### Abstract

[EN] A process for the production of fine powders of inorganic compounds. The process comprises the addition of certain carboxylic acids, or related organic compounds, to the inorganic compounds themselves or to their precursors. The carboxylic acids are either those that cause the foaming of magnesite cement, or those whose aluminum, calcium, or magnesium salts are soluble in water.

### 1st Main Claim

[EN] 1. A process for the production of fine powders, comprising the step of adding, to at least one inorganic material, at least one additive selected from the group consisting of carboxylic acids that are capable of causing the foaming of magnesite cements. anhydrides of said carboxylic acids, salts of said carboxylic acids, acyl halides of said carboxylic acids, foamed magnesite cement made using said carboxylic acids, foamed magnesite cement made using said anhydrides of said carboxylic acids, foamed magnesite cement made using said salts of said carboxylic acids. and foamed magnesite cement made using said acyl halides of said carboxylic acids.

**Assignees:** BARAN ADVANCED MATERIALS LTD; FRIEDMAN MARK M; YANIV YTZHAK

66. Family 96515281 (US2024425411 AA)

[View in PatBase](#)

Title (EP4155278 A1)

[EN] IMPROVING REACTIVITY OF CARBONATED RECYCLED CONCRETE FINES

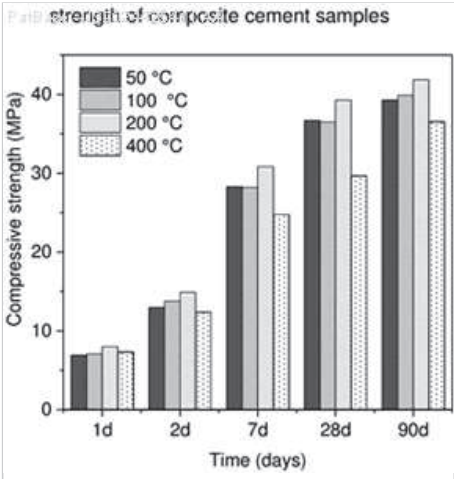
Abstract (EP4155278 A1)

[EN] Method for manufacturing a supplementary cementitious material with improved reactivity from waste concrete, wherein a starting material comprising waste concrete is provided, subjected to carbonation to provide a carbonated product, and the carbonated product is heat treated at a temperature ranging from 120 to 350 degrees centigrade until constant mass to provide the supplementary cementitious material with improved reactivity, the obtained supplementary cementitious material, a method using it as well as its use to manufacture composite cements and composite cements comprising it.

1st Main Claim (EP4155278 A1)

[EN] 1. Method for manufacturing a supplementary cementitious material with improved reactivity from waste concrete, wherein a starting material comprising waste concrete is provided, subjected to carbonation to provide a carbonated product, and the carbonated product is heat treated at a temperature ranging from 120 to 350 degrees centigrade until constant mass to provide the supplementary cementitious material with improved reactivity.

Assignees: HEIDELBERG MAT AG; HEIDELBERGCEMENT AG; HCONNECT 2 GMBH



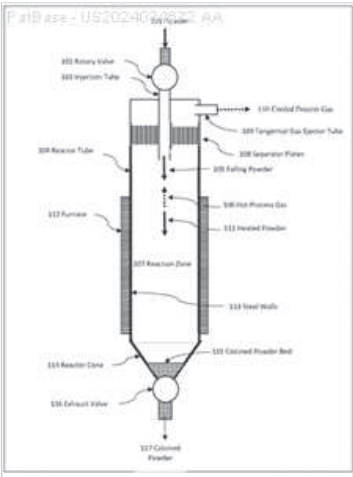
67. Family 91720257 (US2024034672 AA)

[View in PatBase](#)

**Title (EP4255862 A1)**  
[EN] PROCESSES AND METHODS FOR THE CALCINATION OF MATERIALS

**Abstract (EP4255862 A1)**  
[EN] A system for the calcination of powder materials comprising a plurality of vertical reactor tubes in which a falling powder is heated about a heating zone by radiation from the externally heated walls of the reactor tubes, in which the calcination process of the powder may be a reaction which liberates a gas, or induces a phase change; wherein the average velocity of the particles of falling powder during its transit through the reactor tubes is 1.0 m/s or less; the powder material flux for each tube is preferably in the range of 0.5-1 kg m<sup>-2</sup> s<sup>-1</sup>, and wherein the length of the heating zone is in the range of 10 to 35 m.

**1st Main Claim (EP4255862 A1)**  
[EN] 1. A system for the calcination of powder materials comprising a plurality of vertical reactor tubes in which a falling powder is heated about a heating zone by radiation from the externally heated walls of the reactor tubes, in which the calcination process of the powder may be a reaction which liberates a gas, or induces a phase change; wherein the average velocity of the particles of falling powder during its transit through the reactor tubes is 1.0 m/s or less; the powder material flux for each tube is preferably in the range of 0.5-1 kg m<sup>-2</sup> s<sup>-1</sup>, and wherein the length of the heating zone is in the range of 10 to 35 m.



**Assignees:** CALIX LTD

68. Family 87551563 (CN113526884 A)

[View in PatBase](#)

Title

[EN] HYDRAULIC LIME MATERIAL, PREPARATION METHOD AND APPLICATION THEREOF

Abstract

[EN] The invention belongs to the technical field of cultural relic protection materials, and discloses a hydraulic lime material, a preparation method and application thereof, the hydraulic lime material comprises limestone and potassium feldspar, and the mass ratio of the limestone to the potassium feldspar is (70-80 percent): (30-20 percent). The preparation method comprises the following steps: respectively crushing limestone and potassium feldspar, and mixing according to a mass ratio to obtain a mixture; roasting the obtained mixture, and naturally cooling to generate hydraulic lime materials with different contents of lime, calcium silicate and calcium aluminosilicate; grinding the roasted hydraulic lime material in a ball mill, and sieving to obtain powder; the cementing material obtained after the reaction is the hydraulic lime material. The inorganic cementing material for protecting and reinforcing rock and soil cultural relics has the characteristics of hydraulicity and air hardness, and also has the characteristics of good compatibility, low shrinkage, good weather resistance, good stability, self-healing function and the like; the service life of cultural relics can be prolonged.

1st Main Claim

[MT] 1. A hydraulic lime material characterized in that said hydraulic lime material consists of limestone with potassium feldspar;

The mass ratio of said limestone to potassium feldspar is: limestone: potassium feldspar= (70%~ 80%): (30%~ 20%).

Assignees: DUNHUANG RES ACADEMY



69. Family 54740606 (US2015030523 AA)

[View in PatBase](#)

Title

[EN] CARBON DIOXIDE CHEMICAL SEQUESTRATION FROM INDUSTRIAL EMISSIONS BY CARBONATION

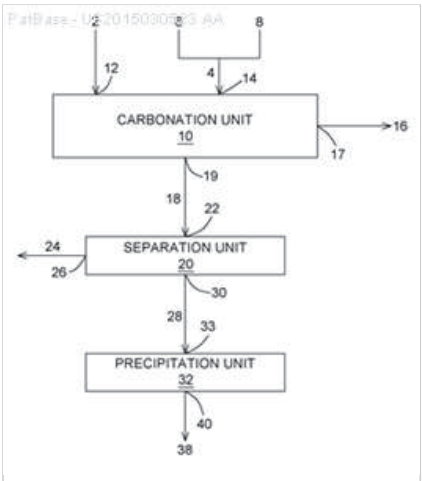
Abstract

[EN] Processes, methods, system and uses in relation to chemical sequestration of carbon dioxide from a carbon dioxide containing gas by carbonation of an alkaline earth metal containing material. The carbon dioxide containing gas is contacted with an aqueous slurry in a carbonation unit for carbonation of at least a portion of the alkaline earth metal to produce a carbon dioxide depleted gas and a carbonate loaded slurry which is substantially exempt of precipitated alkaline earth. metal carbonates, The carbonate loaded slurry is then separated into an aqueous phase and a solid phase; and the aqueous phase is supplied to a precipitation unit for precipitating alkaline earth metal carbonates. The carbonation stage may be performed at a carbonation temperature between about 10 degrees centigrade and about 40 degrees centigrade and a carbonation pressure between about 1 bar and about 20 bars. The solid phase may be recycled to the carbonation stage.

1st Main Claim

[EN] **54.** A process for sequestering carbon dioxide from a carbon dioxide containing gas, the process comprising: contacting the carbon dioxide containing gas with an aqueous slurry comprising an alkaline earth metal containing material in a carbonation unit for carbonation of at least a portion of an alkaline earth metal to produce a carbon dioxide depleted gas and a carbonate loaded slurry comprising precipitable carbonates and substantially exempt of precipitated alkaline earth metal carbonates; removing the carbonate loaded slurry from the carbonation unit and separating the carbonate loaded slurry into an aqueous phase comprising the precipitable carbonates and a solid phase; and supplying the aqueous phase to a precipitation unit and precipitating alkaline earth metal carbonates in the precipitation unit to produce a precipitation slurry.

**Assignees:** INST NAT RECH SCIENT INRS; INST NAT RECH SCIENT; NATIONAL DE LA RECHERCHE SCIENT INST; INST NAT DE LA RECH SCIENT NRS; INST NAT DE LA RECH SCIENT INRS



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### Title

## Abstract

### 1st Main Claim

**Assignees:** CALERA CORP



## 71. Family 105519565 (CN119038936 A)

[View in PatBase](#)

### Title

[EN] JET MORTAR MATERIAL BASED ON QUINARY CEMENTING MATERIAL AND PREPARATION METHOD THEREOF

### Abstract

[EN] The invention belongs to the technical field of building materials, and relates to a spraying mortar material based on a quinary cementing material and a preparation method thereof, and the preparation method comprises the following steps: S1, preparing alkali residue powder and carbide slag powder; s2, carrying out modification treatment on the slag by using the alkaline residue powder and the carbide slag powder; s3, preparing a quinary cementing material; s4, preparing a mortar prefabricated body containing a quinary cementing material; and S5, spraying, curing and forming to prepare the spraying mortar material. According to the preparation method of the jet mortar material based on the five-component cementing material, the solid waste-based cementing material is adopted to replace cement to produce the jet concrete, a new way for treating the solid waste material is provided, and in addition, the compressive strength of the five-component cementing material can be improved by adjusting the percentage of each component in the five-component cementing material. Compared with a conventional jet mortar material, the jet mortar material based on the quinary cementing material has higher compressive strength, the cost of raw materials is lower, and the influence on the environment is smaller.

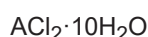
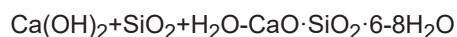
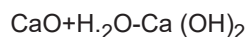


### 1st Main Claim

[MT] 1. A method for preparing a jet mortar material based on a pentasal gelling material, characterized by the steps of:

S1, Preparation of alkaline slag powder and electrosag powder: The alkaline slag slurry and the electrosag slurry are allowed to stand for 5-7 days, respectively, and the sediment layer is stirred to a wet-based state after removing the supernatant liquid. The soda slurry and the electrosag slurry in the wet-based state are oven-dried in a drying oven of 60 to 80 degrees centigrade, then the dried soda and electrosag are ground separately, and sieved with a 200 to 300 mesh screen to obtain soda powder and electrosag powder;

S2, alkaline slag powder and electrosag powder modification treatment of slag: The alkaline slag powder, the electrosag powder and slag are mixed uniformly, and then put into a horizontal ball mill for dry milling, mixed dry milling 30-40 min after which the preservation film is covered for 24 ~ 36 h, Obtaining a modified base slag-electrosag-slag mixture, the horizontal ball mill operating frequency is set at 40 to 60 Hz and the rotation speed is set at 250 to 300 r/min, CaO (OH) is introduced into the gelling system by alkaline slag powder and electrosag powder during the modification process<sub>2</sub>The reaction chemistry of the entire system is as follows:



S3, preparation of penta-cement: The modified alkali slag-electrosag-slag-slag mixture and fly ash and cement prepared in step S2 are added to the cement mortar mixer at a preset mass percentage for mixing 30 to 40 seconds to obtain alkali slag-electrosag-fly ash-slag-cement penta-cement cement cement;

S4, preparing a mortar preform comprising a pentagon material: Adding a first preset amount of machine sand, a second preset amount of water, a third preset amount of water reducing agent, and a fourth preset amount of speed-setting agent to a cement mortar mixer placed with an alkali slag-electrosag-fly ash-slag-cement pentagon material in order, And stirring separately after each addition of a material, to finally obtain a mortar preform of alkaline slag-electric slag-fly ash-slag-cement pentasectic material, wherein the machine sand, The water, The mass ratio of the water reducing agent and the fast-setting agent to the alkali slag-electrosag-fly ash-slag-cement penta-cement cementitious material is 2 ~ 4:0.3 ~ 0.5:0.01 ~ 0.02:0.05 ~ 0.07:1; alkali slag-electrosag-fly ash-slag-cement penta-cement cementitious material is included 10 to 20% of alkaline slag, 0 to 10% of electric slag, 0 to 20% of fly ash, 0 to 20% of slag, 50 to 70% of cement;

S5, jet solidification molding preparation of jet mortar material: The slurry preforms of the alkali slag - electrosag - fly ash - slag - cement penta cement cement prepared in step S4 are jet solidified using a mortar sprayer.

**Assignees:** YANSHAN UNIV; UNIV YANSHAN

72. Family 95634584 (CN115626855 A)

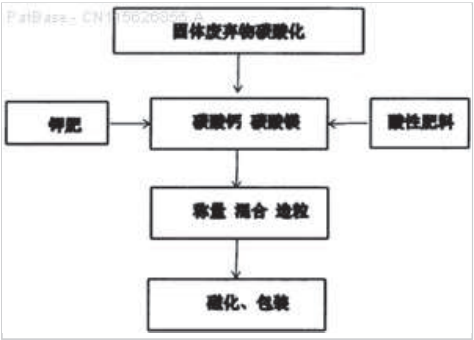
[View in PatBase](#)

Title

[EN] PREPARATION METHOD OF MULTIFUNCTIONAL CARBON DIOXIDE GAS FERTILIZER

Abstract

[EN] The invention discloses a preparation method of a multifunctional carbon dioxide gas fertilizer, which is technically characterized in that when the carbon dioxide gas fertilizer is prepared, carbonates containing alkaline metal ions, such as calcium carbonate or magnesium carbonate, prepared by carbonating solid wastes are adopted, so that the carbonates generate carbon dioxide gas in an acid environment; the acidic substance is provided by one or more of monoammonium phosphate, diammonium phosphate, ammonium sulfate and elemental sulfur, and is matched with an appropriate potash fertilizer to produce the multifunctional carbon dioxide gas fertilizer with different carbon dioxide release speeds and different crop nutrient contents through a compound fertilizer granulation process. Compared with the method without application, the yield of tomatoes is increased by 80-90 percent, the yield of peppers is increased by 40 percent -50 percent, the yield of green peppers is increased by 50 percent -60 percent, the yield of oil gourds is increased by 70 percent -80 percent, the yield of eggplants is increased by 100 percent, the yield of green beans is increased by 70 percent -100 percent, the yield of cucumbers is increased by 60 percent -70 percent, the yield of strawberries is increased by 40 percent -50 percent, grapes are increased by 30 percent -50 percent, the yield of lettuces is increased by 100 percent, coriander is increased by 40 percent -50 percent, spinach



1st Main Claim

[MT] 1. A method for producing a multifunctional carbon dioxide gas fertilizer, the technical feature of which is that carbonates containing alkali metal ions, such as calcium carbonate or magnesium carbonate, prepared by carbonation with solid waste, are produced such that carbon dioxide gas is generated in an acidic environment, the acidic substance being composed of mono-ammonium phosphorus acid, di-ammonium phosphorus acid, sulfuric acid ammonium, elemental sulfur provided with one or more of ammonium, combined with an appropriate amount of potassium fertilizer, producing a multifunctional carbon dioxide gas fertilizer having different rates of carbon dioxide release and different levels of crop nutrients by a complex composting granulation process and a magnetizing process, Included are base fertilizer and top-fertilizer carbon dioxide gas fertilizers.

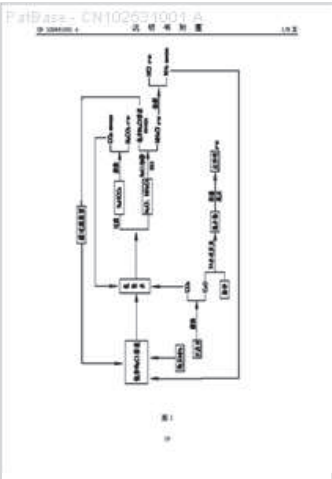
Assignees: ZHANG YUCHANG

73. Family 51475839 (CN102531001 A)

[View in PatBase](#)

**Title**  
[EN] COMPREHENSIVE SODA ASH PRODUCING PROCESS AND PRODUCT APPLICATION THEREOF

**Abstract**  
[EN] The invention relates to the technical field of soda ash production, and especially relates to a comprehensive soda ash producing process and product applications thereof; the process comprises the following process steps: introducing ammonia gas into a saturated sodium chloride solution to prepare ammoniacal brine; introducing carbon dioxide generated in limestone calcination into the ammoniacal brine to generate a mixture of sodium bicarbonate, sodium chloride and ammonium chloride; filtering the mixture to obtain sodium bicarbonate, sodium chloride and ammonium chloride; calcining the sodium bicarbonate to generate soda ash and carbon dioxide, recycling the carbon dioxide; adding sodium chloride fine powder and ammonia gas into the mixed filtrate of ammonium chloride and sodium chloride to generate ammonium chloride and sodium chloride solutions; separating impurities from the sodium chloride solution by a membrane filter, recycling the sodium chloride solution. The process has the advantages of low production cost, high soda ash whiteness, high sodium chloride utilization rate, no water waste or solid waste generation, environment protection, safety, simple processes, full use of geographic advantages in our country, low raw material purchase cost, waste change into things of value, high economic benefits, and good social benefits.



**1st Main Claim**  
[MT] CN 1. An integrated soda process, characterized in that it comprises the following process steps: Step A, saturated sodium chloride (NaCl) solution of ammonia gas purchased (NH3), system ammonia brine obtained; step B, calcined limestone (CaCO3) to produce carbon dioxide (CO2) and solid calcium oxide (CaO), carbon dioxide (CO2) generated through the above-mentioned ammonia brine to produce sodium bicarbonate solids (NaHCO3), chlorine ammonium chloride solution and the mixture (NH4Cl) solution of sodium (NaCl); step C, the step B, the mixture was filtered to give the solid sodium bicarbonate (NaHCO3), and ammonium chloride (NH4Cl) and sodium chloride (NaCl) mixing the filtrate; step D, the calcined solid sodium bicarbonate (NaHCO3) generates soda (Na2CO3) products and carbon dioxide (CO2), and the resulting carbon dioxide (CO2) is recovered and introduced to the ammonia recycled brine; in chloride (NH4Cl) and sodium chloride (NaCl) filtrate was added a mixture of sodium chloride (NaCl) and ammonia powder purchased (NH3), cooled, filtered, washed, and dried to form ammonium chloride (NH4Cl) Product and saturated sodium chloride (NaCl) solution; step E, the step D of saturated sodium chloride (NaCl) solution was separated by filtration through a membrane filtering device impurities, and then recycled.

**Assignees:** GUANGDONG DAZHONG AGRICULTURE SCIENCE CO LTD

74. Family 95267830 (CN115536432 A)

[View in PatBase](#)

Title

[EN] CARBON DIOXIDE MINERALIZATION MAINTENANCE METHOD FOR PRECAST CONCRETE COMPONENT

Abstract

[EN] The invention provides a carbon dioxide mineralization maintenance method for a concrete prefabricated part. The carbon dioxide mineralization maintenance method comprises the following steps: forming holes in a concrete prefabricated part template; preparing pre-treated water-absorbent resin, and attaching the pre-treated water-absorbent resin to the water-permeable template cloth; the water permeable formwork cloth is tightly attached to the inner wall of the concrete prefabricated part formwork, the prepared saturated carbonated water or saturated calcium bicarbonate solution is sprayed to the water permeable formwork cloth, and the water content of the water permeable formwork cloth is controlled to be in an unsaturated state; the stirred concrete is poured on the inner side of the permeable formwork cloth, and vibration, surface finishing and forming are conducted; and introducing industrial waste carbon dioxide gas into the closed curing space. According to the invention, the surface of the concrete can be quickly carbonized, the early surface strength and hardness of the concrete are improved, the compactness of the surface layer of the concrete structure is enhanced, the curing time of the precast concrete component is shortened, and quick demolding of the precast concrete component is realized; and a large amount of industrial solid waste and carbon dioxide industrial waste gas are utilized.



1st Main Claim

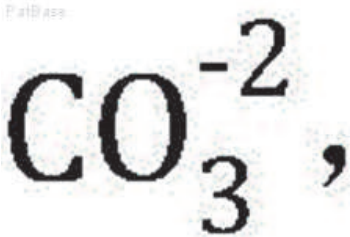
[MT] 1. A method for the mineralization of carbon dioxide for concrete prefabricated elements, comprising the steps of: Providing a concrete preform having a first surface and a second surface;

The steps of: 1) providing a through-hole through-hole in the concrete preform form;

Step 2) of pre-absorbing saturated calcium bicarbonate solution in the water-absorbent resin, and then subjecting the water-absorbent resin absorbing saturated calcium bicarbonate solution to a baking treatment to obtain a pre-treated water-absorbent resin, and attaching the pre-treated water-absorbent resin to a water-permeable template cloth;

Step 3) cleaning the surface of the concrete preform formwork in step 1) clean, and applying the water-permeable formwork cloth attached to the pre-treated water absorbent resin in step 2) closely to the inner wall of the concrete preform formwork, spraying the prepared saturated carbonated water or saturated calcium bicarbonate solution on the water-permeable formwork cloth. And controlling the water content of the water-permeable template cloth to an unsaturated state;

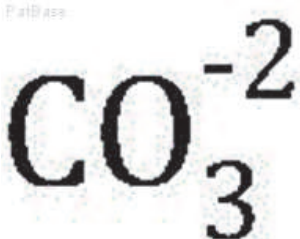
Step 4) casting the mixed concrete on the inside of the water-permeable formwork cloth, ramping, shaping, and spreading the water or bicarbonate solution sprayed on the water-permeable formwork cloth into the concrete skin. (C) water-permeable stencil absorbs residual moisture from the concrete skin layer, reduces the skin layer strength and skin densification of the concrete at an early stage; The pre-treated water-absorbent resin adsorbs excess moisture from the surface of the concrete, and the calcium



bicarbonate in the pre-treated water-absorbent resin gradually dissolves and replenished

(B) to provide long-term mineral conservation for carbon dioxide;

Step 5) introducing industrially waste carbon dioxide gas into the enclosed preservation space, which is penetrated through the template through holes into the water permeable template cloth and dissolved to form saturated water carbonate or bicarbonate



solution, In a water-permeable template cloth

Complementary to further enhance the conservation of CO<sub>2</sub>.

**Assignees:** CCCC SECOND HARBOUR ENG CO LTD; CCCC HIGHWAY BRIDGES NAT ENG RES CENTER CO LTD; CCCC SECOND HARBOR ENGINEERING CO LTD

75. Family 81302263 (KR20200113890 A)

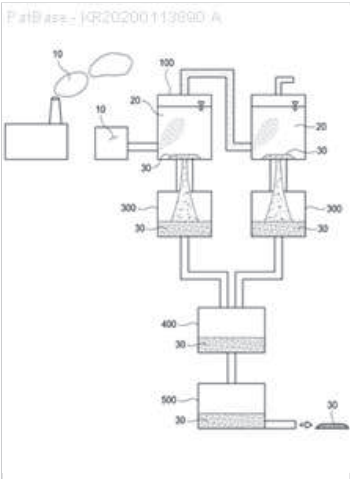
[View in PatBase](#)

**Title**  
[EN] FLOWABLE MATERIAL USING BOILER ASH

**Abstract**  
[EN] The present invention relates to a flowable composition including boiler ash. The flowable composition includes: 10-15 wt percent of captured carbon dioxide; 30-40 wt percent of boiler ash; 40-50 wt percent of slag; 4-7 wt percent of an activating agent; and 1-3 wt percent of a quick-setting agent, wherein the boiler ash uses coal and limestone as combustion media and is generated from a circulated fluidized bed boiler carrying out complete combustion of coal and limestone by circulating heat continuously. The composition according to the present invention uses no cement causing environmental pollution. The composition uses captured carbon dioxide and slag as binders. In addition, since the composition uses slag as a binder, it can solve the problems of a rapid drop in strength and early strength development, occurring in the conventional solidifying material and a ground modifier using cement as a binder.

**1st Main Claim**  
[MT] 1. 10-15% by weight of the carbon dioxide capture water boiler ash slag 30 to 40% by weight 40 to 50% by weight to 7 parts by weight of activator 4% by weight of the admixture, 1-3, the boiler comprising a combustion medium coal ash and limestone, but using a continuous heat by circulating the complete combustion of coal and limestone generated from circulating fluidized bed boiler, characterized in that the boiler ash mixed flowable composition.

**Assignees:** SINCHANG ENC



76. Family 81813665 (US2020346165 AA)

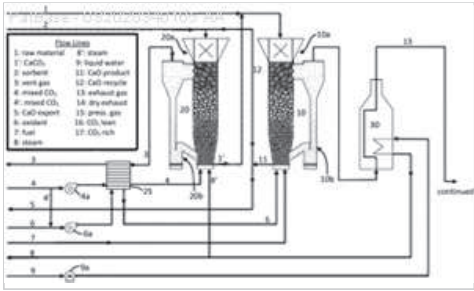
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**Title (EP3962632 A1)**  
[EN] SYSTEM AND METHOD FOR CARBON CAPTURE

**Abstract (EP3962632 A1)**  
[EN] The present disclosure provides systems for carbon capture in combination with production of one or more industrially useful materials. The disclosure also provides methods for carrying out carbon capture in combination with an industrial process. In particular, carbon capture can include carrying out calcination in a reactor, separation of carbon dioxide rich flue gases from industrially useful products, and capture of at least a portion of the carbon dioxide for sequestration of other use, such as enhanced oil recovery.

**1st Main Claim (EP3962632 A1)**  
[EN] 1. A system for calcination with carbon capture, the system comprising: a reactor configured to heat a carbonate-containing raw material in the presence of an oxidant to form a decomposition stream containing at least solids and carbon dioxide gas; a separator configured to separate the decomposition stream into a gas stream including the carbon dioxide gas and a solids stream; a heat exchange unit configured to receive one or both the gas stream including the carbon dioxide gas and the solid stream and withdraw heat therefrom to provide a cooled gas stream including the carbon dioxide and a cooled solids stream; and a CO2 separation unit configured to separate the cooled gas stream including the carbon dioxide into a CO2 lean stream and a CO2 rich stream.

**Assignees:** 8 RIVERS CAPITAL LLC



## 77. Family 12718588 (CN1245186 A)

[View in PatBase](#)

### Title

[EN] Water-soluble enamel-like paint for cement

### Abstract

[EN] A water-soluble toughened paint for cement is prepared from sierozen powder, OK powder, adhesive "801", surfactant, and aqueous solution of cross-linking agent through reaction, and further adding lime mass and additive. Its advantages are low cost, no poison, high air permeability, and anti-freezing nature. During its filming,  $\text{Ca(OH)}_2$  chemically reacts on  $\text{CO}_2$  in air to generate water-insoluble compact layer of  $\text{CaCO}_3$ , resulting in high strength, adhesion and washing resistance.

### 1st Main Claim

[MT] 98118063.9 clams: Page 1/1 2 1, the present invention Aqueous tempered cement paint, characterized in that the ash calcium powder, OK powder with 801 glue and surfactant solution, crosslinking agent solution configured after the reaction, adding lime and additives made. 2, according to claim 1, wherein the water-based paint, characterized in that the addition of steel and cement stone gray matter including light calcium powder, wollastonite powder, heavy calcium powder and talc. 3, according to claim 1 or 2, wherein the aqueous tempered cement paint, characterized in that formulation in 801 gum accounted for 35-45 percent, accounting for 20-30 percent of the ash calcium powder, OK powder other add accounts for 15-25 percent of the calcareous

**Assignees:** XINLONG DECORATION MATERIALS C

78. Family 13041650 (US5624493 A)

[View in PatBase](#)

Title

[EN] QUICK-SETTING CONCRETE AND A METHOD FOR MAKING QUICK-SETTING CONCRETE

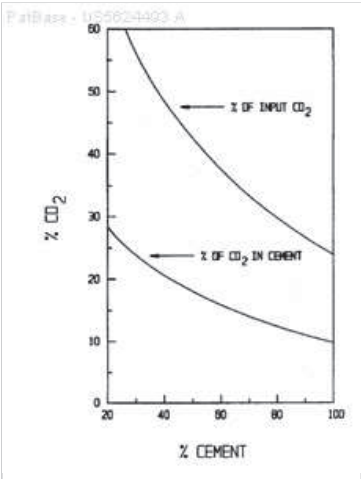
Abstract

[EN] A method for producing quick setting concrete is provided comprising hydrating a concrete dry mixture with carbonate solution to create a slurry, and allowing the slurry to cure. The invention also provides for a quick setting concrete having a predetermined proportion of  $\text{CaCO}_3$  of between 5 and 23 weight percent of the entire concrete mixture, and whereby the concrete has a compression strength of approximately 4,000 pounds per square inch (psi) within 24 hours after pouring.

1st Main Claim

[EN] 1. A method for producing quick setting concrete comprising:a.) heating a mixture consisting of a calcareous material and an argillaceous material to produce cement powder and carbon dioxide;b.) mixing said carbon dioxide with an hydroxide solution to produce a carbonate solution;c.) combining said cement powder with aggregate to produce a dry concrete mixture whereby 10 to 80 percent of the weight of the concrete mixture is cement;d.) mixing said dry concrete mixture with said carbonate solution in a cement:carbonate solution weight ratio selected from approximately 4:1 to 6:1 to produce a slurry; ande.) allowing the slurry cure.

Assignees: US ARMY



## 79. Family 101491954 (WO24044690 A1)

[View in PatBase](#)

### Title (EP4577330 A1)

[EN] PASSIVE AND FORCED SYNTHESIS OF  $Mg(OH)_2$  FOR THE PURPOSE OF SUPPLYING MAGNESIUM-BASED CAPTURE OF  $CO_2$

### Abstract

[EN] The present invention relates to a method for capturing carbon dioxide and sequestering the carbon dioxide as calcium carbonate. The method involves the use of an aqueous solution of magnesium hydroxide as a carbon dioxide uptake fluid. The magnesium hydroxide in the uptake fluid is produced by two distinct pathways, a forced decomposition pathway and a passive dissolution pathway. The combined use of the forced decomposition and passive dissolution pathways is a significant contributing factor to the low energy penalty of the carbon dioxide capture and sequestration method.

### 1st Main Claim

[EN] 1. A method for capturing  $CO_2$  from a gas stream and sequestering the  $CO_2$  in the form of  $CaCCh$ , the method comprising: (a) decomposing a  $MgCh$ -containing material to form a first mixture comprising  $Mg(OH)_2$  and a second mixture comprising  $HCl$  and  $H_2O$ ; (b) combining  $CaO$  with a  $MgCh$  brine to produce a third mixture comprising  $Mg(OH)_2$  and  $CaCl_2$ ; (c) combining the first and third mixtures to provide a fourth mixture comprising  $Mg(OH)_2$  and  $CaCh$ ; and (d) contacting the fourth mixture with  $CO_2$  to produce a product mixture comprising  $CaCCh$  and an aqueous solution of  $MgCh$ .

**Assignees:** CARBONFREE CHEMICALS HOLDINGS LLC; JOE JONES

80. Family 106980076 (CN119569391 A)

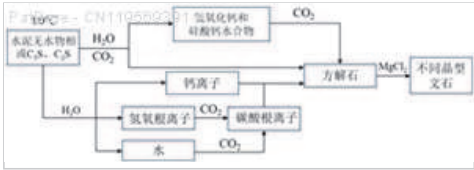
[View in PatBase](#)

Title

[EN] DESIGN METHOD FOR MIX PROPORTION OF CARBONIZED 3D PRINTING CONCRETE AND CARBONIZED 3D PRINTING CONCRETE

Abstract

[EN] The invention relates to a design method for the mix proportion of carbonized 3D printing concrete and the carbonized 3D printing concrete. Carbon dioxide is introduced into cement-based printing slurry, the introduction amount of the carbon dioxide is controlled, and when the carbon dioxide is introduced into the cement-based printing slurry, the use amount of magnesium chloride is calculated according to the content of a carbonization reaction product  $\text{CaCO}_3$  and the proportion of calcite to aragonite in a required concrete mixture. Magnesium chloride and carbon dioxide are added into the cement-based printing slurry at the same time for full reaction, and finally the 3D printing concrete material is prepared. By adding magnesium chloride and generating aragonite type calcium carbonate, the thixotropic behavior of the material is improved, the constructability of the cement slurry is higher, the orientation of the nano-scale aragonite fibers is arranged according to the printing direction, the reinforcing and toughening effects are excellent, and the bending resistance, bending resistance and compressive strength are all improved.



1st Main Claim

[MT] 1. A method for designing a mix ratio of carbonized 3D printed concrete, comprising the following steps:

- 1) Weigh component A, add deionized water to dissolve calcium ions, add admixtures, adjust pH, and react fully to obtain cement-based printing slurry;
- 2) introducing component B into the cement-based printing slurry, controlling the amount of component B introduced, so that the minerals in the cement-based printing slurry react with component B to form carbonates, and while introducing component B into the cement-based printing slurry, calculating the amount of component C according to the content of  $\text{CaCO}_3$ , a carbonization product, and the ratio of calcite to aragonite in the desired concrete mixture, and adding component C and component B into the cement-based printing slurry at the same time to fully react;
- 3) Then, component D is added and stirred thoroughly to obtain a 3D printing concrete material.

**Assignees:** SHANDONG UNIV; UNIV SHANDONG

81. Family 46814484 (EP2207753 A1)

[View in PatBase](#)

Extended Family Number: 42613795

Title

[EN] METHODS AND SYSTEMS FOR UTILIZING WASTE SOURCES OF METAL OXIDES

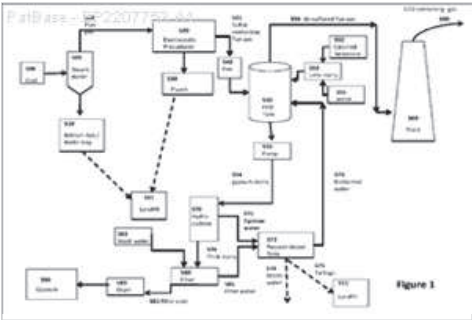
Abstract

[EN] Methods are provided for producing a composition comprising carbonates, wherein the methods comprise utilizing waste sources of metal oxides. An aqueous solution of divalent cations, some or all of which are derived from a waste source of metal oxides, may be contacted with CO<sub>2</sub> and subjected to precipitation conditions to provide compositions comprising carbonates. In some embodiments, a combustion ash is the waste source of metal oxides for the aqueous solution containing divalent cations. In some embodiments, a combustion ash is used to provide a source of proton-removing agents, divalent cations, silica, metal oxides, or other desired constituents or a combination thereof.

1st Main Claim

[EN] 1. A method comprising: a) contacting an aqueous solution with a source of metal oxides from an industrial process; b) charging the aqueous solution with carbon dioxide from a source of carbon dioxide from an industrial process; and c) subjecting the aqueous solution to precipitation conditions under atmospheric pressure to produce a carbonate-containing precipitation material.

Assignees: CALERA CORP



## 82. Family 107922934 (CN119954467 A)

[View in PatBase](#)

### Title

[MT] A KIND OF RECYCLED AGGREGATE CONCRETE WITH CARBON ABSORPTION AND CARBON FIXATION ABILITY AND PREPARATION METHOD THEREOF

### Abstract

[MT] [0001] The invention discloses a recycled aggregate concrete with carbon absorption and carbon fixation capabilities and a preparation method thereof, comprising the following components by mass: 1031-1244 parts of pre-treated recycled coarse aggregate, 708-854 parts of fine aggregate, 168-212 parts of cement, 89-125 parts of mineral powder, 198-264 parts of composite micropowder, 132-158 parts of water, 7.7-10.4 parts of water reducer, and 42-64 parts of carbon fixation material. The present invention can fill and seal the micropores on the recycled aggregate, further enhance the mechanical properties of the recycled aggregate, reduce the influence of the large water absorption of the recycled aggregate on the concrete mix design, mixing and later performance, and utilize the carbon dioxide affinity of nonylphenol polyoxyethylene ether and the porous characteristics of the recycled aggregate to further enhance the adsorption of carbon dioxide in the structure.

### 1st Main Claim

[MT] 1. A recycled aggregate concrete with carbon absorption and carbon fixation capabilities, characterized in that it includes the following components by mass: 1031-1244 parts of pretreated recycled coarse aggregate, 708-854 parts of fine aggregate, 168-212 parts of cement, 89-125 parts of mineral powder, 198-264 parts of composite micropowder, 132-158 parts of water, 7.7-10.4 parts of water reducer, and 42-64 parts of carbon fixation material.

83. Family 46814492 (US2010000444 AA)

[View in PatBase](#)

Extended Family Number: 42613795

Title

[EN] METHODS AND SYSTEMS FOR UTILIZING WASTE SOURCES OF METAL OXIDES

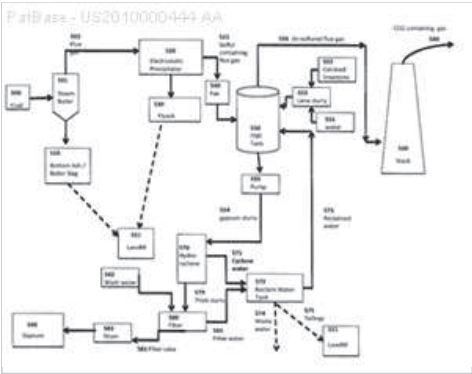
Abstract

[EN] Methods are provided for producing a composition comprising carbonates, wherein the methods comprise utilizing waste sources of metal oxides. An aqueous solution of divalent cations, some or all of which are derived from a waste source of metal oxides, may be contacted with CO<sub>2</sub> and subjected to precipitation conditions to provide compositions comprising carbonates. In some embodiments, a combustion ash is the waste source of metal oxides for the aqueous solution containing divalent cations. In some embodiments, a combustion ash is used to provide a source of proton-removing agents, divalent cations, silica, metal oxides, or other desired constituents or a combination thereof.

1st Main Claim

[EN] 1. A method comprising: a) contacting an aqueous solution with a source of metal oxides from an industrial process; b) charging the aqueous solution with carbon dioxide from a source of carbon dioxide from an industrial process; and c) subjecting the aqueous solution to precipitation conditions under atmospheric pressure to produce a carbonate-containing precipitation material.

**Assignees:** FARSAD KASRA; CONSTANTZ BRENT; GERAMITA KATHARINE; FERNANDEZ MIGUEL; MONTEIRO PAULO J M; YACCATO KARIN; OMELON SIDNEY; CALERA CORP



84. Family 46814466 (WO09155378 A1)

[View in PatBase](#)

Extended Family Number: 42613795

Title

[EN] METHODS AND SYSTEMS FOR UTILIZING WASTE SOURCES OF METAL OXIDES

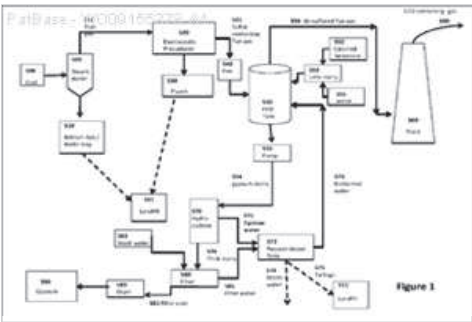
Abstract

[EN] Methods are provided for producing a composition comprising carbonates, wherein the methods comprise utilizing waste sources of metal oxides. An aqueous solution of divalent cations, some or all of which are derived from a waste source of metal oxides, may be contacted with CO<sub>2</sub> and subjected to precipitation conditions to provide compositions comprising carbonates. In some embodiments, a combustion ash is the waste source of metal oxides for the aqueous solution containing divalent cations. In some embodiments, a combustion ash is used to provide a source of proton-removing agents, divalent cations, silica, metal oxides, or other desired constituents or a combination thereof.

1st Main Claim

[EN] 1. A method comprising: a) contacting an aqueous solution with a source of metal oxides from an industrial process; b) charging the aqueous solution with carbon dioxide from a source of carbon dioxide from an industrial process; and c) subjecting the aqueous solution to precipitation conditions under atmospheric pressure to produce a carbonate-containing precipitation material.

**Assignees:** CALERA CORP; ARELAC INC; CONSTANTZ BRENT; FERNANDEZ MIGUEL; YACCATO KARIN; GERAMITA KATHARINE; FARSAD KASRA; OMELON SIDNEY; MONTEIRO PAULO



85. Family 53428851 (US2013255542 AA)

[View in PatBase](#)

Title

[EN] CEMENT AND CONCRETE WITH CALCIUM ALUMINATES

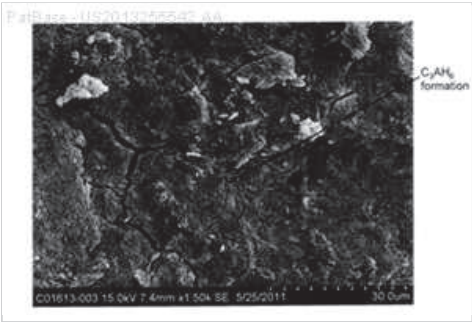
Abstract

[EN] Provided herein are systems, methods, and compositions related to mixtures of calcium aluminate cements with compositions comprising carbonate. The compositions comprising carbonates may be formed by sequestering carbon dioxide.

1st Main Claim

[EN] 1. A cementitious composition, comprising: calcium aluminate cement (CAC) and a composition comprising carbonate wherein the composition comprising carbonate comprises a metastable component selected from the group consisting of vaterite, amorphous calcium carbonate, and combination thereof.

**Assignees:** CALERA CORP; MORGAN SAMUEL O; CHEN IRVIN; CLODIC LAURENCE



86. Family 88934308 (WO21257757 A1)

[View in PatBase](#)

Title

[EN] CARBONATABLE COMPOSITIONS WITH ADMIXTURES

Abstract

[EN] The invention provides novel methods and novel additive compositions and use thereof in a wide range of concrete production for improving properties of concrete materials. The methods and compositions of the invention may be applied in a variety of cement and concrete components in the infrastructure, construction, pavement and landscaping industries.

1st Main Claim

[EN] 1. A calcium silicate-based material comprising: grains of carbonatable phases selected from wollastonite or pseudowollastonite ( $\text{CaSiO}_3$ , CS), rankinite ( $\text{Ca}_3\text{Si}_2\text{O}_7$ , C3S2) and larnite ( $\text{Ca}_2\text{SiO}_4$ , C2S, belite); grains of partially reactive amorphous phases; or grains or particles of uncarbonatable phases selected from melilite ( $(\text{Ca}, \text{Na}, \text{K})_2[(\text{Mg}, \text{Fe}^{2+}, \text{Fe}^{3+}, \text{Al}, \text{Si})_3\text{O}_7]$ ) and crystalline silica ( $\text{SiO}_2$ ); or a combination of any two or more types thereof; and a combination of one or more admixtures selected from: strength enhancers, hydrophobic compounds, set retarders, pH enhancing additives, efflorescence reducers, ettringite growth inhibitors, minerals, corrosion inhibitors, air-entraining admixtures, shrinkage-reducing admixtures, evaporation controlling admixtures, plasticizers, superplasticizers, and crystallization inhibitors.

**Assignees:** SOLIDIA TECHNOLOGIES INC



## 87. Family 54707464 (KR101306186 B1)

[View in PatBase](#)

### Title

[EN] MANUFACTURING METHOD OF GEOPOLYMERIC CONCRETE FOR ECO-FRIENDLY NON-CEMENT OF NEW CONSTRUCTION MATERIALS USING RECYCLED AGGREGATE FROM WASTE OF CONSTRUCTION

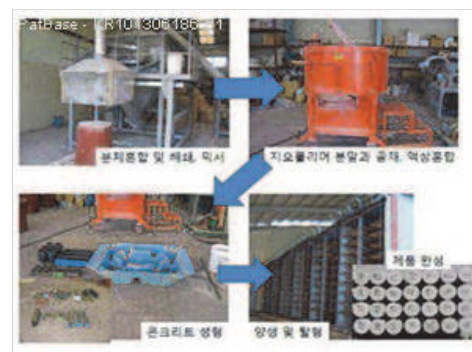
### Abstract

[EN] PURPOSE: A manufacturing method of GEO polymer concrete is provided to enhance compressive strength by maximizing use amount of recycled aggregate without using natural aggregate or natural sand. CONSTITUTION: A manufacturing method of GEO polymer concrete comprises the following steps: drying and pulverizing waste concrete powder; preparing GEO polymer powdery raw material by measuring blast furnace slag, fly ash, waste concrete powder and phosphate with respective range of 30:55:10:3-80:10:5:5; pulverizing and mixing the GEO Polymer powdery raw material; manufacturing GEO polymer concrete raw material by mixing 150-500 parts by weight of recycled coarse aggregate with 150-500 parts by weight of recycled fine aggregate based on 100 parts by weight of the GEO polymer powder; obtaining slurry by mixing 30-200 parts by weight of fluid activator with 100 parts by weight of the GEO polymer concrete raw material; molding the slurry into the GEO polymer concrete; and curing the molded GEO polymer concrete. [Reference numerals] (AA) Powder mixing and crushing, mixer; (BB) GEO polymer powder and aggregate, liquid phase mixing; (CC) Concrete molding; (DD) Curing and demolding; (EE) Finishing the production

### 1st Main Claim

[MT] 1. 1) waste generated from processing the middle of construction waste concrete pulverized powder used as a raw material for the geo-polymer 105 plus or minus 5 degrees centigrade for 24 hours in a dryer, and 2,500rpm/min dried overnight (5 minutes) for crushing and grinding the blender, 2) used as a raw material of geo-polymers in order powdery amorphous calcium aluminosilicate has a mean particle size of 20mm of blast furnace slag, fly ash, waste concrete pulverized and phosphate, using an electronic balance: fly ash, blast furnace slag fine powder 30: Waste Concrete: 55: 10: phosphate, respectively 80: 10: 3: 5: 5 so that the range of 0.05 to 5% by weight to cumulative comprising the steps of preparing a raw material of the solid phase, 3) and the flow-through of the geopolymers 45~100rpm/min blender in the powdery material at a rate of 3)-1 pulverizing and mixing a raw material for the geo-polymer additive based on 100 parts by weight powdery  $\text{Na}_2\text{CO}_2$ ,  $\text{BASO}_4$ ,  $\text{CACO}_3$ ,  $\text{CA}(\text{CLO}_4)2\text{CA}_4\text{AL}_{16}\text{O}_{12}\text{SO}_4$  Naca(oh)<sub>3</sub>, disintegration and mixing 1.6 parts by weight of the additive mixture, comprising the steps of: 4) Geo-polymer powder 100 parts by weight of coarse aggregate circulation of 13mm~19mm 150 parts by weight to 500 parts by weight and 5mm~2mm of circular 150 parts by weight to 500 parts by weight of aggregate mixer and uniformly mixed for 5 minutes in the fan (60rpm/min) geo-polymer material of the solid phase and generating a concrete, 5) The 100 parts by weight of the raw material in the solid phase in the geopolymers concrete liquid activator added to 30 parts by weight to 200 parts by weight of uniformly mixed in the mixer (60rpm/min) fan slurry comprising the steps of: 6) of the raw material, a flowchart of the slurry, the slurry when 180~230mm  $\Phi$  100 × 200mm filled in circular mold, is a vibration while molding the geo-polymer concrete, 7) Geo-polymer concrete of the molded solid phase surface covered with plastic wrap and let the water so that the exit is prevented at 60 degrees centigrade for 8 hours at room curing step of curing the heat characterized in that it comprises a building concrete using waste recycled aggregate, method for producing a geo-polymer.

**Assignees:** HANA K ENVIRONMENT CO LTD; HANAKTEC CO LTD



88. Family 43546364 (US2011017101 AA)

[View in PatBase](#)

Title (EP2238087 B1)

[EN] PROCESS FOR PRODUCING A GRANULAR MATERIAL

Abstract (EP2238087 B1)

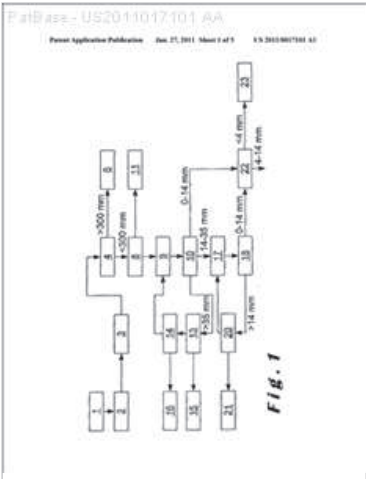
[EN] The present invention relates to a process for producing a granular material 26 for mixing with at least a hydraulic binding agent and with water to produce mortar or concrete. This process comprises at least an aggregation step and a carbonation step. In the aggregation step, steel slag particles from at least a fine fraction 24 of steel slag, in particular a fine fraction of steel slag containing a significant amount of gamma-dicalcium silicate, are aggregated into larger grains so as to form a coarser granular material 25. In the carbonation step, said aggregated particles in said coarser granular material 25 are carbonated by means of carbon dioxide so as to produce a carbonated granular material 26. The present invention also relates to a carbonated granular material of aggregated steel slag particles containing a significant amount of gamma-dicalcium silicate, in particular at least 3 weight percent, preferably at least 5 weight percent and more preferably at least 7 weight percent, and bound within each grain by a solid matrix containing at least calcium and/or magnesium carbonates.

1st Main Claim (EP2238087 B1)

[EN] 1. A process for producing a granular material (26) for mixing with at least a hydraulic binding agent and with water to produce mortar or concrete, **characterised in that** it comprises:

- an aggregation step, wherein steel slag particles from at least a fine fraction (24) of steel slag containing a significant amount of gamma-dicalcium silicate are aggregated into larger grains so as to form a coarser granular material (25); and
- a carbonation step wherein said steel slag particles in said coarser granular material (25) are carbonated by means of carbon dioxide so as to produce a carbonated granular material (26), the grains of which contain said steel slag particles bound to one another by a solid matrix containing carbonates formed during the carbonation step.

**Assignees:** RECOVAL BELGIUM; NGUYEN EVELYNE; DESCAMPS PHILIPPE; VAN MECHELEN DIRK



89. Family 32252759 (US2005238563 AA)

[View in PatBase](#)

Title (EP1723078 A2)

[EN] METHOD FOR SEQUESTERING CARBON DIOXIDE

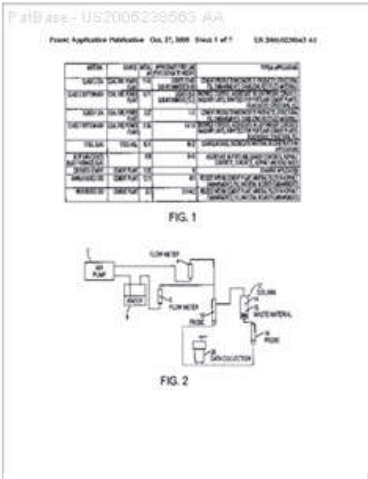
Abstract (EP1723078 A2)

[EN] A method for permanently sequestering CO<sub>2</sub> by bringing a gas containing the CO<sub>2</sub>, which may be the atmosphere, into contact with alkaline waste materials containing Ca to form a carbonate that is stable and environmentally benign.

1st Main Claim (EP1723078 A2)

[EN] 1. A method for sequestering CO comprising: bringing a gas containing CO<sub>2</sub> into contact with an alkaline waste material containing Ca-bearing phases; and allowing the CO to react with the Ca to produce CaCO<sub>3</sub>.

**Assignees:** UNIV NEW HAMPSHIRE; SEAGER THOMAS; EIGHMY T T; GARDNER KEVIN H; EIGHMY TAYLOR T



## 90. Family 73924826 (US2020392043 AA)

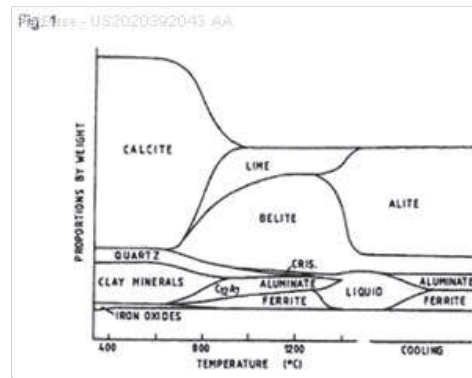
[View in PatBase](#)

### Title (EP3694818 B1)

[EN] METHOD FOR MANUFACTURING BINDERS HARDENING BY HYDRATION AND CARBONATION

### Abstract

[EN] A method for manufacturing a binder of a hydratable material includes providing a starting material from one or more raw materials convertible by tempering at 600 to 1200 degrees centigrade into the hydratable material, tempering the starting material to provide the hydratable material containing not more than 10 percent by weight monocalcium silicate and at least 15 percent by weight hydratable phases in the form of lime and dicalcium silicate, wherein the residence time and the tempering temperature are adapted to obtain the hydratable material by converting not more than 80 percent by weight of the starting material, and cooling the hydratable material to provide the binder comprising the hydratable material. The binder can be mixed with water and optionally one or more of aggregate, additives, admixtures to obtain a binder paste that is placed, hydrated and carbonated to produce a building product.



### 1st Main Claim (EP3694818 B1)

[EN] 1. Method for manufacturing a binder comprising a hydratable material comprising the steps:

- - providing a starting material from one or more raw materials convertible by tempering at 600 to 1200 degrees centigrade into the hydratable material, wherein the starting material has a Ca/Si molar ratio from 0.5 to 1.8 and contains no or up to 30 percent by weight of other elements than CaO and SiO<sub>2</sub> with regard to the total mass calculated as oxides,
- - tempering the starting material at a temperature in the range from 600 to 1200 degrees centigrade during a residence time from 1 minute to 5 hours to provide the hydratable material containing not more than 10 percent by weight monocalcium silicate and at least 15 percent by weight hydratable phases in the form of lime and dicalcium silicate, wherein at least 50 percent of the crystalline hydratable phases are dicalcium silicate, wherein the residence time and the tempering temperature are adapted to obtain the said hydratable material by converting not more than 80 percent by weight of the starting material, and cooling the hydratable material to provide the binder comprising the hydratable material.

**Assignees:** HEIDELBERGCEMENT AG; HCONNECT 2 GMBH

91. Family 95636283 (CN115626787 A)

[View in PatBase](#)

Title

[EN] ARDEALITE-BASED CARBON-FIXABLE UNFIRED LIGHTWEIGHT AGGREGATE AS WELL AS PREPARATION METHOD AND APPLICATION THEREOF

Abstract

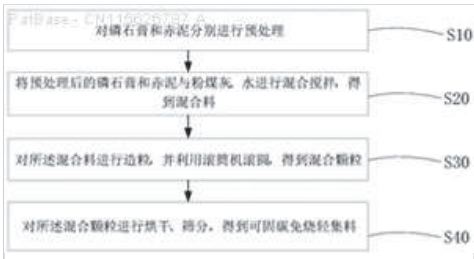
[EN] The invention relates to the technical field of solid waste treatment, in particular to ardealite-based carbon-fixable unfired lightweight aggregate as well as a preparation method and application of the ardealite-based carbon-fixable unfired lightweight aggregate. The carbon-sequestration unfired lightweight aggregate takes phosphogypsum, red mud and fly ash as main raw materials; acidic compounds such as phosphoric acid and fluoride exist in the ardealite, so that the high alkalinity of the red mud can be neutralized, and the harm generated by the red mud is reduced;  $\text{CaSO}_4$  in the ardealite,  $\text{Al}_2\text{O}_3$  in the red mud and  $\text{SiO}_2$  and  $\text{Al}_2\text{O}_3$  in the fly ash are utilized, hydration products such as C-S-H gel, ettringite and mullite are formed on the basis of Ca, Al and Si to provide strength, and meanwhile harmful substances in the ardealite and the red mud are solidified; high-alkalinity ( $\text{OH}^-$ ) provided by the red mud and  $\text{Ca}^{2+}$  in the ardealite can synthesize  $\text{Ca}(\text{OH})_2$ , and the  $\text{Ca}(\text{OH})_2$  can react with  $\text{CO}_2$  in air to generate  $\text{CaCO}_3$ , so that the carbon sequestration effect is achieved, and the carbon sequestration capacity is about that each ton of the unfired lightweight aggregate capable of sequestration carbon can cure 35-44kg of  $\text{CO}_2$ .

1st Main Claim

[MT] 1. A phosphorus gypsum-based fixable carbon-free lightweight aggregate comprising the following components in parts by weight: phosphorus gypsum 10-20 parts, red mud 50-70 parts, red mud 40:50 parts of fly ash and 56 parts of water;

Wherein the phosphorus gypsum is semi-aqueous phosphorus gypsum; the phosphorus gypsum and the red mud each have a particle size of less than 150 micro m.

**Assignees:** SHENZHEN GUONENG ENVIRONMENTAL PROTECTION TECH CO LTD; SHENZHEN UNIV; UNIV SHENZHEN; ZHONGXIANG LYUJING ENVIRONMENTAL PROTECTION TECH CO LTD



## 92. Family 13497392 (JP8143382 A2)

[View in PatBase](#)

### Title

[EN] PRODUCTION OF CONCRETE FOR VEGETATION AND PRECAST CONCRETE FOR VEGETATION

### Abstract

[EN] PURPOSE: To produce a concrete for vegetation and a precast concrete for vegetation suitable to plant propagation by kneading cement, aggregate, water and frothing agent in a gaseous CO<sub>2</sub> atmosphere to neutralize an alkali content in the concrete with carbonic acid. CONSTITUTION: A low alkali cement, aggregate, water and frothing agent are kneaded in the gaseous CO<sub>2</sub> atmosphere to obtain an aerated concrete for vegetation, and alkali content such as Ca(OH)<sub>2</sub> generated by a hydration reaction of the cement is neutralized with the CO<sub>2</sub> and adjusted to pH5-9.5 which is a suitable liq. quality range for a plant growing. A neutralization by using the gaseous CO<sub>2</sub> can be executed in the process of kneading and/or in the process of aging, and an accomplishment of an object is possible by using a calcareous water instead of the gaseous CO<sub>2</sub> atmosphere, and by aging an aging pot under gaseous CO<sub>2</sub> high concn. environment in the case of a cast concrete.

### 1st Main Claim

[MT] 1. asymmetric cement, aggregate, water, foaming in a carbon dioxide atmosphere, characterized in that kneaded with a Conch. vegetation for the cleat

**Assignees:** OHBAYASHI CORP

## 93. Family 99088922 (CN116789410 A)

[View in PatBase](#)

### Title

[EN] CARBON SEQUESTRATION CONCRETE AND PREPARATION PROCESS THEREOF

### Abstract

[EN] The invention belongs to the technical field of novel building materials, and particularly relates to carbon sequestration concrete and a preparation process thereof. The carbon sequestration concrete comprises cement, a carbon sequestration carrier suspension, water, gravel, stone sand and a water reducing agent, the carbon sequestration carrier is carbonized solid waste, a wrapping layer is formed on the carbon sequestration carrier through a coating polymer, and the coating polymer is at least one of acrylate resin, epoxy resin and polyurethane resin; the solid waste is used for sealing CO<sub>2</sub>, so that industrial solid waste is recycled, and the mechanical property of the solid waste is improved; the wrapping layer is arranged on the carbon sequestration carrier, and a coating polymer in the wrapping layer infiltrates an interface transition area of the carbon sequestration carrier and directly acts with the interior of the carbon sequestration carrier, so that the mechanical strength of the interface transition area is enhanced, and the bonding strength between the interface transition area and slurry is improved, and the prepared carbon sequestration concrete has excellent mechanical strength.

### 1st Main Claim

[MT] 1. A carbon-fixed concrete, characterized in that the raw material comprises, in parts by weight, 26 to 50 parts of cement, 20 to 35 parts of a suspension of a carbon-fixed carrier, 10 to 35 parts of water, 40 to 90 parts of crushed stone, 25 to 65 parts of sand, 0.13 to 0.25 parts of a water reducing agent;

The solid carbon support suspension comprises a solid carbon support and a coating mixture;

The solid waste which is porous and contains Ca ions and/or Mg ions is prepared after treatment with an aqueous solution of carbon dioxide or carbon dioxide;

The coating mixture includes a coating polymer and water, the fixed carbon carrier is placed in the coating mixture, the coating polymer forms a coating layer on the fixed carbon carrier; the coating polymer is at least one of an acrylate resin, an epoxy resin, and a polyurethane resin.

**Assignees:** HANGZHOU YUHANG HENGLI CONCRETE CO LTD

94. Family 64548539 (WO17000075 A1)

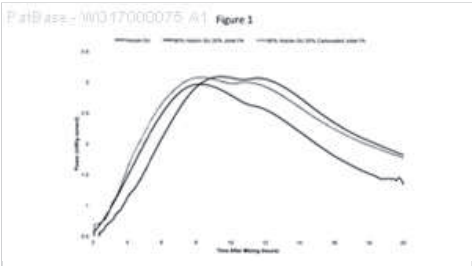
[View in PatBase](#)

Title

[EN] CARBONATED FLY ASH AS A CEMENT REPLACEMENT

Abstract

[EN] A process for producing a blended binder material containing high calcium fly ash, in particular ASTM Class C fly ash, is provided. The process comprises: (i) carbonating the fly ash with carbon dioxide; and (ii) combining the carbonated fly ash with a cement binder such as Portland cement. The carbonation process improves the performance of the high calcium fly ash and thus allows for higher amounts of the fly ash to be used with the cement binder in cement mix compositions such as concrete. The results presented herein demonstrate the benefits of the carbonation process on the rate of cement hydration, and on the compressive strength and the dimensional stability of the resulting cement products.



1st Main Claim

[EN] 1. A method of producing a blended binder material comprising (i) carbonating a combustion ash, wherein the carbonation comprises contacting an aqueous combustion ash slurry with carbon dioxide, wherein the slurry comprises less than 10 percent water, to produce a carbonated combustion ash; (ii) combining the carbonated ash with a cement binder to produce a blended binder.

Assignees: CARBONCURE TECH INC

## 95. Family 78282965 (KR20200037174 A)

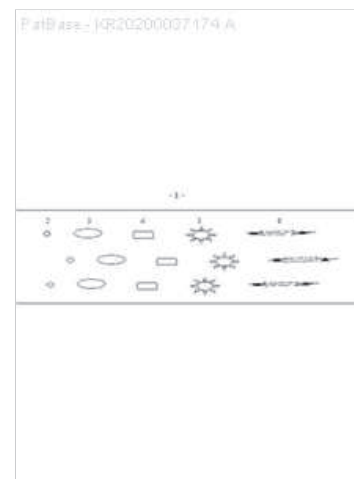
[View in PatBase](#)

### Title

[EN] FUNCTIONAL MATERIAL MANUFACTURE CONSTRUCTION CLEANUP EQUIPMENT FACILITY BUILDING STRUCTURE

### Abstract

[EN] The present invention relates to: a) a cone, a cone bar, a cone spiral, a cone net bar frame, a bar frame spiral, a cone net bar frame spiral on which a magnet, an electromagnet, a magnetic material, a superconducting magnet, and a solenoid electromagnet are mounted, a hollow body in which the same is embedded, a placing machine equipped therewith, and equipment such as a wind power compressor, a drone, a solar power generator, and a wind power generator having the same; b) a magnetized member which passed therethrough or a material, mortar, milk, ready-mixed concrete and concrete containing Ca, Mg, Si, Fe, Me, Al, K, Na, OH, COO, CaSi and CaFe; c) a material, a brick, a block, a main material, a subsidiary material, and a construction material using the equipment to the concrete; and d) a method of using the equipment or the construction material, a construction method, manufacture, construction, a placing construction method, a facility, a building and a structure. Therefore, the performance of a placing material can be improved.



### 1st Main Claim

[MT] 1. A magnet mounted to the network rod; b) the magnet housing helix porous body, mounted on the mobile communication device; c) wave, hollow body, one of said magnet to hollow body, pouring nozzle mounted to the outlet or inside the injector, the injector; d), injector that moves one of the magnet to a drone; e) the injector, 3D printer that is equipped with a magnetic oxide while moving their drone; f) injecting the pouring in its place to mount on the plotter for moving the 3D printer; g) of the hollow body is provided with a hollow body material ejected from the drone pouring pouring; h) pouring the hollow body provided with a rotor which is provided on its pouring pouring the material is injected from the 3D printer 3D printer; i) one of the hollow body to reduced pressure through the hose to the compressor supplying the wind; j) to one of the magnet, the magnet coil of the electromagnet 3-D printer, a motor for rotating the wings of the drone through a wire for supplying electricity to the one of the one or more of solar generators, wind power generators; or one or more of the provided in the rough magnetization, eddy current, One of magnetization is pouring pouring vortex is a device that is, 1) the network; b) a beacon frame or a helical rod, rods, frame, two or more of the network, one of the helix, the rod; a housing, a mesh, a net, mesh, spiral, rod, rod downward spiral, helical, spiral, helical rods, the framework of the mesh network, the mesh mold mold frame rod, a spiral, a rod mold spiral helix, Network Mesh rod rod mold frame, the spiral helix and the rod mold; c) network to connect two or more of the plurality of spiral; one of the two or more network-network with a rod mold frame spiral helix rod, rod-frame spiral-a network beacon network, the network-mold frame rod-helical spiral helix, cone-network network rod-frame-network-mold frame rod spiral helix; d) a network, the network to the spiral binding or frame-frame rod, the rod, the rod-frame spiral helix--the mesh network, the network-mold frame-helical spiral, helical, cone-beam (cone-network rod mold frame, cone-manganese-manganese rod spiral helix, cone-manganese-rod-mold frame, cone-network-spiral helix; e) a network-frame-polymers, the rod spiral helical frame ago after the network mesh rod, the network dongsang rod spiral, helical frame to frame after the mesh network to the dongsang rod mold after mold spiral helix, the network, the network frame after the dongsang after rod spiral helix, the network frame; f) the network bong bong ago combination of spiral helix-turn a combination of the network, the network frame frame-helical spiral rod, the combination of a combination of a spiral turn-manganese rod, The combination of frame-helix-manganese; g)--porous or perforated holes are formed rod of the cone-type; h) 1922), and the mesh of the helical turn located within the interior of the cone mounted on the network and the network is located on the outside of the rod, the holes of the mesh, and the shape of the mold holes is larger than the cone, net, Frame consisting of one of the one side of the spiral configuration; i) and external ramp pouring material while being introduced into the degreaser swirling inner inclined portion; placing a finely divided material while passing through their holes and screw holes; placing the network to re-Budithimyeonseo rods; pouring vortex grid holes in their material while passing through the fine larger than the mold; pouring the swirling vortex (vortex helices; a re-configuration of one or more contacts; j) j1, net, bars, rods, helical rods, the network, the network, the network, the network rod spirals, battle, mesh rod rod framework, the network rod mold frame spiral helix; 1 double one front and rear, left, right, top, bottom, above, below, top, bottom, side, and one side, both sides, and both ends, some, one surface once, Double-sided, part, in part, to one point, two points, the multi-point, multi-point, place, one, two, three, where, in the bottom, the inner surface, the hollow inside, outside the central outer peripheral, an exterior surface, around the passage, the inlet, outlet, a neighborhood, near, middle, front, rear, side, front, back, one-way, two-way, three-way, four-way, re-flow to flow or pouring; forward, backward, provided in at least one of installation, configuration, arrangement, combination, mounted, fastened position, the open position, the deceased, position, location, first column arrangement, cross-linking, it is possible two-column arrangement, interleaved, checcurboard arrangement heat disposed, differential arrangement, has been recognized as one of the zigzag arrangement to the network one or more of the cone having a spiral; k) the rod frame is one of a zigzag arrangement to the network through the mold casting material rod, spiral, one of the raw material is in contact with the mesh bar frame, one of the impingement spiral in the casting material is one of raw materials, materials, aeration, vortex stirring, the magnetization hexagonal water, wave, pulse, increase cavitation, promotion, times, one;; To be one of the one of the network, 2) to the beacon frames helices; rod or the network beacon is a frame spiral included in the rod, and the body, cone, cone, cone, a hookah, rod, rod, a mesh network, and the cone, cone, double cone, cone, cone, spiral, multiple hollow cone, cone, porous, contact the, spaced from the passage, the spirals, screw, then forward, reverse cone, cone, the cone, the cone of the spiral helix of spiral after, spiral, helical, spiral, one side is spaced apart from the above, both on the network, the network separation cones, rods, helical spiral, helical, the rod spirals the mesh network, the network, the network, the bar frame rod rod spirals, the network rod spiral helix; b) a frame of the inclination angle is 1 ~ 89, spaced apart between the outer diameter and the inner diameter of the other side of the one side, the pore diameter of the pore diameter is from 1.1 to 5.0 times the length of the magnet to 0.1 to 0.8 times the length of the plurality of magnets or the 0.1 to 10.0 times the diameter of one side of the hollow cone, wherein one side of the hollow of the hollow body inner cross-sectional area of the cross-sectional area 0.9 times 0.05~0.25 1.1 to 10.0 times of the cross-sectional area or the magnet, wherein the magnet is a

magnet, magnet group 3)), the electromagnet. Magnet, magnet, magnet, plate pairs, each magnet, the magnet is a magnet, and a magnetic body, the magnetization of the magnetic material, the magnetic material, the magnetic wave, hexagonal, magnetization, magnetization of the magnet provided with a wave, double magnet, magnet, it is possible energy at magnet, magnet, a superconducting magnet, Nano composite, lining magnet, the magnet N pole, S-pole of the magnet bacteria cotton, the N pole S pole magnet N pole, S-pole, the N pole S pole is the S-pole magnet N pole S pole facing the N-pole, S-pole of the N pole magnet N pole S pole magnets on the stator core, N-s-s-n-n-s-s-n N-s-n-s-n-s-n-s magnet, magnet, an electromagnet, a coil wound around the gin, through a solenoid electromagnet, the swirling through Daegu Daegu Visa Visa, the pipelined magnetic material, the magnetic force of the magnet is the same as or different from each other two or more of a plurality of magnets; b), the magnetic force of the magnetic force of the magnetic force or the entire summer 1000 to 20,000 Gauss; c) a plurality of magnets of the magnet to one or more of the magnet, such as magnet embedded to a plurality lining has been recognized as one of the magnet, electromagnet; d) through to a plurality of the magnet through the magnet to Daegu visa; e) a plurality of magnets that is more than one combination of the central passageway through the fitting the magnet, the magnetic body or the inner diameter of the hollow body; f) 0.01 to 0.8 times that of the internal diameter of the cross-sectional area Or diameter or cross-sectional area; one of the magnet, the magnetic body is characterized in that the equipment.

**Assignees:** CHUNG HA IK; CHUNG YONG JIN; KOREA IND TECH INST; CHUNG YONG HOON

96. Family 92500616 (CN114776073 A)

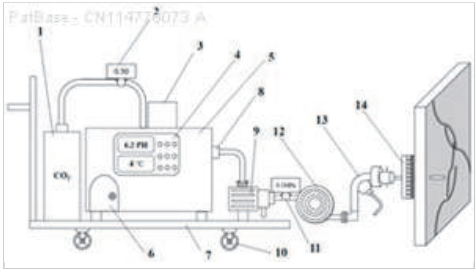
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Title

[EN] CONCRETE MICRO-CRACK GROUTING REPAIRING DEVICE BASED ON INDUSTRIAL CALCIUM-BASED SOLID WASTE AND CARBON DIOXIDE TAIL GAS AND WORKING METHOD

Abstract

[EN] The invention relates to a concrete micro-crack grouting repairing device based on industrial calcium-based solid waste and carbon dioxide tail gas and a working method, and belongs to the field of concrete repairing. Comprising a repairing agent preparation device, a repairing agent conveying device and a grouting repairing device. A water filling nozzle is arranged above the liquid storage tank, the liquid storage tank is filled with a mixed solution of a calcium-based industrial solid material and deionized water which are proportionally prepared, and the carbon dioxide gas tank is connected to the liquid storage tank through a pipeline; the repairing agent conveying device comprises a water pump and a conveying hose, the grouting repairing device comprises a liquid injection gun, the water pump conveys a solution in the liquid storage tank to the liquid injection gun through the conveying hose, and a heating plate is arranged on the liquid injection gun. According to the invention, carbon dioxide can be sealed, and the prepared calcium bicarbonate solution is used as a concrete microcrack repairing agent, has high fluidity, can generate calcium carbonate crystals with a cementing effect in concrete microcracks, fills gaps, builds a net-shaped structure, and gradually forms an integral structure with original concrete to complete crack repairing.



1st Main Claim

[MT] 1. Concrete microcrack injection repair device based on industrial calcium-based solid waste and carbon dioxide tail gas, characterized by comprising a repairing agent preparation device, a repairing agent delivery device and an injection repair device;

The repairing agent preparation apparatus comprises a carbon dioxide gas tank and a slurry preparation tank, in which a liquid reservoir is placed, a water injection port is provided above the liquid reservoir, in which the liquid reservoir is a proportionally configured mixed liquor of calcium-based industrial solid material and deionized water, in which the carbon dioxide gas tank is an industrial waste gas containing carbon dioxide, and the carbon dioxide gas tank is connected to the liquid reservoir via piping;

The repairing agent delivery device comprises a water pump and a delivery hose, the slurry repair device comprises a filling gun through which the water pump delivers the solution in the sump to the filling gun, the filling gun being provided with a heating plate for heating the area around the crack of the concrete structure.

**Assignees:** UNIV SHANDONG; SHANDONG HI SPEED GROUP CO LTD; SHANDONG UNIV

97. Family 69443677 (WO18074638 A1)

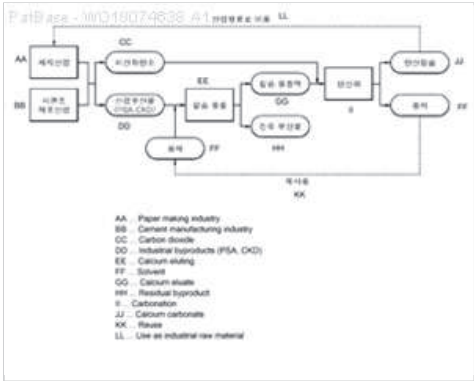
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Title

[EN] METHOD FOR PRODUCING HIGH-PURITY CALCIUM CARBONATE AND REUSING SOLVENT USING INDIRECT CARBONATION OF ALKALI INDUSTRIAL BYPRODUCTS

Abstract

[EN] The present invention relates to a storage of a carbon dioxide and a production of a high-purity calcium carbonate using an indirect carbonation of alkali industrial byproducts. Particularly, the present invention provides a method for storing a carbon dioxide through the production of high-purity calcium carbonate, comprising a first step of adding a solvent to the alkali industrial byproducts to thereby elute calcium; a second step of separating the calcium eluate from the residual byproduct; a third step of performing a carbonation reaction in which carbon dioxide is introduced into the calcium eluate to thereby produce a calcium carbonate; a fourth step of separating the calcium eluate into the calcium carbonate and a solvent after the carbonation reaction; and a fifth step of reusing the solvent of the fourth step as the solvent of the first step, wherein the solvent is a chelating reagent of which the stabilization constant with calcium is smaller than the stabilization constant of calcium carbonate.



1st Main Claim

[MT] Alkaline industrial by-products of the solvent was added to elute the calcium;

calcium eluate and the first to the second residual byproduct into the vessel;

the calcium by injecting the carbon dioxide in the eluent generating a calcium carbonate, a third step to carry out the reaction carbonation

carbonation reaction; wherein, the calcium eluate after calcium carbonate and solvent; and a fourth step of removing

the first solvent in the first step of Step 4 of the solvent comprises a; a fifth step of reuse, the solvent stabilization of calcium carbonate of calcium stabilization constant is constant smaller than chelating reagent (grignard reagent), characterized in that the production of high purity carbon dioxide through storage method of calcium carbonate.

**Assignees:** KOREA MARITIME UNIV IND ACADEMIC COOPERATION FOUNDATION; KOREA MARITIME UNIV IND ACAD; KOREA MARITIME AND OCEAN UNIV IND ACADEMIC COOPERATION CENTER

# 98. Family 103706013 (CN118376567 A)

[View in PatBase](#)

**Title**

[EN] METHOD FOR EVALUATING CARBON DIOXIDE CORROSION RESISTANCE OF OIL WELL CEMENT

**Abstract**

[EN] The invention provides a method for evaluating carbon dioxide corrosion resistance of oil well cement. The method comprises the following steps: (1) evaluating according to a change rule of mechanical indexes; (2) evaluating according to a microstructure change rule; and (3) evaluating according to the change rule of numerical simulation carbonization depth. And (4) comprehensive evaluation is carried out by combining mechanical indexes, microstructures and change rules of numerical simulation carbonization depth. The evaluation speed of the carbon dioxide corrosion resistance of the oil well cement can be further improved.

**1st Main Claim**

[MT] 1. A method for evaluating the corrosion resistance of oil well cement against carbon dioxide, comprising:

- Step (1). Sample preparation, at least 3 of each sample must be prepared;
- Step (2). Cement corrosion for a long period of time of at least 7 days;
- Step (3). Microstructure and mechanical index testing;
- Step (4). Carbide depth test;
- Step (5). Build a numerical model;
- Step (6). Combined with mechanical indicators, microstructure and numerical modeling of the pattern of change in the depth of carbonization.

**Assignees:** OF ROCK AND SOIL MECHANICS CHINESE ACADEMY OF SCIENCES INST; OF ROCK AND SOIL MECH CHINESE ACADEMY OF SCIENCES INST; INST ROCK AND SOIL MECH CAS



99. Family 49580428 (JP2011524253 T2)

[View in PatBase](#)

Extended Family Number: 42613795

Title

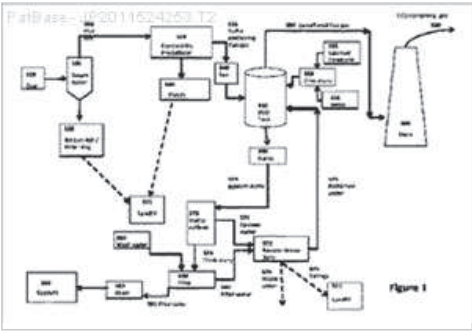
[MT] Systems and methods for using waste metal oxide sources

Abstract

[MT] There is provided a method for producing a composition comprising a carbonate, it will include how to use the source of the metal oxide waste. Aqueous solution of divalent cations (some or all of their waste obtained from the sources of the metal oxide) was brought into contact with CO<sub>2</sub>, and placed in the precipitation conditions, it is possible to obtain a composition containing a carbonate. In some embodiments, the combustion ash, waste is a source for metal oxide solution containing divalent cations. In some embodiments, using the burning ash, the source of a proton scavenger, divalent cations, silica, metal oxides, or other desired constituent, or combinations thereof are provided.

1st Main Claim

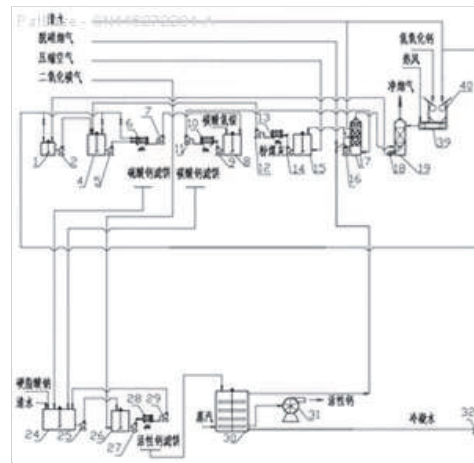
[MT] 1. A) an aqueous solution, the step of contacting the source of the metal oxide from industrial processes; b) in aqueous solution, the charge of carbon dioxide from sources of carbon dioxide from industrial processes step; c) and precipitation conditions at atmospheric pressure of the aqueous solution, the process to produce a material containing carbonate precipitate; including ways.



[View in PatBase](#)

## [EN] DESULFURIZATION METHOD AND SYSTEM FOR CO-PRODUCTION OF ACTIVE CALCIUM OR GYPSUM BY COMBINING AMMONIA AND CALCIUM WITH REGENERATED AMMONIA WATER

[EN] The invention discloses a desulfurization method and system for co-producing active calcium or gypsum by combining ammonia and calcium with regenerated ammonia water, and relates to the technical field of atmosphere control. Ammonia-process first-stage incomplete desulfurization is matched with calcium hydroxide dry-process second-stage complete desulfurization, and around regeneration and conversion of two-stage desulfurization products, a relatively pure ammonium bisulfate solution reacts with calcium sulfate containing excessive calcium hydroxide, and a relatively pure ammonium bisulfate solution reacts with calcium sulfate containing insufficient calcium hydroxide; and correspondingly regenerating ammonia water and precipitating calcium sulfate containing calcium hydroxide, carbonizing and drying the ammonia water containing ammonium bisulfate and precipitating calcium sulfate to obtain an active calcium product with high added value and large market demand, and drying the latter to obtain a high-purity gypsum product with wide application prospect. Ammonia water regenerated by the two methods and ammonium bisulfate and ammonia water containing ammonium bisulfate return to an ammonia-process desulfurization system to form a waste-free closed-loop process, two ultra-clean emission desulfurization methods and desulfurization systems are derived, and the method and the system are truly embodied in flue gas recycling, tail gas ultra-purification and treatment benefit of the desulfurization technology.



[MT] 1. A method of sulfur of ammonia calcium in combination with regenerating ammonia hydration to produce active calcium or gypsum, comprising the steps of:

Step 1: Obtaining an sulfuric acid hydrogen ammonium solution using ammonia primary incomplete sulfur: Flue gas containing SO<sub>x</sub> enters the upstream side of the primary ammonia incomplete sulfur column and is sequentially absorbed in reverse spray with the recycle sulfur liquid and the water wash recycle sulfur liquid, controlling the biased acidic environment of the recycle sulfur liquid PH=3-4. Keep most of the SO<sub>x</sub> in the flue gas here converted to sulfuric acid ammonia and sulfuric acid ammonium hydrogen sulfur liquid, in the prevention of NH<sub>3</sub>Evaporate to the next escape premise, will flue gas in SO<sub>2</sub>To (NH<sub>4</sub>)<sub>2</sub>SO<sub>3</sub> - NH<sub>4</sub>HSO<sub>3</sub>- Ammonia recirculation sulfur reobtained (NH<sub>4</sub>)<sub>2</sub>SO<sub>3</sub> - (NH<sub>4</sub>)<sub>2</sub>SO<sub>3</sub>Cycle sulfur - again to NH<sub>4</sub>HSO<sub>3</sub>- O in the flue gas<sub>2</sub>Oxidation to NH<sub>4</sub>HSO<sub>4</sub>The cyclic sulfur process is carried out; the flue gas is SO<sub>3</sub>To NH<sub>4</sub>HSO<sub>4</sub>The cyclic sulfur process is carried out; in the process, the pH of the cyclic sulfur solution is changed to control the amount of ammonia added, i.e. when the pH is close to 3, supplementing the ammonia water increases the sulfur capacity and promotes NH<sub>4</sub>HSO<sub>3</sub>To (NH<sub>4</sub>)<sub>2</sub>SO<sub>3</sub>Conversion of the, when pH is close to 4, stops supplementing ammonia to prevent NH<sub>3</sub>The volatilization escapes; is carried out in the process to recycle the sulfur solution from the NH<sub>4</sub>HSO<sub>4</sub>The content of the control reaction endpoint, i.e. when NH<sub>4</sub>HSO<sub>4</sub>When the content rises to the expected concentration index to obtain the sulfur completion liquid is quantitatively discharged from the bottom of the column, complete the ammonia first stage incomplete sulfur removal, keep a small fraction of the SO<sub>x</sub> in the flue gas is not removed here at the SO<sub>x</sub> limit less than or equal to 200mg/M.<sup>3</sup>;

Step 2: Second-stage complete sulfur using calcium hydroxide dry process: The calcium hydroxide dry particles or calcium hydroxide dry powder are combined with water, granulated, and dried to obtain calcium hydroxide dry particles are charged to a calcium hydroxide dry-stage second-stage complete sulfur column, Ammonia first stage incomplete sulfur flue gas from calcium hydroxide dry second stage complete sulfur tower bottom into upstream with excess calcium hydroxide alkaline particulate matter absorption and adsorption reaction, will residual SO in flue gas<sub>2</sub>And SO<sub>3</sub>Conversion to CaSO<sub>3</sub>And CaSO<sub>4</sub>At the same time, the smoke in the O<sub>2</sub>The impact of CaSO<sub>3</sub>Conversion to CaSO<sub>4</sub>The flue gas entrained sulfur liquid aerosol and some moisture are also adsorbed by calcium hydroxide particles, in the process to keep calcium hydroxide dry particles in excess, its make-up amount by the secondary complete sulfur off-gas SO<sub>x</sub>The emission limit affects when the exhaust SO<sub>x</sub>The calcium hydroxide particles are replenished when the content is close to the emission limit, when the replenishment is stopped when it is low to the set point, and in the case of ultra-net emission of flue gas, the dry particles of calcium hydroxide become Ca (OH)<sub>2</sub>, CaSO<sub>4</sub>The spent sulfur agent of the components and quantitatively removed from the bottom of the column;

Step 3: Aeration purification sulfur liquid: The ammonia first stage incomplete sulfur completion liquid is injected into the aeration oxidizer, aeration oxidation with compressed air, pH between 3 and 4 of the sulfur process residual  $\text{NH}_4\text{HSO}_3$  Oxidation to  $\text{NH}_4\text{HSO}_4$  The solution was filtered off the  $\text{NH}_4\text{HSO}_4$  The solution of fly ash, VOC organic matter and other impurity particles, to obtain relatively pure  $\text{NH}_4\text{HSO}_4$  Solutions;

Step 4: The two-stage sulfur products react with each other to regenerate ammonia and precipitated sulfuric acid calcium: The spent sulfur agent obtained in step 2 is slurried in the pulper with condensate or fresh water, with the pure NH obtained after aeration in step 3.  $\text{H}_2\text{SO}_4$  solution press  $\text{Ca}(\text{OH})_2$  significantly higher than  $\text{NH}_4\text{HSO}_4$ . Mix the reaction molar ratio, slurry with fresh water or system steam condensate to make  $\text{NH}_4\text{HSO}_4$ .  $\text{NH}_4^+$  ions and  $\text{Ca}(\text{OH})_2$  OH in the  $^-$ . The ion reacts completely to generate ammonia (NH) which is recycled for sulfuric acid, so that  $\text{Ca}(\text{OH})_2$   $\text{Ca}^{2+}$  ions and  $\text{NH}_4\text{HSO}_4$  ionized  $\text{SO}_4^{2-}$ . The ions precipitate to

form  $\text{CaSO}_4$ ,  $\text{CaSO}$  in the slurry<sub>4</sub>Do not participate in the reaction to form  $\text{CaSO}_4$ ,  $\text{Ca(OH)}_2$ The ammonia mixture slurry is separated by a single filtration and contains  $\text{Ca(OH)}_2\text{CaSO}_4$ Filter cake and regenerated ammonia;

Step 5: Regeneration of ammonia water Purify calcium removal with carbonium: Step 4 Regeneration of  $\text{NH}_4\text{OH}$  solution due to  $\text{CaSO}_4$ ,  $\text{Ca(OH)}_2\text{Ca}$  remains in sparingly soluble residue<sup>2+</sup>Ion, with  $\text{NH}_4\text{HCO}_3$ The metathesis reaction will be  $\text{Ca}^{2+}$ Ions precipitate into  $\text{CaCO}_3$ A new aqueous ammonia is formed and separated by a second filtration, except that  $\text{CaCO}$  is obtained<sub>3</sub>In addition to the filter cake, a relatively pure recycled  $\text{NH}$  is also born<sub>4</sub> $\text{OH}$  returns to the ammonia primary incomplete sulfur system to adjust the pH of the sulfur solution and make up the system for ammonia loss;

Step 6: Carbonation of the modified co-production of active calcium product: The  $\text{Ca(OH)}$  containing product is isolated by filtration in Step 4<sub>2</sub> $\text{CaSO}_4$ The filter cake and the second filtration step 5 separate the  $\text{CaCO}$  obtained<sub>3</sub>The filter cake is mixed, according to the active calcium filtration filtrate, steam condensate water, fresh water priority order is formulated to moderate slurry, according to the total slurry solids ratio of the surfactant sodium stearate is added moderately, the mixing is homogenized after bubbling carbon dioxide gas for carbonation, will be accompanied by excess  $\text{Ca(OH)}_2$ Conversion to  $\text{CaCO}_3$ sulfuric acid calcium-calcium carbonate binary mixture slurry is formed, after filtration separation, the filtrate returns to this step preferentially to mix the slurry, the filter cake is activated calcium filter cake, after drying and crushing to obtain combined activated calcium product.

**Assignees:** XINGTAI RUNTIAN ENVIRONMENTAL PROTECTION TECH CO LTD

101. Family 104785682 (CN118754704 A)

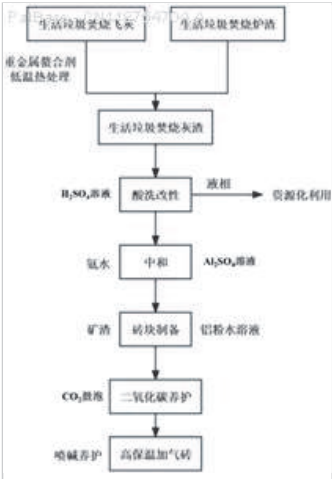
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Title

[EN] METHOD FOR PREPARING HIGH-HEAT-PRESERVATION AERATED BRICK BY MODIFYING HOUSEHOLD GARBAGE ASH THROUGH SULFURIC ACID

Abstract

[EN] The invention provides a method for preparing a high-heat-preservation aerated brick by modifying household garbage ash through sulfuric acid. The method comprises the following steps: carrying out acid pickling pretreatment on the ash; preparing the high-thermal-insulation aerated brick; and carbon dioxide and alkali spraying maintenance. According to the method, after the fly ash is detoxified by using a metal chelating agent and low-temperature pyrolysis, the fly ash and the slag are subjected to acid pickling modification treatment by using an H2SO4 solution. The obtained liquid phase is subjected to resource utilization, and ammonia water and Al2SO4 are added into the solid phase to be mixed, so that aluminum silicate gel is generated to enhance the heat preservation effect of the aerated brick. And mixing the obtained dried solid with slag and an Al powder solution to prepare an aerated concrete brick, performing mineralization maintenance on the aerated concrete brick in a CO2 bubbling manner, and regularly spraying a Ca (OH) 2 solution during natural maintenance to perform alkali spraying maintenance, so that the compressive strength of the aerated brick is improved, and carbon emission is reduced. The problems of harmlessness of fly ash and resource utilization of solid waste are solved, and the aerated brick is prepared from solid waste, meets the performance requirements of the national standard of aerated concrete, and has social and economic values.



1st Main Claim

[MT] 1. A method of sulfuric acid-modified domestic waste ash to produce high temperature aerated bricks, comprising the steps of: Providing a first layer of domestic waste ash having a first surface and a second surface;

Detoxifying the fly ash in order to reduce the concentration of dioxins and heavy metals in the fly ash to obtain detoxified fly ash;

Carrying out a pickling modification treatment on detoxified fly ash and slag;

By mass percentage, weighed after pickling detoxified fly ash 18 ~ 22%, after pickling slag 38 ~ 42%, slag 38 ~ 42%, mixed, according to the liquid-solid ratio 0.36 ~ 0.40, added water, stirred evenly; by mass percentage, Weigh 0.004 to 0.006% aluminum powder in the solid phase, Add water to dilute the suspension and pour into the slurry; stir into the slurry, pour into the mold, air, demolding;

After the demolded specimen is naturally maintained, it is placed in a carbon dioxide conservation chamber for carbon dioxide conservation, and removed for alkali spray maintenance.

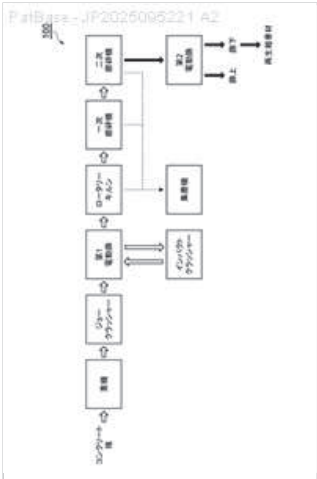
Assignees: ZHEJIANG UNIV OF TECHNOLOGY; UNIV ZHEJIANG TECHNOLOGY

102. Family 108503898 (JP2025095221 A2)

[View in PatBase](#)

**Title**  
[MT] RECYCLED COARSE AGGREGATE AND ITS MANUFACTURING METHOD, CONCRETE COMPOSITION AND CONCRETE

**Abstract**  
[MT] The present invention provides a method for producing recycled coarse aggregate that reduces the environmental load and allows the production of recycled coarse aggregate having excellent quality.  
[Solution] A method for producing recycled coarse aggregate using crushed concrete chunks is provided, which includes a carbonation step in which the crushed concrete chunks are made to absorb carbon dioxide in a carbon dioxide-containing atmosphere at a temperature of 0 degrees centigrade or higher but lower than 80 degrees centigrade and a relative humidity of 0 to 75 percent, to obtain recycled coarse aggregate containing aggregate components and cement paste components, with the cement paste component ratio being 5 to 30 mass percent.  
[Selected Figure] Figure 1



**1st Main Claim**  
[MT] A method for producing recycled coarse aggregate using crushed concrete blocks, comprising the steps of:  
A carbonation process is performed in which carbon dioxide is absorbed into the crushed concrete blocks in a carbon dioxide-containing atmosphere having a temperature of 0 degrees centigrade or higher and lower than 80 degrees centigrade and a relative humidity of 0 to 75 percent.  
A method for producing recycled coarse aggregate, comprising the steps of: obtaining recycled coarse aggregate containing an aggregate component and a cement paste component, the cement paste component having a ratio of 5 to 30 mass percent.

## 103. Family 40974579 (US2010119426 AA)

[View in PatBase](#)

### Title

[EN] PROCESS FOR RECOVERY OF SILICA FOLLOWED BY ALUMINA FROM COAL FLY ASH

### Abstract

[EN] A process for recovery of silica and alumina from fly ash, in which, Si is leached out from the fly ash in the form of  $\text{Na}_2\text{SiO}_3$  using a NaOH solution of  $\text{NaOH} > 40$  percent (w/w), followed by separation to obtain a  $\text{Na}_2\text{SiO}_3$  solution and a residue having Al-Si ratio  $\geq 2$ ; vaporizing the solution to obtain  $\text{Na}_2\text{SiO}_3$  solutions of various concentrations, or producing silica by carbonation, and producing  $\text{Al}_2\text{O}_3$  by prior art methods from residues obtained after alkali-leaching, ultimately producing filler or cement from the residue after the recovery of Al. The method permits recovery of  $\text{Al}_2\text{O}_3$  directly from fly ash by removing Si before recovering the Al, which raises the Al-Si ratio of the residue after alkali-leaching and thus simplifies the recovery of  $\text{Al}_2\text{O}_3$  and raises the rate of Al recovery from fly ash. The invention further includes calcining high Al coal gangue, kaolinite and middle-low-class bauxite at 900-1100 degrees centigrade

### 1st Main Claim

[EN] 1. A process for recovering silica and alumina from coal fly ash, comprising: a) alkali-leaching Si from fly ash at 70-150 degrees centigrade with a NaOH solution of concentration  $> 40$  percent (w/w), then separating a  $\text{Na}_2\text{SiO}_3$  solution from a residue having Al-Si ratio  $\geq 2$ ; b) concentrating the  $\text{Na}_2\text{SiO}_3$  solution by vaporization, or obtaining silica by carbonation; and c) producing  $\text{Al}_2\text{O}_3$  from the residue having Al-Si ratio  $\geq 2$ .

**Assignees:** PINGSUO COALS IND CO; PINGSHUO COAL INDUSTRY COMPANY; PINGSHUO IND LTD; PINGSKHUO INDUSTRIAL LTD; SONGQING GU; JINGUO QIN; GU SONGQING; QIN JINGUO

## 104. Family 58126983 (US2014373755 AA)

[View in PatBase](#)

### Title (EP3013544 B1)

[EN] METHOD FOR CONCRETE PRODUCTION

### Abstract

[EN] The invention provides compositions and methods directed to carbonation of a cement mix during mixing. The carbonation may be controlled by one or more feedback mechanisms to adjust carbon dioxide delivery based on one or more characteristics of the mix or other aspects of the mixing operation.



### 1st Main Claim (EP3013544 B1)

[EN] 1. A method for producing a carbonated cement mix in a mix operation in a cement mix apparatus comprising: (i) contacting a cement mix comprising cement binder and water in a mixer with carbon dioxide while the cement mix is mixing, wherein the mix is exposed to a dose of carbon dioxide of 0.01 to 1.5 percent by weight of cement (bwc) and wherein:

- - the carbon dioxide is in liquid form and is delivered to the cement mix in such a manner as to form a mixture of gaseous and solid carbon dioxide;
- - the cement mix comprises Portland cement;
- - the duration of flow of carbon dioxide to the cement mix is less than or equal to 5 minutes; and
- - the carbon dioxide is delivered to the surface of the cement mix in a mixer that is open to the atmosphere.

**Assignees:** CARBONCURE TECHNOLOGIES INC; CARBONCURE TECH INC

105. Family 88615352 (US2023212020 AA)

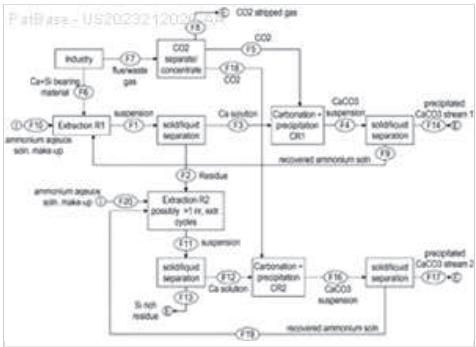
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Title (EP4157794 B1)

[EN] A TWO STAGES EXTRACTION METHOD FOR SYNTHESIZING PRECIPITATED CALCIUM CARBONATE

Abstract

[EN] Present invention relates to a multi-stage method for preparing high purity calcium carbonate precipitate from wastes and by-products containing high concentrations of calcium and silica. The calcium and silica rich material is introduced into a stirred reactor containing the extraction solution. The calcium rich solution, produced in the reactor, is separated from residual material and a gas containing carbon dioxide is passed into the said solution to precipitate calcium carbonate. The calcium carbonate precipitate is then separated from solution. The recovered solution and residual material, from previous extraction stage; is stirred in a reactor to further extract calcium from the residual material. After separating the solids from solution, carbon dioxide containing gas is introduced into solution to again precipitate calcium carbonate. Calcium carbonate precipitate is then separated from solution. The residual material produced from the process is characterized by high silica content.



1st Main Claim (EP4157794 B1)

[EN] 1. A multistage method for producing precipitated calcium carbonate and silica concentrate from calcium and silica containing waste and by-products, **characterized in that** the method comprises following steps:

- Step 1: adding solid material bearing calcium and silica into the extraction solution in a continuously stirred extraction reactor, said solid material bearing calcium and silica being an oil shale ash or coal ash or waste cement;
- Step 2: separating the solid residual material from the calcium rich solution;
- Step 3: subjecting the calcium rich solution from step 2 to carbonation, in the carbonation reactor, to precipitate calcium carbonate, wherein the carbonation is induced by introducing carbon dioxide gas directly into the calcium containing aqueous solution in a closed reactor;
- Step 4: separating the calcium carbonate precipitate from solution of the previous step;
- Step 5: directing the residual material from step 2 and the recovered extraction solution from step 4 to an extraction reactor, where a second calcium extraction step takes place;
- Step 6: separating the solid residual material from calcium rich solution;
- Step 7: subjecting the calcium rich solution from step 6 to carbonation, in the carbonation reactor, to precipitate calcium carbonate, wherein the carbonation is induced by introducing carbon dioxide gas directly into the calcium containing aqueous solution in a closed reactor;
- Step 8: separating the calcium carbonate precipitate from solution of the previous step.

Assignees: R S OSA SERVICE OUE; R S OSA SERVICE OU; R S OSA SERVICES LLC

## 106. Family 81408668 (US2021198147 AA)

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### Title (EP3953123 B1)

[EN] CARBONATION CURING METHOD TO PRODUCE WET-CAST SLAG-BASED CONCRETE PRODUCTS

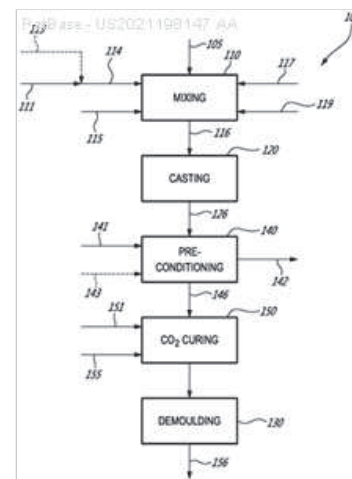
### Abstract

[EN] The present description relates to methods of producing a wet-cast slag-based concrete product particularly where the wet-cast slag-based concrete product is cast, pre-conditioned and cured with carbon dioxide inside a mould and/or inside a mould placed in a curing chamber. The wet-cast slag-based concrete product is optionally reinforced.

### 1st Main Claim (EP3953123 B1)

[EN] 1. A method of producing a wet-cast slag-based concrete product comprising steps of:

- 1) providing a steel-slag-based binder, an aggregate and water;
- 2) mixing the slag based binder, the aggregate and the water to produce a workable non-zero-slump concrete composition comprising a first water to slag-based binder ratio by weight of greater than 0.2;
- 3)
  - a) casting and/or placing the non-zero-slump concrete by transferring and/or consolidating the non-zero-slump concrete composition into an air-tight mould wherein said air-tight mould is comprising at least one punched gas pipe and/or lance or
  - b) casting and/or placing the non-zero-slump concrete by transferring and/or consolidating the non-zero-slump concrete composition into an air-tight mould and further comprising a step of inserting at least one punched gas pipe and/or lance into the non-zero-slump concrete composition; or
  - c) casting and/or placing the non-zero-slump concrete by transferring and/or consolidating the non-zero-slump concrete composition into an air-tight mould, the mould comprising a mould wall and a plurality of inlets in the mould wall, wherein the plurality of inlets are optionally closed to retain the slurry non-zero-slump concrete; or
  - d) casting and/or placing the non-zero-slump concrete by transferring and/or consolidating the non-zero-slump concrete composition into a mould, the mould comprising a mould wall defining an open top surface and a plurality of inlets in the mould wall, wherein the plurality of inlets are optionally closed to retain the workable non-zero-slump concrete;
- 4) pre-conditioning the non-zero-slump concrete composition within the mould with at least one of i) air flow and/or pressurized air from the at least one gas lance, ii) heaters and iii) heating element wires embedded in the non-zero-slump concrete, to produce a pre-conditioned slag-based intermediate comprising a second water to slag-based binder ratio by weight that is less than the first water to slag-based binder ratio by weight;
- 5) sealing the air-tight mould when the casting step is casting step 3a), 3b) or 3c);
- 6) after steps 2) to 5), curing the pre-conditioned slag-based intermediate with a gas containing carbon dioxide
  - a)-b) from the at least one gas pipe and/or lance when the casting step is casting step 3a) or 3b)
  - c) via the plurality of inlets in the mould wall when the casting step is casting step 3c); or
  - d) in a chamber/enclosed space/vessel/room via the plurality of inlets in the mould wall and the open top surface when the casting step is casting step 3d),
 to produce a moulded wet-cast slag-based concrete product, and
- 7) after the curing of the pre-conditioned slag-based intermediate, demoulding the moulded wet-cast slag-based concrete product to provide the wet-cast slag-based concrete product, wherein the non-zero-slump concrete composition has a slump value as assessed according to ASTM C143 in a range of 5mm to 250mm and/or a compaction factor test for the fresh concrete as measured according to BS 1881-103:1993 and BS EN 12350-4:2009 in the range of 0.7 to 1.0.



**Assignees:** CARBICRETE INC

107. Family 59029407 (CN104532718 A)

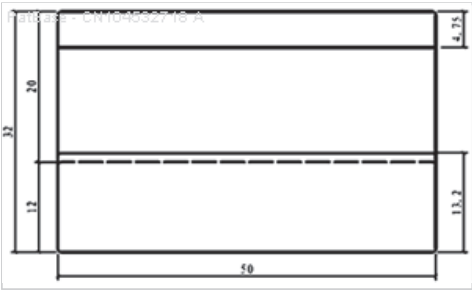
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Title

[EN] L-SHAPED CONCRETE KERB AND PREPARATION METHOD THEREOF

Abstract

[EN] The invention relates to an L-shaped concrete kerb which is internally provided with an L-shaped steel reinforcement framework. The L-shaped concrete kerb is characterized by consisting of a vertical edge and a road along edge and is in an integrally formed integral structure; an outward chamfer with the radius R of 5mm is arranged on the upper part of the inner side wall of the vertical edge; an inward chamfer with the radius R of 5mm is arranged at the border of the vertical edge and the road along edge; the rood along face at the upper end of the rod along edge is a slope, and the slope inclination angle is 2-3 degrees. The invention relates to the L-shaped concrete kerb which has an attractive appearance and is capable of preventing freezing and resisting chlorine salt and sulfate corrosion.



1st Main Claim

[MT] 1 an L-type concrete curbs, built-in L-shaped steel frame, wherein:.

L-type concrete curbs, the curbs vertical edges and curbs along the roadside constitution, and for the overall structure of a molding; curbs up side of the inside wall of the department has a radius R of 5mm fillet outward; curbs Stone stand side and curbs along the street junction radius R of 5mm inward fillet;

Curbs along the roadside along the upper surface of the slope, the slope angle of 2-3 degrees.

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**Assignees:** SHENYANG MUNICIPAL GROUP CO LTD; SHENYANG MUNICIPAL SUBWAY SEGMENT CO LTD; SHENYANG MUNICIPAL METRO SEGMENT CO LTD

108. Family 98177538 (CN116443910 A)

[View in PatBase](#)

Title

[EN] SQUARE CALCIUM CARBONATE WITH LOW OIL ABSORPTION VALUE AND PREPARATION METHOD THEREOF

Abstract

[EN] The invention discloses square calcium carbonate with a low oil absorption value and a preparation method thereof. The method comprises the following steps: leaching raw materials to obtain a calcium ion solution; enabling the calcium ion solution to contain soluble silicon and adding magnesium salt and/or magnesium oxide to obtain a calcium ion solution containing soluble silicon and magnesium ions; the method comprises the following steps: adding an alkaline reagent into a calcium ion solution containing soluble silicon and magnesium ions, and introducing CO<sub>2</sub> to react with Ca<sup>2+</sup> to crystallize to obtain calcium carbonate slurry; and drying and crushing the calcium carbonate slurry to obtain the low-oil-absorption square calcium carbonate. The method comprises the following steps: by taking calcium-containing industrial solid waste as a raw material, leaching a calcium ion solution in an acidic solution under CO<sub>2</sub> aeration, and adding magnesium salt into the calcium ion solution, so that the calcium ion solution contains magnesium ions as a crystallization inhibitor to reduce CaCO<sub>3</sub> crystal nuclei; soluble silicon in the calcium ion solution can reduce the energy barrier of calcite nucleation or provide nucleation sites to inhibit the formation of spherical calcium carbonate. Magnesium ions and soluble silicon have a synergistic effect, so that the square calcium carbonate which is uniform in crystal grains, free of clustered aggregates and low in oil absorption value is formed.

1st Main Claim

[MT] 1. A process for the preparation of low oil absorption square calcium carbonate, comprising:

Providing an industrial solid waste containing calcium as a raw material;

The steps of leaching calcium ions include the use of acidic solutions with CO<sub>2</sub>. The raw material is leached by aeration to obtain a calcium ion solution having a calcium ion concentration of 1000 ppm to 10000 ppm;

Preparing a solution of calcium ions containing dissolved silicon, containing magnesium ions, comprising a step of making said solution of calcium ions containing dissolved silicon and adding a magnesium salt and/or an oxide of magnesium, To obtain a solution of soluble silicon and magnesium containing calcium ions having a concentration of 30 ppm to 500 ppm and a concentration of magnesium ions of 200 ppm to 1000 ppm;

The step of reaction crystallization comprises adding an alkaline agent to the calcium ion solution containing dissolved silicon, magnesium ions to make the OH in the calcium ion solution and Ca<sup>2+</sup> The molar ratio is 2 to 3:1, and CO is passed through the solution of calcium ions containing dissolved silicon and magnesium ions. Reaction crystallization to obtain a calcium carbonate slurry;

The calcium carbonate slurry is dried to less than or equal to 0.5 wt.% water and ground to obtain a low oil absorption square calcium carbonate.

Assignees: RONGKUANG TECH SHANGHAI CO LTD



109. Family 102410237 (CN117945675 A)

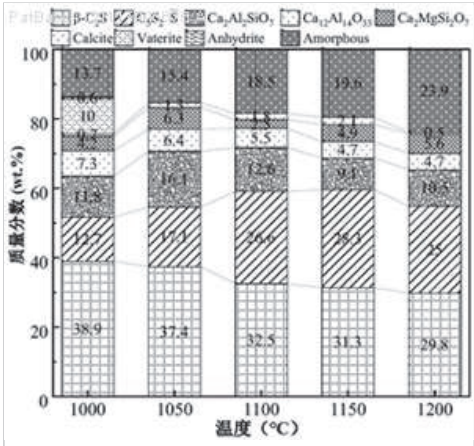
[View in PatBase](#)

Title

[EN] NOVEL CARBON-SEQUESTRATION LOW-CALCIUM CEMENTING MATERIAL AND PREPARATION METHOD THEREOF

Abstract

[EN] The invention discloses a novel carbon-sequestration low-calcium cementing material and a preparation method thereof. The novel carbon-sequestration low-calcium cementing material is prepared from the following components in percentage by weight: 29.8 to 38.9 percent of beta-C<sub>2</sub>S, 12.7 to 28.3 percent of # imgabs0 #, 9.1 to 16.1 percent of Ca<sub>2</sub>Al<sub>2</sub>SiO<sub>7</sub>, 4.7 to 7.3 percent of Ca<sub>12</sub>Al<sub>14</sub>O<sub>33</sub>, 2.5 to 6.3 percent of Ca<sub>2</sub>MgSi<sub>2</sub>O<sub>7</sub> and 13.7 to 23.9 percent of an amorphous phase. The cementing material is prepared by the following steps: completely taking municipal solid waste incineration waste residues (fly ash and bottom ash) as raw materials, uniformly mixing 61-80 parts of fly ash and 20-39 parts of bottom ash, tableting to obtain a raw material cake, sintering at 1000-1200 degrees centigrade at a heating rate of 5-10 DEG C/min, and cooling to obtain the carbon-sequestration low-calcium cementing material. The prepared novel cementing material has the excellent characteristics of low carbon fixation, early strength, high strength and the like, the cement production cost and calcination energy consumption are reduced, and meanwhile low-carbon production of the cement industry is fundamentally achieved through carbon reduction from the source, carbon reduction in the process and carbon removal at the tail end.



1st Main Claim

[MT] 1. A new solid-carbon low-calcium cemented material, characterized in that its main mineral phase comprises, expressed in

PatBase  
C<sub>5</sub>S<sub>2</sub>S̄: 12.7~28.3 份、

parts by weight, beta-C<sub>2</sub>S : 29.8 ~ 38.9 copies,

Ca<sub>2</sub>Al<sub>2</sub>SiO<sub>7</sub>: 9.1-16.1 copies, Ca<sub>12</sub>Al<sub>14</sub>O<sub>33</sub>: 4.7 to 7.3 copies, Ca<sub>2</sub>MgSi<sub>2</sub>O<sub>7</sub>: 2.5 to 6.3 parts, amorphous phase: 13.7 to 23.9 parts.

Assignees: HUNAN UNIV; UNIV HUNAN

## 110. Family 103173046 (CN118206328 A)

[View in PatBase](#)

### Title

[EN] PRODUCTION PROCESS METHOD OF CONCRETE PAVEMENT BRICK RAW MATERIAL

### Abstract

[EN] The invention discloses a concrete pavement brick raw material, which comprises a surface layer material and a base layer material, the surface layer material comprises, by weight, 30-50 parts of a hydraulic cementing material, 30-50 parts of carbon residue, 10-15 parts of a concrete admixture, 10-20 parts of aggregate, and 0.03-0.05 part of a curing agent; the base material is prepared from 20 to 30 parts of hydraulic cementing material, 30 to 50 parts of carbon residue, 30 to 50 parts of fly ash, 10 to 15 parts of concrete admixture and 0.02 to 0.03 part of water-resistant agent. The curing agent is used in the surface layer material of the raw materials of the concrete pavement brick, and the water-resistant agent is doped in the base layer material, so that the wear-resistant and water-resistant characteristics of the concrete pavement brick product are improved; according to the present invention, the carbon residue after the innocent treatment is completely utilized as the basic raw material of the concrete pavement brick, such that the solid waste is converted into the effective resource, the resource utilization rate of the solid waste is improved, the environmental pollution can be reduced, the enterprise production cost can be reduced, and the sufficient profit margin and the market value can be provided for the production enterprise.

### 1st Main Claim

[MT] 1. A concrete pavement brick material, characterized in that the concrete pavement brick material comprises, in parts by weight, a facing material and a base material, The facesheet material includes hydraulic gelling material 30 to 50 parts, carbon slag 30 to 50 parts, concrete blend 10 to 15 parts, aggregate 10 to 20 parts, curing agent 0.03 to 0.05 parts; the facesheet material includes hydraulic gelling material 20 to 30 parts, 30 to 50 parts of carbon slag, 30 to 50 parts of fly ash, 10 to 15 parts of concrete admixture, 0.02 to 0.03 parts of water-resistant agent.

**Assignees:** GONGYI XINGE NEW MAT CO LTD

111. Family 46713826 (TW201016599 A)

[View in PatBase](#)

Extended Family Number: 42613795

Title

[EN] METHODS AND SYSTEMS FOR UTILIZING WASTE SOURCES OF METAL OXIDES

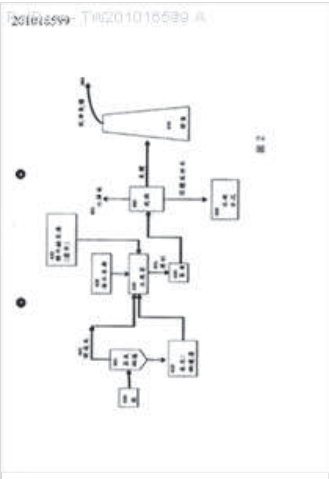
Abstract

[EN] Methods are provided for producing a composition comprising carbonates, wherein the methods comprise utilizing waster sources of metal oxides. An aqueous solution of divalent cations, some or all of which are derived from a waste source of metal oxides, may be contacted with CO2 and subjected to precipitation conditions to provide compositions comprising carbonates. In some embodiments, a combustion ash is the waste source of metal oxides for the aqueous solution containing divalent cations. In some embodiments, a combustion ash is used to provide a source of proton-removing agents, divalent cations, silica, metal oxides, or other desired constituents or a combination thereof.

1st Main Claim

[MT] A way, which includes: a) that an aqueous solution of contact with the metal oxide sources from industrial processes; b) the sources of carbon dioxide from industrial processes, carbon dioxide charge into the aqueous solution; and c) enabling the The aqueous solution at atmospheric pressure in the precipitation conditions to manufacture containing carbonate sediments.

Assignees: CALERA CORP



112. Family 103498032 (CN118307266 A)

[View in PatBase](#)

Title

[EN] OFFSHORE WIND POWER SINGLE PILE FOUNDATION ANTI-SCOURING FENDER PILE SOLIDIFIED SOIL AND PREPARATION AND CONSTRUCTION METHOD THEREOF

Abstract

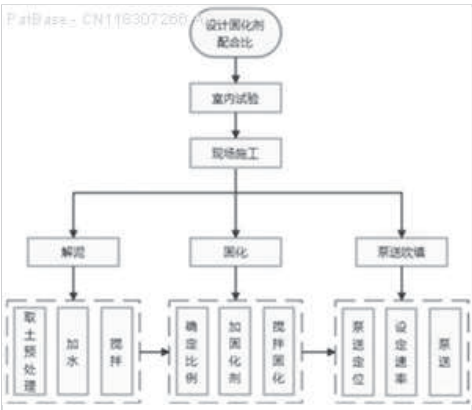
[EN] The invention discloses offshore wind power single pile foundation anti-scouring pile guard solidified soil and a preparation and construction method thereof, the offshore wind power single pile foundation anti-scouring pile guard solidified soil comprises a curing agent, sludge and water, the sludge is nearby sludge on a construction site, the water is fresh water or seawater, and the curing agent is a soft soil curing agent; according to the invention, the composite inorganic curing material is added into natural sludge to promote a series of hydrolysis and hydration reactions between the sludge and the curing material to generate gelling and crystallizing substances. The substances cement and wrap the soil particles, and meanwhile, the activity of secondary minerals in the sludge is excited through the action of the exciting agent, so that the reaction process is promoted and stabilized. Therefore, the sludge has the characteristics of certain strength and the like, and the stable increase of the strength can be kept for a long time. Finally, the solidified soil is used for reinforcing a single-pile foundation, the seawater corrosion resistance and sea wave scouring resistance of the single-pile foundation are improved, and the solidified soil is expected to provide a more stable and sustainable foundation structure for an offshore wind power project.

1st Main Claim

[MT] 1. An offshore wind monopile foundation anti-flush pile curing soil comprising a curing agent, sludge and water, characterized in that the sludge is a near-site sludge, the water is fresh water or seawater, and the curing agent is a soft soil curing agent;

The soft soil curing agent is made of cement 10-25%, quicklime 5-15%, fly ash 15-35%, silica ash 5-20%, steel slag 10-30%, slag 15-45% homogeneously mixed.

**Assignees:** JIANGSU OCEAN UNIV; BLUE BAY MARINE RESOURCES DEVELOPMENT TECH INNOVATION CENTER; UNIV JIANGSU OCEAN



113. Family 105703785 (CN119100627 A)

[View in PatBase](#)

Title

[EN] TERNARY LOW-CALCIUM MINERAL-BASED HIGH-ACTIVITY AUXILIARY CEMENTING MATERIAL AND PREPARATION METHOD THEREOF

Abstract

[EN] The invention relates to a ternary low-calcium mineral-based high-activity auxiliary cementing material and a preparation method thereof, and belongs to the technical field of building materials, the material is a # imgabs0 # ternary low-calcium mineral-based high-activity auxiliary cementing material, and is prepared by uniformly mixing calcium, siliceous and sulfur raw materials in proportion, and then sequentially carrying out high-temperature calcination, cooling, grinding and semi-dry carbonation. The 7-day activity index is greater than 80 percent, and the 28-day activity index is greater than 95 percent. All devices used in the preparation method are conventional equipment in the prior art, and the process is simple and convenient; the used raw materials are relatively common, so that the method is suitable for industrial production and has important significance on low carbon and energy conservation of the cement; the SCM prepared through carbonation not only reduces early hydration heat release of cement, but also contains a small amount of # imgabs 1 # to improve the early strength of the cement, and C2S hydration improves the middle and later strength of the cement; amorphous silica gel generated by carbonation can react with a cement hydration product Ca (OH) 2 to generate C-S-H, high-activity calcium carbonate and calcium sulfate are beneficial to formation and stabilization of ettringite, and the strength of cement is improved.

1st Main Claim

[MT] 1. A ternary low-calcium mineral-based high-activity auxiliary gelling material, characterized in that the ternary low-calcium



mineral-based high-activity auxiliary gelling material is

Three-element low calcium mineral-based high-activity auxiliary gelling material, which is mixed with calcium, siliceous and sulfur raw materials in proportion, calcined low calcium clinker powder and carbonated after grinding to prepare.

Assignees: HAINAN UNIV; DALIAN UNIV OF TECHNOLOGY; UNIV HAINAN; UNIV DALIAN TECH

114. Family 95182444 (CN115504692 A)

[View in PatBase](#)

Title

[EN] METHOD FOR PREPARING CARBONIZED CEMENTING MATERIAL AND CO-PRODUCING SULFURIC ACID BY USING SEMI-DRY DESULFURIZATION ASH

Abstract

[EN] The invention provides a method for preparing a carbonized cementing material and co-producing sulfuric acid by using semi-dry desulfurization ash, which comprises the following steps: firstly, mixing the semi-dry desulfurization ash, coal gangue and pulverized coal according to a certain mass ratio to obtain a mixed raw material; secondly, preheating and decomposing the mixed raw material to obtain a decomposed raw material and tail gas; and finally, carrying out high-temperature calcination and graded cooling on the decomposed raw material to obtain a carbonized cementing material, and preparing sulfuric acid from the tail gas. According to the method provided by the invention, the semi-dry desulfurization ash and the coal gangue are subjected to compatibility, mixing and calcination to obtain the carbonized cementing material, and the prepared carbonized cementing material has the advantages of low calcination temperature, low grinding cost, high carbon sequestration capacity and the like, can effectively absorb carbon dioxide and has relatively high mechanical properties in a short time; the material is a low-carbon environment-friendly material; and after the tail gas is collected, sulfuric acid is prepared through a two-conversion and two-absorption process. The method realizes resource utilization of the semi-dry desulfurization ash and the coal gangue.

1st Main Claim

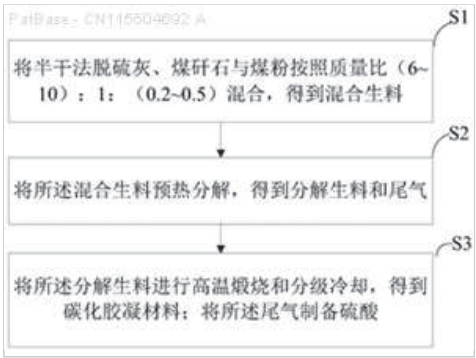
[MT] 1. sulfuric acid a process for preparing a carbonized cementitious material by semi-dry sulfur ashing, comprising the steps of:

S1. Mixing semi-dry sulfur ash, coal mine spoil, and pulverized coal at a mass ratio (6-10):1: (0.2-0.5) to obtain a mixed raw meal;

S2. Prethermally decomposing said mixed raw meal to obtain decomposed raw meal and tail gas;

S3. Subjecting the decomposed raw meal to high temperature calcination and fractional cooling to obtain a carbonized cementitious material; sulfuric acid

Assignees: CHINA CITY ENVIRONMENT PROT ENG LTD CO



## 115. Family 94394155 (US2022403223 AA)

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### Title

[EN] HYDRAULIC CEMENT COMPOSITION, PROCESS AND USE

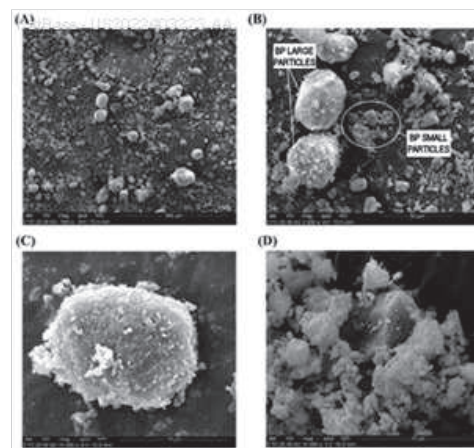
### Abstract

[EN] The present invention describes a hydraulic cement composition, its obtaining process and its use. More precisely, the hydraulic cement composition comprises increased resistance to CO<sub>2</sub> for application in subsurface fluid reservoirs.

### 1st Main Claim

[EN] **1.** A carbon dioxide (CO<sub>2</sub>) resistant hydraulic cementitious composition, comprising basalt powder (BP) as a supplementary cementitious material (SCM) in dry base cement powder.

**Assignees:** UNIAO BRASILEIRA DE EDUCACAO E ASSISTENCIA MANTENEDORA DA PUCRS; PETROLEO BRASILEIRO S A PETROBRAS; PETROLEO BRASILEIRO PETROBRAS SA; UNIAO BRASILEIRA DE EDUCAGAO E ASSISTENCIA MANTENEDORA DA PUCRS



## 116. Family 95261459 (US2024286965 AA)

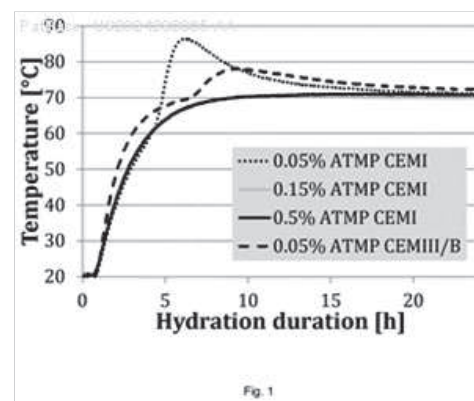
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### Title (EP4359366 A1)

[EN] METHOD OF PREPARATION OF A CONSTRUCTION ELEMENT BY CARBONATION OF CEMENT

### Abstract (EP4359366 A1)

[EN] The present invention relates to a method of preparation of a construction element by carbonation, comprising the consecutive steps of a) preparing a composition containing a cement, water and chemical additives; then b) pre-drying the composition; then c) placing the pre-dried composition in a chamber of an incubator, the chamber of the incubator containing at least one inlet and one outlet, the pre-dried composition being carbonated, in a carbonation step, by feeding into the chamber of the incubator, through the inlet, a flow of CO<sub>2</sub> containing gas, variations of the CO<sub>2</sub> concentration in the chamber of the incubator being kept below 10 percent of a reference value during the whole carbonation step, during the carbonation step, the pressure within the chamber of the incubator being atmospheric pressure, the relative humidity within the chamber of the incubator being above 80 degrees percent and the temperature within the chamber of the incubator ranging from 20 degrees centigrade to 80 degrees centigrade, characterized in that the chemical additives in the composition comprise more than 0.05 percent in weight, compared to the total weight of the cement, of a cement hydration retarder.



### 1st Main Claim (EP4359366 A1)

[EN] 1. Method of preparation of a construction element by carbonation, comprising the consecutive steps of: a) preparing a composition containing a cement, water and chemical additives; then b) pre-drying the composition; then c) placing the pre-dried composition in a chamber of an incubator the chamber of the incubator contains at least one inlet and one outlet, the pre-dried composition is carbonated, in a carbonation step, by feeding into the chamber of the incubator, through the inlet, a flow of CO<sub>2</sub> containing gas, variations of the CO<sub>2</sub> concentration in the chamber of the incubator are kept below 10 percent of a reference value during the whole carbonation step, during the carbonation step, the pressure within the chamber of the incubator is atmospheric pressure or with slight overpressure, the relative humidity within the chamber of the incubator is above 80 degrees percent and the temperature within the chamber of the incubator is ranging from 20 degrees centigrade to 80 degrees centigrade, characterized in that the chemical additives in the composition comprise more than 0.05 percent in weight, compared to the total weight of the cement, of a cement hydration retarder, wherein the additives further contain a carbonation accelerator selected from triethylamine (TEA), triisopropanolamine (TIPA), calcium salts, sodium salts, or mixtures thereof, the composition comprises from 0.1 percent to 3 percent, of the carbonation accelerator, the percentages are expressed in weight compared to the total weight of the cement.

**Assignees:** HOLCIM TECH LTD; HOLCIM TECHNOLOGY LTD

117. Family 67637522 (CN107398173 A)

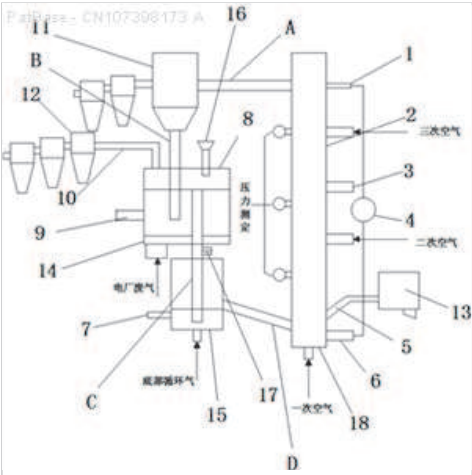
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Title

[EN] DEVICE FOR CIRCULARLY COLLECTING CO2 BY USING LIMESTONE IN DOUBLE-TOWER FLUIDIZED BED AND PROCESS OF DEVICE

Abstract

[EN] The invention relates to the technical field of energy conservation and emission reduction, in particular to a device for circularly collecting CO2 by using limestone in a double-tower fluidized bed and a process of the device. The process comprises the following steps: preparation of absorbents, mixing of the absorbents, collecting of carbon dioxide gas, recycling of the absorbents and recovery of the carbon dioxide gas. The limestone and dolomite which are low in price are used as circulating absorbents, the carbon dioxide collecting rate is greatly improved and can reach 90 percent or above, discharged waste residues can be used for the industry of cement production, wastes are reused, the purposes of saving energy and reducing emission are achieved, and high-concentration carbon dioxide recycles in a regenerator. On one hand, heat of circulating gas is utilized, and on the other hand, the concentration of carbon dioxide of an outlet can be improved, and energy consumption required for CO2 collection is reduced.



1st Main Claim

[MT] 1. A limestone in the fluidized bed of the twin towers were CO2recycle trapping device includes a regenerator (2) and the absorber (8), the regenerator (2) of bottom is mounted a secondary air access tube, said regenerator (2) mounted on the side wall of the secondary air and tertiary air access, the access tube pipe, said regenerator (2) has opened the bottom discharge port (18), characterized in that said regenerator (2) of the side wall opened a fuel inlet (5), (5) the open end of the fuel inlet connecting the screw feeder (13), the regenerator (2) through a connecting pipe (D) and the circulator (15) connected to the bottom of the bottom of the loop through the overflow pipe (15) (C) and the absorber (8), the absorber (8) is mounted at a bottom portion of the gas disperser (14), said gas disperser (14) with an external power plant exhaust pipe connected to the absorber (8) is opened a top absorber gas outlet (10), absorber gas outlet (10) and the cyclone separation system (12) connected to the regenerator (2) outlet (A) and cyclone separation system (11) connected to the the absorber (8) The top also opened a feed inlet (16), cyclone separation system (11) connected to a bottom of the first cyclone tube (B), the whereabouts of the whereabouts of the tube (B) inserted into the absorber (8) inside.

Assignees: BEIFANG UNIV OF NATIONALITIES; UNIV BEIFANG NATIONALITIES

118. Family 91739409 (KR102406620 B1)

[View in PatBase](#)

Title

[EN] COMPOSITE FOR REDUCTION OF CARBON DIOXIDE AND PLANTER MANUFACTURED BY SUCH COMPOSITE AND MANUFACTURING METHOD OF PLANTER

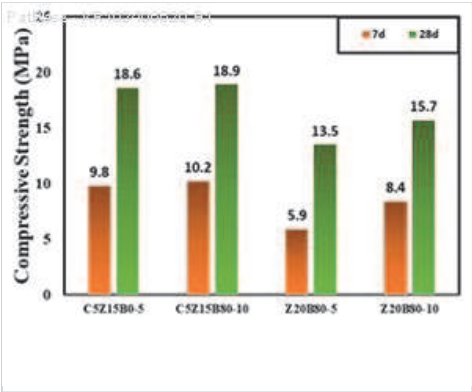
Abstract

[EN] The present invention relates to an inorganic composition. The inorganic composition is prepared using blast furnace slag fine powder, zeolite, and an alkaline stimulant as substitutes for cement, and a planter is manufactured using the same. The inorganic composition can reduce the high amount of CO<sub>2</sub> generated in a process of producing ordinary Portland cement used in conventional cement compositions, and can maximize absorption of carbon dioxide in an atmosphere when manufactured into a product. Furthermore, the present invention relates to a planter for planting as a product using the inorganic composition, and a method for manufacturing the same.

1st Main Claim

[MT] 1. A fine powder composition comprising a binder, a fine aggregate, an admixture, an additive and a compounded water; the binder comprising galloslag fine powder and natural zeolite, wherein the content of the galloslag fine powder is 80 wt% and the content of the natural zeolite is 20 wt% in total 100 wt% of the binder; the content of the fine aggregate is 300 parts by weight with respect to 100 parts by weight of the binder; and the additive comprises CSA, Ca (OH)<sub>2</sub> And MgO are mixed and the content of the alkaline stimulating agent is 5 parts by weight with respect to 100 parts by weight of the binder; and the weight ratio of the compounded water to the binder is 40%.

**Assignees:** KOREA INST CIVIL ENG AND BUILDING TECH; KOREA INST OF CIVIL ENGINEERING AND BUILDING TECHNOLOGY KICT



## 119. Family 55756264 (RU2594181 C2)

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### Title

[EN] METHOD FOR PREPARATION OF EXPANDED-CLAY CONCRETE

### Abstract

[EN] FIELD: construction. SUBSTANCE: invention relates to production of construction materials and specifically to production of expanded-clay concrete on activated ceramsite gravel. Method for preparation of expanded-clay concrete involves soaking granules claydite gravel in aqueous saturated solution of calcium hydroxide  $\text{Ca}(\text{OH})_2$ , putting some applications of granules claydite gravel on screen for draining solution until state of drop, treatment applications of granules jets of compressed carbon dioxide  $\text{CO}_2$  alternating with treatment of jets of water vapour to produce on their outer surfaces of active shells from calcium hydroxide  $\text{Ca}(\text{OH})_2$  and calcium carbonate  $\text{CaCO}_3$ , mixing cement, activated granules claydite gravel, construction sand and water saturated solution of calcium hydroxide  $\text{Ca}(\text{OH})_2$ , vibro forming of ceramsite-concrete mix in molds, inner surfaces of which is saturated with aqueous solution of calcium hydroxide are  $\text{Ca}(\text{OH})_2$ . EFFECT: technical result is production of more uniform strength of expanded-clay concrete. 1 cl, 2 tbl

### 1st Main Claim

[MT] A method for preparing clay comprising the preliminary activation of individual components, followed by mixing cement, granules of clay gravel, building sand, an aqueous solution of an activator, mixing water, further processing and keramzitobeton mixture, characterized in that the prepared aqueous saturated solution of calcium hydroxide  $\text{Ca}(\text{OH})_2$ , further soaked pellets of clay gravel in an aqueous saturated solution of calcium hydroxide  $\text{Ca}(\text{OH})_2$ , after which the wetted granules of clay gravel laid onto a sieve to drain from them solution state before dropping point, further wetted granules are treated by jets of compressed carbon dioxide  $\text{CO}_2$  alternately with treatment of the jets of water vapor and receive on their outer surfaces of active shell of calcium hydroxide  $\text{Ca}(\text{OH})_2$  and calcium carbonate  $\text{CaCO}_3$ , and then produce mixing cement, Activated beads clay gravel, building sand, aqueous saturated solution of calcium hydroxide  $\text{Ca}(\text{OH})_2$  - as water The mixing water, then treated with claydite-concrete mixture vibromolding in molds, the inner surface of which is pre-pollinate an aqueous saturated solution of calcium hydroxide  $\text{Ca}(\text{OH})_2$ .

**Assignees:** NAGORNOV ALEKSANDR GENNADEVICH

## 120. Family 89495925 (CN113958365 A)

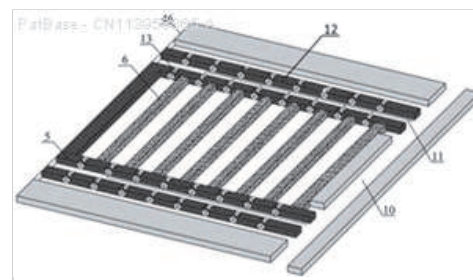
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### Title

[EN] SHORT-LONG WALL INTERMITTENT FILLING MINING AND BASE SOLID WASTE CO<sub>2</sub> SEALING SYSTEM AND METHOD

### Abstract

[EN] The invention discloses a short-long wall intermittent filling mining and base solid waste CO<sub>2</sub> sealing system and method. The sealing system comprises a CO<sub>2</sub> sealing structure, a base solid waste and CO<sub>2</sub> pipeline conveying system and a CO<sub>2</sub> sealing monitoring system. The sealing method comprises the steps that 1, base solid waste to be disposed and CO<sub>2</sub> to be sealed are prepared; 2, a short-long wall intermittent filling non-coal-pillar mining method is designed; 3, mining is conducted between mining areas through the short-long wall intermittent filling non-coal-pillar mining method, the CO<sub>2</sub> sealing structure is constructed in the mining process, and the base solid waste and CO<sub>2</sub> pipeline conveying system and the CO<sub>2</sub> sealing monitoring system are connected; and 4, the base solid waste to be disposed and the CO<sub>2</sub> to be sealed are conveyed into the CO<sub>2</sub> sealing structure. According to the short-long wall intermittent filling mining and base solid waste CO<sub>2</sub> sealing system and method, the CO<sub>2</sub> sealing types are enriched, a new thought is provided for CO<sub>2</sub> sealing library exploration, CO<sub>2</sub> can be safely and effectively sealed, the CO<sub>2</sub> emission amount is decreased, and the influence of the greenhouse effect caused by carbon emission on human is relieved.



### 1st Main Claim

[MT] 1. A short-wall intermittent packing recovery cooperative base-waste CO<sub>2</sub> sequestration system, comprising:

CO<sub>2</sub> storage structure: Construction using a short-long wall interrupted packed coal-free column mining method enclosing a plurality of enclosed CO<sub>2</sub> storage spaces for storing alkali waste and CO<sub>2</sub> conveyed therein by the alkali waste and CO<sub>2</sub> plumbing system;

An alkaline waste and CO<sub>2</sub> plumbing system for transporting CO<sub>2</sub> and alkaline waste into the CO<sub>2</sub> sequestration space and discharging gas within the CO<sub>2</sub> sequestration space out of the CO<sub>2</sub> sequestration space, including a CO<sub>2</sub> transfer pipe (1) and an alkaline waste transfer pipe (2) from outside into the CO<sub>2</sub> sequestration space through the CO<sub>2</sub> sequestration structure, and an exhaust pipe (3) from inside the CO<sub>2</sub> sequestration space out of the CO<sub>2</sub> sequestration structure;

CO<sub>2</sub> sequestration monitoring system: for monitoring the CO<sub>2</sub> sequestration process.

**Assignees:** XI AN UNIV OF SCIENCE AND TECHNOLOGY; XIAN F LVCHUANG MINING TECH CO LTD; UNIV XIAN SCI AND TECHNOLOGY

121. Family 82318982 (CN112028564 A)

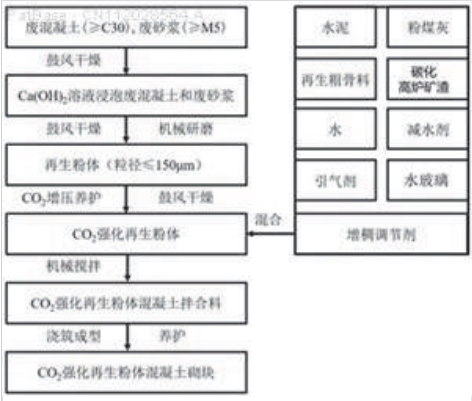
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Title

[EN] RECYCLED CONCRETE BLOCK PREPARED FROM CO2 REINFORCED RECYCLED POWDER

Abstract

[EN] The invention provides a concrete block prepared from CO2 reinforced regenerated powder. The invention further provides a preparation method for preparing the concrete block by utilizing the CO2 reinforced regenerated powder. According to the concrete block prepared from the CO2 reinforced regenerated powder, the CO2 reinforced regenerated powder is used as an auxiliary cementing material, the carbonization maintenance reinforced industrial blast furnace slag is used as a fine aggregate, and the regenerated coarse aggregate is used as a coarse aggregate, so that the regenerated concrete block is prepared; the method realizes full substitution and full regeneration of cementing materials and aggregates in concrete, can be used for preparing recycled concrete blocks meeting different strength requirements, reduces the production cost of block products, can meet functional requirements of sound insulation, heat insulation and the like, has the characteristics of simple process and the like, and is remarkable in economic benefit and suitable for large-scale popularization.



1st Main Claim

[MT] 1. A concrete block, in parts by weight, comprises the following components:

水泥:	100 份;
CO <sub>2</sub> 强化再生粉体:	10-200 份;
粉煤灰:	10-200 份;
碳化高炉矿渣:	100-600 份;
再生粗骨料:	200-1500 份;
水:	30-300 份;
减水剂:	0.5-10 份;
引气剂:	0.01-50 份;
水玻璃:	0.01-30 份;
增稠调节剂:	0.01-20 份。

Assignees: UNIV TONGJI; TONGJI UNIV

## 122. Family 47399510 (IN02594CN2010 A)

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### Title

[EN] REDUCED-CARBON FOOTPRINT CONCRETE COMPOSITIONS

### Abstract

[EN] Reduced-carbon footprint concrete compositions, and methods for making and using the same, are provided. Aspects of the reduced-carbon footprint concrete compositions include CO<sub>2</sub>-sequestering carbonate compounds, which may be present in the hydraulic cement and/or aggregate components of the concrete. The reduced-carbon footprint concrete compositions find use in a variety of applications, including use in a variety of building materials and building applications.

### 1st Main Claim

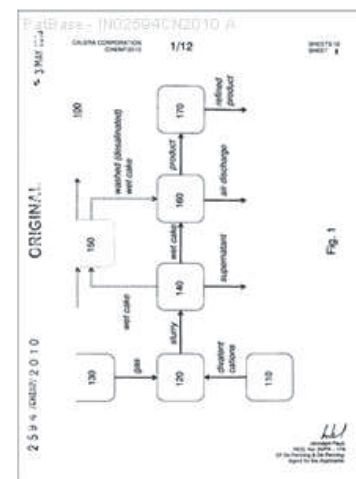
[EN] 1. 2, 5, 10, or 20 years, or for more than 20 years, for example, for more than 100 years. In some embodiments, reduced-carbon footprint concrete compositions do not release more than 1 percent of their total con when exposed to normal conditions of temperature and moisture, including rainfall of normal pH, for their intended use. for a least 1 year. In some embodiments, reduced-carbon footprint concrete compositions do not release more than 5 percent of their total con when exposed to normal conditions of temperature and moisture, including rainfall of normal pH, for their intended use. for at least 1 year. In some embodiments, reduced-carbon footprint concrete compositions do not release more than 10 percent of their total con when exposed to normal conditions of temperature and moisture, including rainfall of normal pH, for their intended use, for at least 1 year. In some embodiments, reduced-carbon footprint concrete compositions do not release more than 1 percent of their total con when exposed to normal conditions of temperature and moisture, including rainfall of normal pH, for their intended use, for at least 10 years. In some embodiments, reduced-carbon footprint concrete compositions do not release more than 1 percent of their total con when exposed to normal conditions of temperature and moisture, including rainfall of normal pH, for their intended use, for at least 100 years. In some embodiments, the reduced-carbon footprint concrete compositions do not release more than 1 percent of their total CO<sub>3</sub> when exposed to normal conditions of temperature and moisture, including rainfall of normal pH, for their intended use, for at least 1000 years.

[0051] Any suitable surrogate marker or test that is reasonably able to predict such stability may be used. For example, an accelerated test comprising conditions of elevated temperature and/or moderate to more extreme pH conditions is reasonably able to indicate stability over extended periods of time. For example, depending on the environment and intended use of the reduced-carbon footprint concrete composition, a sample of the composition may be exposed to 50, 75, 90, 100, 120, or 150 degrees centigrade for 1, 2, 5, 25, 50, 100, 200, or 500 days at between 10 percent and 50 percent relative humidity, and a loss less than 1 percent, 2 percent, 3 percent, 4 percent, 5 percent, 10 percent, 20 percent, 30 percent, or 50 percent of its carbon may be considered sufficient evidence of slability of the reduced-carbon footprint concrete composition of the invention for a given period (e.g. 1. 10. 100. 1000. or more than 1000 years).

[0052] con content of the CO<sub>3</sub>-sequestering component(s) (e.g., precipitation material comprising carbonates, bicarbonates, or a mixture thereof) of the reduced-carbon footprint concrete compositions may be monitored by any suitable method (e.g., coulometry). Other conditions may be adjusted as appropriate, including pH, pressure, UV radiation, and the like, again depending on the intended or likely environment. It will be appreciated that any suitable conditions may be used that one of skill in the art would reasonably conclude would indicate the requisite stability over the indicated time period. In addition, if accepted chemical knowledge indicates that the composition would have the requisite stability for the indicated period, this may be used as well, in addition to, or in place of actual measurements. For example, some carbonate compounds that may be part of a reduced-carbon footprint concrete composition of the invention (e.g., in a given polymorphic form) may be well-known geologically, and may be Known to have withstood normal weather for decades, centuries, or even millennia, without appreciable breakdown, and so have the requisite stability.

[0053] Depending on the particular reduced-carbon footprint concrete composition, the amount of CO<sub>2</sub>-sequestering component (e.g., precipitation material comprising carbonates, bicarbonates, or a mixture thereof) present may vary. In some instances, (he amount of the Corsequestering component (e.g., precipitation material comprising carbonates, bicarbonates, or a mixture thereof) in (he reduced-carbon footprint concrete composition range, from 5 (o 100 percent (w/w), such as 5 io 90 percent (w/w), including 5 to 75 percent (w/w), 5 to 50 percent (w/w), 5 to 25 percent (w/w), and 5 to 10 percent (w/w),

[0054] Reduced-carbon footprint concrete compositions have reduced carbon footprints when compared to corresponding concrete compositions that lack (he carbonate/bicarbonate component (e.g., con-sequestering component). Using any convenient carbon footprint calculator, the magnitude of carbon footprint reduction of the reduced-carbon footprint concrete compositions of the invention as compared to corresponding concrete compositions that lack the carbonate/bicarbonate component (e.g., con-sequestering component) may be 5 percent or more, such as 10 percent or more, including 25 percent, 50 percent, 75 percent or even 100 percent or more. In certain embodiments, the reduced-carbon footprint concrete compositions of the invention may be carbon neutral, in that they have substantially no, if any, calculated carbon footprint, e.g., as determined using any convenient carbon footprint calculator that may be relevant for a particular concrete composition of interest. Carbon neutral concrete compositions of the invention include those compositions thai exhibit a carbon footprint of 50 lbs CO<sub>2</sub>/yd<sup>3</sup> material or less, such as 10 lbscon/yd<sup>3</sup> material or less, including 5 lbscon/yd<sup>3</sup> material or less, where in certain embodiments the carbon neutral concrete compositions have 0 or negative lbscon/yd material, such as negative 1 or more, e.g., negative 3 or more lbscon/yd concrete composition. In some instances, (he reduced-carbon footprint concrete compositions have a significantly negative carbon footprint, e.g., -100 or more lbscon/yd or less.



[0055] CO<sub>2</sub>-sequestering components (i.e., precipitation material comprising carbonates, bicarbonates, or a combination thereof) of the invention comprise CO<sub>2</sub> that otherwise would have been released into the atmosphere, most of which results from combusting fossil fuels, which fuels are of plant origin. As such, CO<sub>2</sub>-sequestering components of the invention, which comprise one or more synthetic carbonates and/or bicarbonates derived from industrial con, reflect the relative carbon isotope composition ( $\delta^{13}\text{C}$ ) of the fossil fuel (e.g., coal, oil, natural gas, or flue gas) from which the industrial con (from combustion of the fossil fuel) was derived. The relative carbon isotope composition ( $\delta^{13}\text{C}$ ) value with units of percent o (per mille) is a measure of the ratio of the concentration of two stable isotopes of carbon, namely <sup>12</sup>C and <sup>13</sup>C relative to a standard of fossilized belemnite (the PDB standard).

[0056] As such, the  $\delta^{13}\text{C}$  value of the synthetic carbonate- and/or bicarbonate-containing precipitation material (e.g., CO<sub>2</sub>-sequestering component) serves as a fingerprint for a con gas source, especially con released from burning fossil fuel. The  $\delta^{13}\text{C}$  value may vary from source to source (i.e., fossil fuel source), but the  $\delta^{13}\text{C}$  value for carbonate/bicarbonate components (e.g., CO<sub>2</sub>-sequestering components) of the invention generally, but not necessarily, ranges between -9 percent o to -35 percent o. In some embodiments, the  $\delta^{13}\text{C}$  value for the synthetic carbonate-containing precipitation material may be between -1 percent o and -50 percent o, between -5 percent o and -40 percent o, between -5 percent o and -35 percent o, between -7 percent o and -40 percent o, between -7 percent o and -35 percent o, or between -9 percent o and -35 percent o. In some embodiments, the  $\delta^{13}\text{C}$  value for the synthetic carbonate-containing precipitation material may be less than (i.e., more negative than) -3 percent o, -5 percent o, -6 percent o, -7 percent o, -8 percent o, -9 percent o, -10 percent o, -11 percent o, -12 percent o, -13 percent o, -14 percent o, -15 percent o, -16 percent o, -17 percent o, -18 percent o, -19 percent o, -20 percent o, -21 percent o, -22 percent o, -23 percent o, -24 percent o, -25 percent o, -26 percent o, -27 percent o, -28 percent o, -29 percent o, -30 percent o, -31 percent o, -32 percent o, -33 percent o, -34 percent o, -35 percent o, -36 percent o, -37 percent o, -38 percent o, -39 percent o, -40 percent o, -41 percent o, -42 percent o, -43 percent o, -44 percent o, or -45 percent o, wherein the more negative the  $\delta^{13}\text{C}$  value, the more rich the synthetic carbonate-containing precipitation material is in <sup>12</sup>C. Any suitable method may be used for measuring the  $\delta^{13}\text{C}$  value, methods including, but not limited to, mass spectrometry or off-axis integrated-cavity output spectroscopy (off-axis ICOS).

[0057] In some embodiments, the invention provides a reduced-carbon footprint concrete composition containing a CO<sub>2</sub>-sequestering component comprising carbonates, bicarbonates, or combinations thereof, where the carbon in the carbonates and/or bicarbonates has a  $\delta^{13}\text{C}$  value less than -5 percent o. In some embodiments, the  $\delta^{13}\text{C}$  value for the reduced-carbon footprint concrete composition may be between -1 percent o and -50 percent o, between -5 percent o and -40 percent o, between -5 percent o and -15 percent o, between -7 percent o and -40 percent o, between -7 percent o and -35 percent o, between -9 percent o and -40 percent o, or between -9 percent o and -35 percent o. In some embodiments, the  $\delta^{13}\text{C}$  value for the reduced-carbon footprint concrete composition may be less than (i.e., more negative than) -3 percent o, -5 percent o, -6 percent o, -7 percent o, -8 percent o, -9 percent o, -10 percent o, -11 percent o, -12 percent o, -13 percent o, -14 percent o, -15 percent o, -16 percent o, -17 percent o, -18 percent o, -19 percent o, -20 percent o, -21 percent o, -22 percent o, -23 percent o, -24 percent o, -25 percent o, -26 percent o, -27 percent o, -28 percent o, -29 percent o, -30 percent o, -31 percent o, -32 percent o, -33 percent o, -34 percent o, -35 percent o, -36 percent o, -37 percent o, -38 percent o, -39 percent o, -40 percent o, -41 percent o, -42 percent o, -43 percent o, -44 percent o, or -45 percent o, wherein the more negative the  $\delta^{13}\text{C}$  value, the more rich the synthetic carbonate-containing composition is in <sup>12</sup>C.

[0058] The carbonate compounds of the CO<sub>2</sub>-sequestering components may be melasable carbonate compounds precipitated from a solution of divalent cations, such as a saltwater, as described in greater detail below. The carbonate compound compositions of the invention include precipitated crystalline and/or amorphous carbonate compounds. Specific carbonate minerals of interest include, but are not limited to: calcium carbonate minerals, magnesium carbonate minerals, and calcium magnesium carbonate minerals. Calcium carbonate minerals of interest include, but are not limited to: calcite (CaCO<sub>3</sub>), aragonite (CaCO<sub>3</sub>), vaterite (CaCO<sub>3</sub>), and amorphous calcium carbonate (CaCO<sub>3</sub>·nH<sub>2</sub>O). Magnesium carbonate minerals of interest include, but are not limited to: magnesite (MgCO<sub>3</sub>), barringtonite (MgCO<sub>3</sub>·2H<sub>2</sub>O), nesquehonite (MgCO<sub>3</sub>·3H<sub>2</sub>O), lanfordite (MgCO<sub>3</sub>·5H<sub>2</sub>O), and amorphous magnesium carbonate (MgCO<sub>3</sub>·nH<sub>2</sub>O). Calcium magnesium carbonate minerals of interest include, but are not limited to: dolomite (CaMgCO<sub>3</sub>), huntite (CaMg<sub>2</sub>(CO<sub>3</sub>)<sub>4</sub>), and sergelyevite (Ca<sub>2</sub>Mg<sub>3</sub>(CO<sub>3</sub>)<sub>6</sub>·nH<sub>2</sub>O). In certain embodiments, non-carbonate compounds like brucite (Mg(OH)<sub>2</sub>) may also form in combination with the minerals listed above. As indicated above, the compounds of the carbonate compound compositions may be metastable carbonate compounds (and may include one or more metastable hydroxide compounds) that are more stable in saltwater than in freshwater such that upon contact with fresh water of any pH they dissolve and re-precipitate into other fresh water stable compounds, e.g., minerals such as low-Mg calcite.

[0059] The carbonate/bicarbonate components (e.g., CO<sub>2</sub>-sequestering components) of the invention may be derived from, e.g., precipitated from, a solution of divalent cations (e.g., an aqueous solution of divalent cations) (as described in greater detail below). As the carbonate/bicarbonate components (e.g., CO<sub>2</sub>-sequestering components) may be precipitated from water, they might include one or more components that are present in the water from which they are derived. For example, where the solution of divalent cations is saltwater, the CO<sub>2</sub>-sequestering product (e.g., precipitation material comprising carbonates, bicarbonates, or a mixture thereof) will include one or more compounds found in the saltwater source. These compounds identify the solid precipitations of the compositions that come from the saltwater source, where these identifying components and the amounts thereof may be collectively referred to herein as a saltwater source identifier. For example, if the saltwater source is seawater, identifying compounds that may be present in precipitation material include, but are not limited to: chloride, sodium, sulfur, potassium, bromide, silicon, strontium, and the like. Any such source-identifying or "marker" elements are generally present in small amounts, e.g., in amounts of 20,000 ppm or less, such as amounts of 2000 ppm or less. In certain embodiments, the "marker" compound may be strontium, which may be incorporated into, for example, an aragonite lattice, and make up 10,000 ppm or less, ranging in certain embodiments from 3 to 10,000 ppm, such as from 5 to 5000 ppm, including 5 to 1000 ppm, e.g., 5 to 1000 ppm, including 5 to 100 ppm. Another "marker" compound of interest is magnesium, which may be present in amounts of up to 20 percent mole substitution for calcium in carbonate compounds. The saltwater source identifier of the compositions may vary depending on the particular saltwater source employed to produce the saltwater-derived carbonate composition. Also of interest are isotopic markers that identify the water source.

[0060] In certain embodiments, the con-sequestering component, which comprises carbonates, bicarbonates, or a mixture thereof, may be a supplementary cementitious material. SCMs are those materials which, though they may or may not be hydraulically cementitious in and of themselves, react to a degree with a hydraulic cement composition, such as Portland cement, to produce a cured material. In certain embodiments, con-sequestering SCMs (e.g., SCM comprising carbonates, bicarbonates, or a mixture thereof) may be such that each ton of the SCM stores about 0.5 tons or more of CO<sub>2</sub>, such as about 1 ton or more of CO<sub>2</sub>, including about 1.2 tons or more of CO<sub>2</sub>. For example, a con-sequestering SCM (e.g., SCM comprising carbonates, bicarbonates, or a mixture thereof) of the invention may store about 0.5 tons or more of con per ton of SCM material. In other words, a CO<sub>2</sub>-sequestering SCM (e.g., SCM comprising carbonates, bicarbonates, or a mixture thereof) of the invention may have a negative carbon footprint of -0.5 tons CO<sub>2</sub> per ton of material. In these embodiments, the con-sequestering compound (e.g., carbonates, bicarbonates, or a combination thereof) may be present as a dry particulate composition, e.g., powder. In certain embodiments, the dry particulate compositions may be made up of particles having an average particle size ranging from 0.1 to 100 microns, such as 10 to 40 microns as determined using any convenient particle size determination protocol, such as Multi-detector laser scattering or sieving (i.e. <38 microns). In certain embodiments, multimodal, e.g., bimodal or other, distributions are present. Bimodal distributions allow the surface area to be minimized, thus allowing a lower liquids/solids mass ratio for the cement yet providing smaller reactive particles for early reaction. In these instances, the average particle size of the larger size class can be upwards of 1000 microns (1 mm). The surface area of the components making up the SCM may vary. A given cement may have an average surface area sufficient to provide for a liquids to solids ratio upon combination with a liquid to produce a settable composition (e.g., as described in greater detail below) ranging from 0.5 m<sup>2</sup>/gm to 50 m<sup>2</sup>/gm, such as 0.75 to 20 m<sup>2</sup>/gm and including 0.80 to 10 m<sup>2</sup>/gm. In certain embodiments, the surface area of the cement ranges from 0.9 to 5 m<sup>2</sup>/gm, such as 0.95 to 2 m<sup>2</sup>/gm and including 1 to 2 m<sup>2</sup>/gm, as determined using the surface area determination protocol described in Breuninger, Emmil, and Teller (1953).

[0061] When present, the amount of CO<sub>2</sub>-sequestering SCM (e.g., SCM comprising carbonates, bicarbonates, or a mixture thereof) in the concrete composition may vary. In certain embodiments, the concrete includes from 5 to 50 percent w/w, such as 5 to 25 percent w/w, including 5 to 10 percent w/w, 10 percent to 25 percent w/w of CO<sub>2</sub>-sequestering SCM (e.g., SCM comprising carbonates, bicarbonates, or a mixture thereof). In certain embodiments, the carbonate compound composition makes up greater than 50 percent of the cement.

[0062] Instead of, or in addition to, a CO<sub>2</sub>-sequestering SCM, the concrete compositions may include one or more types of con-sequestering aggregates (e.g., aggregates comprising carbonates, bicarbonates, or a mixture thereof), which may be fine aggregates, coarse aggregates, etc. The term aggregate is used herein in its art accepted manner to refer to a particulate composition that finds use in concretes, mortars and other materials, e.g., as defined above. Aggregates of the invention may be particulate compositions that may be classified as fine or coarse. Fine aggregates according to embodiments of the invention are particulate compositions that almost entirely pass through a Number 4 sieve (ASTM C 125 and ASTM C 33). Fine aggregate compositions according to embodiments of the invention (which may be referred to as "sands") have an average particle size ranging from 0.0075 in. to 0.25 in., such as 0.075 in. to 0.125 in. and including 0.075 in. to 0.08 in.

As such, fine aggregate may be used as a replacement for sand in concrete compositions. Coarse aggregates of the invention are compositions that are predominantly retained on a Number 4 sieve (ASTM C 125 and ASTM C 33). Coarse aggregate compositions according to embodiments of the invention are compositions that have an average particle size ranging from 0.125 in. to 6 in., such as 0.187 in. to 3.0 in. and including 0.25 in. to 1.0 in. As such, coarse aggregate may be used as a replacement for conventional aggregate in concrete compositions.

[0063] In some embodiments, con-sequestering aggregates (i.e., synthetic aggregates comprising carbonates, bicarbonates, or a mixture thereof) of the invention may be such that each ton of the aggregate stores about 0.5 tons or more of con, such as about 1 ton or more of con, including about 1.2 tons or more of con. For example, a con-sequestering aggregate (e.g., aggregate comprising carbonates, bicarbonates, or a mixture thereof) of the invention may store about 0.5 tons or more of con per ton of material. In other words, a con-sequestering aggregate (e.g., aggregate comprising carbonates, bicarbonates, or a mixture thereof) of the invention may have a negative carbon footprint of -0.5 tons con per ton of material. In addition, aggregates of the invention have a density that may vary so long as the aggregate provides the desired properties to the building material in which it is employed. In certain instances, the density of the aggregates ranges from 1.1 to 5 gm/cc, such as 1.5 gm/cc to 3.15 gm/cc, and including 1.8 gm/cc to 2.7 gm/cc. The hardness of the aggregate particles making up the aggregate compositions of the invention may also vary, and in certain instances the Mohr's hardness ranges from 1.5 to 9, such as 2 to 7, including 4 to 5.

[0064] The weight ratio of the cement component (e.g., clinker and SCM) to the aggregate component, e.g., fine and coarse aggregate, may vary. In certain embodiments, the weight ratio of cement component to aggregate component in the dry concrete component ranges from 1:10 to 4:10, such as 2:10 to 5:10 and including from 55:100 to 70:100.

[0065] The con-sequestering aggregates of the invention, which comprise carbonates, bicarbonates, or a mixture thereof, include one or more carbonate compounds, e.g., as described above, and further described in U.S. Provisional Application No. 61/056,972. Admixtures

[0066] In certain embodiments, the cements may be employed with one or more admixtures. In some embodiments, the cements may be employed with one or more CO<sub>2</sub>-sequestering admixtures. Admixtures are compositions added to concrete to provide it with desirable characteristics that may not obtainable with basic concrete mixtures or to modify properties of the concrete to make it more readily useable or more suitable for a particular purpose or for CO<sub>2</sub> reduction. As is known in the art, an admixture may be any material or composition, other than the hydraulic cement, aggregate and water, that is used as a component of the concrete or mortar to enhance some characteristic, or lower the cost, thereof. The amount of admixture that is employed may vary depending on the nature of the admixture. In certain embodiments, the amounts of these components, which include synthetic admixtures, range from 1 to 50 percent w/w, such as 5 to 25 percent w/w, including 10 to 20 percent w/w, for example, 2 to 10 percent w/w.

[0067] Major reasons for using admixtures may be (1) to achieve certain structural improvements in the resulting cured concrete; (2) to improve the quality of concrete through the successive stages of mixing, transporting, placing, and curing during adverse

weather or traffic conditions; (3) to overcome certain emergencies during concreting operations; and/or (4) to reduce the cost of concrete construction. In some instances, the desired concrete performance characteristics can only be achieved by the use of an admixture. In some cases, using an admixture allows for the use of less expensive construction methods or designs, the savings from which can more than offset the cost of the admixture.

[0068] Admixtures of interest include finely divided mineral admixtures. Finely divided mineral admixtures are materials in powder or pulverized form added to concrete before or during the mixing process to improve or change some of the plastic or hardened properties of Portland cement concrete. The finely divided mineral admixtures can be classified according to their chemical or physical properties as: cementitious materials; pozzolans; pozzolanic and cementitious materials; and nominally inert materials. A pozzolan is a siliceous or aluminosiliceous material that possesses little or no cementitious value but will, in the presence of water and in finely divided form, chemically react with the calcium hydroxide released by the hydration of Portland cement to form materials with cementitious properties. Pozzolans can also be used to reduce the rate at which water under pressure is transferred through concrete. Diatomaceous earth, opaline cherts, clays, shales, fly ash, silica fume, volcanic tuffs, and pumicites are some of the known pozzolans. Certain ground granulated blast-furnace slags and high calcium fly ashes possess both pozzolanic and cementitious properties. Nominally inert materials can also include finely divided raw quartz, dolomites, limestone, marble, granite, and others. Fly ash is defined in ASTM C618.

[0069] Fly ash, as well as material comprising metal silicates (e.g., wollastonite, mafic minerals such as olivine and serpentine), may be used to produce carbon-sequestering pozzolanic material (i.e., a synthetic admixture), which may be used in carbon neutral or carbon negative concrete compositions of the invention. Such pozzolanic materials are described in U.S. Patent Application 12/486,692, filed 17 June 2009 and U.S. Patent Application No. 12/501,217, filed 10 July 2009, each of which is incorporated herein by reference. Briefly, digestion of fly ash (e.g., by slaking) or material comprising metal silicates generates, in addition to divalent cations, proton-removing agents, or a combination thereof, silica-based material, which, if present during precipitation of carbonate compositions, may be encapsulated by calcium carbonate, magnesium carbonate, or a combination thereof. As such, silica-based material acts as a nucleation site for precipitation of calcium carbonate, magnesium carbonate, or a mixture thereof. Pozzolanic material prepared in this way may be passivated, which reduces the reactivity of the pozzolanic material, which may be desired in certain embodiments. CO<sub>2</sub>-sequestering pozzolanic material, which comprises synthetic carbonates, bicarbonates, or a mixture thereof, in carbon neutral or carbon negative concrete may range from 1 to 50 percent w/w, such as 5 to 25 percent w/w, including 10 to 20 percent w/w, for example, 2 to 10 percent w/w. In addition, CO<sub>2</sub>-sequestering pozzolanic material (e.g., pozzolanic material comprising carbonates, bicarbonates, or a combination thereof) is such that each ton of the pozzolanic material stores 0.25 tons or more of CO<sub>2</sub>, such as 0.5 tons or more of CO<sub>2</sub>, including 1 ton or more of CO<sub>2</sub>, for example, 2 tons or more of CO<sub>2</sub> per ton of pozzolanic material. For example, a CO<sub>2</sub>-sequestering pozzolanic material (e.g., pozzolanic material comprising carbonates, bicarbonates, or a combination thereof) of the invention may store about 0.25 tons or more of CO<sub>2</sub> per ton of pozzolanic material. In other words, a CO<sub>2</sub>-sequestering pozzolanic material of the invention may have a negative carbon footprint of -0.25 tons CO<sub>2</sub> per ton of material.

[0070] One type of admixture of interest may be a plasticizer. Plasticizers may be added to a concrete to provide it with improved workability for ease of placement with reduced consolidating effort and in reinforced concretes required to flow uniformly without leaving void space under reinforcing bars. Also of interest as admixtures are accelerators, retarders, air-entrainers, foaming agents, water reducers, corrosion inhibitors, and pigments. Accelerators are used to increase the cure rate (hydration) of the concrete formulation and are of particular importance in applications where it is desirable (or the concrete to harden quickly and in low temperature applications. Retarders act to slow the rate of hydration and increase the time available to pour the concrete and to form it into a desired shape. Retarders are of particular importance in applications where the concrete is being used in hot climates. Air-entrainers are used to distribute tiny air bubbles throughout the concrete. Air-entrainers are of particular value for utilization in regions that experience cold weather because the tiny entrained air bubbles help to allow for some contraction and expansion to protect the concrete from freeze-thaw damage. Pigments can also be added to concrete to provide it with desired color characteristics for aesthetic purposes.

[0071] As such, admixtures of interest include, but are not limited to: set accelerators, set retarders, air-entraining agents, defoamers, alkali-reactivity reducers, bonding admixtures, dispersants, coloring admixtures, corrosion inhibitors, dampproofing admixtures, gas formers, permeability reducers, pumping aids, shrinkage compensation admixtures, fungicidal admixtures, germicidal admixtures, insecticidal admixtures, rheology modifying agents, finely divided mineral admixtures, pozzolans, aggregates, wetting agents, strength enhancing agents, water repellents, and any other concrete or mortar admixture or additive. When using an admixture, the fresh cementitious composition, to which the admixture raw materials are introduced, may be mixed for sufficient time to cause the admixture raw materials to be dispersed relatively uniformly throughout the fresh concrete.

[0072] Set accelerators are used to accelerate the setting and early strength development of concrete. A set accelerator that can be used with the admixture system can be, but is not limited to, a nitrate salt of an alkali metal, alkaline earth metal, or aluminum; a nitrile salt of an alkali metal, alkaline earth metal, or aluminum; a thiocyanate of an alkali metal, alkaline earth metal or aluminum; an alkanolamine; a thiosulfate of an alkali metal, alkaline earth metal, or aluminum; a hydroxide of an alkali metal, alkaline earth metal, or aluminum; a carboxylic acid salt of an alkali metal, alkaline earth metal, or aluminum (preferably calcium formate); a polyhydroxyalkylamine; a halide salt of an alkali metal or alkaline earth metal (e.g., chloride). Examples of set accelerators that may be used in the present dispensing method include, but are not limited to, POZZOL[TH(R)]NC534, nonchloride type set accelerator and/or RHEOCRETE(R)CNI calcium nitrite-based corrosion inhibitor, both sold under the above trademarks by BASF Admixtures Inc. of Cleveland, Ohio,

[0073] Also of interest are set retarding admixtures. Set retarding, also known as delayed-setting or hydration control, admixtures are used to retard, delay, or slow the rate of setting of concrete. They can be added to the concrete mix upon initial batching or sometime after the hydration process has begun. Set retarders are used to offset the accelerating effect of hot weather on the setting of concrete, or delay the initial set of concrete or grout when difficult conditions of placement occur, or problems of delivery to the job site, or to allow time for special finishing processes. Most set retarders also act as low level water reducers and can also be used to entrain some air into concrete. Retarders that can be used include, but are not limited to an oxy-boron compound, corn

syrup, lignin, a polyphosphonic acid, a carboxylic acid, a hydroxycarboxylic acid, polycarboxylic acid, hydroxylated carboxylic acid, such as fumaric, itaconic, malonic, borax, gluconic, and tartaric acid, lignosulfonates, ascorbic acid, isoascorbic acid, sulphonic acid-acrylic acid copolymer and their corresponding salts, polyhydroxysilane, polyacrylamide, carbohydrates and mixtures thereof. Illustrative examples of retarders are set forth in U.S. Pat. Nos. 5,427,617 and 5,203,919, incorporated herein by reference. A further example of a retarder suitable for use in the admixture system is a hydration control admixture sold under the trademark DELVO(R) by BASF Admixtures Inc. of Cleveland, Ohio.

[0074] Also of interest as admixtures are air entrainers. The term air entrainer includes any substance that will entrain air in cementitious compositions. Some air entrainers can also reduce the surface tension of a composition at low concentration. Air-entraining admixtures are used to purposely entrain microscopic air bubbles into concrete. Air-entrainment dramatically improves the durability of concrete exposed to moisture during cycles of freezing and thawing. In addition, entrained air greatly improves concrete's resistance to surface scaling caused by chemical deicers. Air entrainment also increases the workability of fresh concrete while eliminating or reducing segregation and bleeding. Materials used to achieve these desired effects can be selected from wood resin, natural resin synthetic resin, sulfonated lignin, petroleum acids, proteinaceous material, fatty acids, resinous acids, alkylbenzene sulfonates, sulfonated hydrocarbons, vinyl resin, anionic surfactants, cationic surfactants, nonionic surfactants, natural resin, synthetic resin, an inorganic air entrainer, synthetic detergents, and their corresponding salts, and mixtures thereof. Air entrainers are added in an amount to yield a desired level of air in a cementitious composition. Examples of air entrainers that can be utilized in the admixture system include, but are not limited to MB AE 90, MB VR and MICRO AIR(R), all available from BASF Admixtures Inc. of Cleveland, Ohio.

[0075] Also of interest as admixtures are defoamers. Defoamers are used to decrease the air content in the cementitious composition. Examples of defoamers that can be utilized in the cementitious composition include, but are not limited to mineral oils, vegetable oils, fatty acids, fatty acid esters, hydroxyl functional compounds, amides, phosphoric esters, metal soaps, silicones, polymers containing propylene oxide moieties, hydrocarbons, alkoxylated hydrocarbons, alkoxylated polyalkylene oxides, tributyl phosphates, dibutyl phthalates, octyl alcohols, water-insoluble esters of carbonic and boric acid, acetylenic diols, ethylene oxide-propylene oxide block copolymers and silicones.

[0076] Also of interest as admixtures are dispersants. The term dispersant as used throughout this specification includes, among others, polycarboxylate dispersants, with or without polyether units. The term dispersant is also meant to include those chemicals that also function as a plasticizer, water reducer such as a high range water reducer, fluidizer, antiflocculating agent, or superplasticizer for cementitious compositions, such as lignosulfonates, salts of sulfonated naphthalene sulfonate condensates, salts of sulfonated melamine sulfonate condensates, beta naphthalene sulfonates, sulfonated melamine formaldehyde condensates, naphthalene sulfonate formaldehyde condensate resins for example LOMAR D(R) dispersant (Cognis Inc., Cincinnati, Ohio), polyaspartates, or oligomeric dispersants. Polycarboxylate Dispersants can be used, by- which is meant a dispersant having a carbon backbone with pendant side chains, wherein at least a portion of the side chains are attached to the backbone through a carboxyl group or an ether group. Examples of polycarboxylate dispersants can be found in U.S. Pat. No. 2002/0019459 A1, U.S. Pat. No. 6,267,814, U.S. Pat. No. 6,290,770, U.S. Pat. No. 6,310,143, U.S. Pat. No. 6,187,841, U.S. Pat. No. 5,158,996, U.S. Pat. No. 6,008,275, U.S. Pat. No. 6,136,950, U.S. Pat. No. 6,284,867, U.S. Pat. No. 5,609,681, U.S. Pat. No. 5,494,516; U.S. Pat. No. 5,674,929, U.S. Pat. No. 5,660,626, U.S. Pat. No. 5,668,195, U.S. Pat. No. 5,661,206, U.S. Pat. No. 5,358,566, U.S. Pat. No. 5,162,402, U.S. Pat. No. 5,798,425, U.S. Pat. No. 5,612,396, U.S. Pat. No. 6,063,184, U.S. Pat. No. 5,912,284, U.S. Pat. No. 5,840,114, U.S. Pat. No. 5,753,744, U.S. Pat. No. 5,728,207, U.S. Pat. No. 5,725,657, U.S. Pat. No. 5,703,174, U.S. Pat. No. 5,665,158, U.S. Pat. No. 5,643,978, U.S. Pat. No. 5,633,298, U.S. Pat. No. 5,583,183, and U.S. Pat. No. 5,393,343, which are all incorporated herein by reference as if fully written out below. The polycarboxylate dispersants of interest include but are not limited to dispersants or water reducers sold under the trademarks GLENIUM(R) 3030NS, GLENIUM(R) 3200 HES, GLENIUM 3000NS(R) (BASF Admixtures Inc., Cleveland, Ohio), ADVA(R) (W. R. Grace Inc., Cambridge, Mass.), VISCOCRETE(R) (Sika, Zurich, Switzerland), and SUPERFLUX(R) (Axim concrete Technologies Inc., Middlebranch, Ohio).

[0077] Also of interest as admixtures are alkali reactivity reducers. Alkali reactivity reducers can reduce the alkali-aggregate reaction and limit the disruptive expansion forces that this reaction can produce in hardened concrete. The alkali-reactivity reducers include pozzolans (fly ash, silica fume), blast-furnace slag, salts of lithium and barium. And other air-entraining agents.

[0078] Natural and synthetic admixtures are used to color concrete for aesthetic and safety reasons. These coloring admixtures are usually composed of pigments and include carbon black, iron oxide, phthalocyanine, umber, chromium oxide, titanium oxide, cobalt blue, and organic coloring agents.

[0079] Also of interest as admixtures are corrosion inhibitors. Corrosion inhibitors in concrete serve to protect embedded reinforcing steel from corrosion due to its highly alkaline nature. The high alkaline nature of the concrete causes a passive and noncorroding protective oxide film to form on steel. However, carbonation or the presence of chloride ions from deicers or seawater can destroy or penetrate the film and result in corrosion. Corrosion-inhibiting admixtures chemically arrest this corrosion reaction. The materials most commonly used to inhibit corrosion are calcium nitrite, sodium nitrite, sodium benzoate, certain phosphates or fluorosilicates, fluoroaluminates, amines and related chemicals.

[0080] Also of interest are dampproofing admixtures. Dampproofing admixtures reduce the permeability of concrete that have low cement contents, high water-cement ratios, or a deficiency of fines in the aggregate. These admixtures retard moisture penetration into dry concrete and include certain soaps, stearates, and petroleum products.

[0081] Also of interest are gas former admixtures. Gas formers, or gas-forming agents, are sometimes added to concrete and grout in very small quantities to cause a slight expansion prior to hardening. The amount of expansion is dependent upon the amount of gas-forming material used and the temperature of the fresh mixture. Aluminum powder, resin soap and vegetable or animal glue, saponin or hydrolyzed protein can be used as gas formers.

[0082] Also of interest are permeability reducers. Permeability reducers are used to reduce the rate at which water under pressure

is transmitted through concrete. Silica fume, fly ash, ground slag, natural pozzolans, water reducers, and latex can be employed to decrease the permeability of the concrete.

[0083] Also of interest are rheology modifying agent admixtures. Rheology modifying agents can be used to increase the viscosity of cementitious

[0084] Compositions. Suitable examples of rheology modifier include fumed silica, colloidal silica, hydroxyethyl cellulose, hydroxypropyl cellulose, fly ash (as defined in ASTM C618), mineral oils (such as light naphthenic), Hectorite clay, polyoxyalkylenes, polysaccharides, natural gums, or mixtures thereof.

[0085] Also of interest are shrinkage compensation admixtures. The shrinkage compensation agent which may be used in the cementitious composition may include, but is not limited to, RO(AO)I.HIH, wherein R is a C1-5 alkyl or C5-6 cycloalkyl radical and A is a C23 alkylene radical, alkali metal sulfate, alkaline earth metal sulfates, alkaline earth oxides, preferably sodium sulfate and calcium oxide. TETRAGUARD(R) is an example of a shrinkage reducing agent and is available from BASF Admixtures Inc. of Cleveland, Ohio.

[0086] Bacteria and fungal growth on or in hardened concrete may be partially controlled through the use of fungicidal and germicidal admixtures. The most effective materials for these purposes are polyhalogenated phenols, dieldrin emulsions, and copper compounds.

[0087] Also of interest in certain embodiments are workability improving admixtures. Entrained air, which acts like a lubricant, can be used as a workability improving agent. Other workability agents are water reducers and certain finely divided admixtures.

[0088] In certain embodiments, the cements of the invention are employed with fibers, e.g., where one desires fiber-reinforced concrete. Fibers can be made of zirconia containing materials, steel, carbon, fiberglass, or synthetic materials. e.g., polypropylene, nylon, polyethylene, polyester, rayon, high-strength aramid, (i.e. Kevlar(R)), or mixtures thereof.

## PREPARATION OF REDUCED-CARBON FOOTPRINT COMPOSITIONS

[0089] Aspects of the invention include methods of preparing reduced-carbon footprint concrete compositions. Reduced-carbon footprint concrete compositions may be prepared by first producing a carbonate/bicarbonate component (e.g., CO<sub>3</sub>-sequestering component [i.e., precipitation material]) and then preparing reduced-carbon footprint concrete compositions from the carbonate/bicarbonate component (e.g., CO<sub>2</sub>-sequestering component). The carbonate/bicarbonate component (e.g., CO<sub>3</sub>-sequestering component) of the reduced-carbon footprint concrete compositions may be produced from a source of CO<sub>2</sub>, a source of proton-removing agents (and/or methods of effecting proton removal), and a source of divalent cations, each of which materials are described in further detail immediately below.

Carbon Dioxide

[0090] Methods of the invention include contacting a volume of a solution of divalent cations (e.g., an aqueous solution of divalent cations) with a source of CO<sub>2</sub>, then subjecting the resultant solution to conditions that facilitate precipitation. Methods of the invention further include contacting a volume of a solution of divalent cations (e.g., an aqueous solution of divalent cations) with a source of CO<sub>2</sub> while subjecting the solution to conditions that facilitate precipitation. There may be sufficient carbon dioxide in the divalent cation-containing solution to precipitate significant amounts of carbonate-containing precipitation material (e.g., from seawater); however, additional carbon dioxide may be used. The source of CO<sub>2</sub> may be any convenient CO<sub>2</sub> source. The CO<sub>2</sub> source may be a gas, a liquid, a solid (e.g., dry ice), a supercritical fluid, or CO<sub>2</sub> dissolved in a liquid. In some embodiments, the CO<sub>2</sub> source is a gaseous CO<sub>2</sub> source. The gaseous stream may be substantially pure CO<sub>2</sub> or comprise multiple components that include CO<sub>2</sub> and one or more additional gases and/or other substances such as ash and other particulates. In some embodiments, the gaseous CO<sub>2</sub> source may be a waste gas stream (i.e., a by-product of an active process of the industrial plant) such as exhaust from an industrial plant. The nature of the industrial plant may vary, the industrial plants including, but not limited to, power plants, chemical processing plants, mechanical processing plants, refineries, cement plants, steel plants, and other industrial plants that produce CO<sub>2</sub> as a by-product of fuel combustion or another processing step (such as calcination by a cement plant).

[0091] Waste gas streams comprising CO<sub>2</sub> include both reducing (e.g., syngas, shifted syngas, natural gas, hydrogen and the like) and oxidizing condition streams (e.g., flue gases from combustion). Particular waste gas streams that may be convenient for the invention include oxygen-containing combustion industrial plant flue gas (e.g., from CO<sub>2</sub> or another carbon-based fuel with little or no pretreatment of the flue gas), turbo charged boiler product gas, CO<sub>2</sub> gasification product gas, shifted CO<sub>2</sub> gasification product gas, anaerobic digester product gas, wellhead natural gas stream, reformed natural gas or methane hydrates, and the like. Combustion gas from any convenient source may be used in methods and systems of the invention. In some embodiments, combustion gases in post-combustion effluent stacks of industrial plants such as power plants, cement plants, and CO<sub>2</sub> processing plants may be used.

[0092] Thus, the waste streams may be produced from a variety of different types of industrial plants. Suitable waste streams for the invention include waste streams produced by industrial plants that combust fossil fuels (e.g., CO<sub>2</sub>, oil, natural gas) and anthropogenic fuel products of naturally occurring organic fuel deposits (e.g., tar sands, heavy oil, oil shale, etc.). In some embodiments, a waste stream suitable for systems and methods of the invention may be sourced from a CO<sub>2</sub>-fired power plant, such as a pulverized CO<sub>2</sub> power plant, a supercritical CO<sub>2</sub> power plant, a mass burn CO<sub>2</sub> power plant, a fluidized bed CO<sub>2</sub> power plant; in some embodiments, the waste stream may be sourced from gas or oil-fired boiler and steam turbine power plants, gas or oil-fired boiler simple cycle gas turbine power plants, or gas or oil-fired boiler combined cycle gas turbine power plants. In some embodiments, waste streams produced by power plants that combust syngas (i.e., gas produced by the gasification of organic matter, for example, CO<sub>2</sub>, biomass, etc.) may be used. In some embodiments, waste streams from integrated gasification combined cycle (IGCC) plants may be used. In some embodiments, waste streams produced by Heat Recovery Steam Generator (HRSG) plants may be used in accordance with systems and methods of the invention.

[0093] Waste streams produced by cement plants may also be suitable for systems and methods of the invention. Cement plant waste streams include waste streams from both wet process and dry process plants, which plants may employ shaft kilns or rotary kilns, and may include pre-calciners. These industrial plants may each burn a single fuel, or may burn two or more fuels sequentially or simultaneously. Other industrial plants such as smelters and refineries may also be useful sources of waste streams that include carbon dioxide.

[0094] Industrial waste gas streams may contain carbon dioxide as the primary non-air derived component, or may, especially in the case of coal-fired power plants, contain additional components such as nitrogen oxides (NO<sub>x</sub>), sulfur oxides (SO<sub>x</sub>), and one or more additional gases. Additional gases and other components may include CO, mercury and other heavy metals, and dust particles (e.g., from calcining and combustion processes). Additional components in the gas stream may also include halides such as hydrogen chloride and hydrogen fluoride; particulate matter such as fly ash dusts, and metals including arsenic, beryllium, boron, cadmium, chromium, chromium VI; cobalt, lead, manganese, mercury, molybdenum, selenium, strontium, thallium, and vanadium; and organics such as hydrocarbons, dioxins, and PAH compounds. Suitable gaseous waste streams that may be treated have, in some embodiments, can present in amounts of 200 ppm to 1,000,000 ppm, such as 200,000 ppm to 1000 ppm, including 200,000 ppm to 2000 ppm, for example 180,000 ppm to 2000 ppm, or 180,000 ppm to 5000 ppm, also including 180,000 ppm to 10,000 ppm. The waste streams, particularly various waste streams of combustion gas, may include one or more additional components, for example, water, NO<sub>x</sub> (mononitrogen oxides: NO and NO<sub>2</sub>), SO<sub>x</sub> (monosulfur oxides: SO, SO<sub>2</sub> and SO<sub>3</sub>), VOC (volatile organic compounds), heavy metals such as mercury, and particulate matter (particles of solid or liquid suspended in a gas). Flue gas temperature may also vary. In some embodiments, the temperature of the flue gas comprising can may be from 0 degrees centigrade to 2000 degrees centigrade, such as from 60 degrees centigrade to 700 degrees centigrade, and including 100 degrees centigrade to 400 degrees centigrade.

[0095] In some embodiments, one or more additional components or co-products (i.e., products produced from other starting materials [e.g., SO<sub>x</sub>, NO<sub>x</sub>, etc.] under the same conditions employed to convert can into carbonates) may be precipitated or trapped in precipitation material formed by contacting the waste gas stream comprising these additional components with a solution comprising divalent cations (e.g., alkaline earth metal ions such as Ca<sup>2+</sup> and Mg<sup>2+</sup>). Sulfates, sulfites, and the like of calcium and/or magnesium may be precipitated or trapped in precipitation material (further comprising calcium and/or magnesium carbonates) produced from waste gas streams comprising SO<sub>x</sub> (e.g., SO<sub>3</sub>). Magnesium and calcium may react to form MgSO<sub>4</sub>, CaSO<sub>4</sub>, respectively, as well as other magnesium-containing and calcium-containing compounds (e.g., sulfites), effectively removing sulfur from the flue gas stream without a desulfurization step such as flue gas desulfurization ("FGD"). In addition, CaCO<sub>3</sub>, MgCO<sub>3</sub>, and related compounds may be formed without additional release of CO<sub>2</sub>. In instances where the solution of divalent cations contains high levels of sulfur compounds (e.g., sulfate), the solution may be enriched with calcium and magnesium so that calcium and magnesium are available to form carbonate compounds after, or in addition to, formation of CaSO<sub>4</sub>, MgSO<sub>4</sub>, and related compounds. In some embodiments, a desulfurization step may be staged to coincide with precipitation of carbonate-containing precipitation material, or the desulfurization step may be staged to occur before precipitation. In some embodiments, multiple reaction products (e.g., MgCO<sub>3</sub>, CaCO<sub>3</sub>, CaSO<sub>4</sub>, mixtures of the foregoing, and the like) may be collected at different stages, while in other embodiments a single reaction product (e.g., precipitation material comprising carbonates, sulfates, etc.) may be collected. In step with these embodiments, other components, such as heavy metals (e.g., mercury, mercury salts, mercury-containing compounds), may be trapped in the carbonate-containing precipitation material or may precipitate separately.

[0096] A portion of the gaseous waste stream (i.e., not the entire gaseous waste stream) from an industrial plant may be used to produce precipitation material. In these embodiments, the portion of the gaseous waste stream that is employed in precipitation of precipitation material may be 75 percent or less, such as 60 percent or less, and including 50 percent and less of the gaseous waste stream. In yet other embodiments, substantially (e.g., 80 percent or more) the entire gaseous waste stream produced by the industrial plant may be employed in precipitation of precipitation material. In these embodiments, 80 percent or more, such as 90 percent or more, including 95 percent or more, up to 100 percent of the gaseous waste stream (e.g., flue gas) generated by the source may be employed for precipitation of precipitation material.

[0097] Although industrial waste gas offers a relatively concentrated source of combustion gases, methods and systems of the invention may also be applicable to removing combustion gas components from less concentrated sources (e.g., atmospheric air), which contains a much lower concentration of pollutants than, for example, flue gas. Thus, in some embodiments, methods and systems encompass decreasing the concentration of pollutants in atmospheric air by producing a stable precipitation material. In these cases, the concentration of pollutants, e.g., CO<sub>2</sub>, in a portion of atmospheric air may be decreased by 10 percent or more, 20 percent or more, 30 percent or more, 40 percent or more, 50 percent or more, 60 percent or more, 70 percent or more, 80 percent or more, 90 percent or more, 95 percent or more, 99 percent or more, 99.9 percent or more, or 99.99 percent. Such decreases in atmospheric pollutants may be accomplished with yields as described herein, or with higher or lower yields, and may be accomplished in one precipitation step or in a series of precipitation steps.

[0098] Divalent Cations

[0099] Methods of the invention include contacting a volume of a solution of divalent cations (e.g., an aqueous solution of divalent cations) with a source of CO<sub>2</sub>, and subjecting the resultant solution to conditions that facilitate precipitation. In some embodiments, a volume of a solution of divalent cations (e.g., an aqueous solution of divalent cations) may be contacted with a source of CO<sub>2</sub>, while subjecting the solution to conditions that facilitate precipitation. Divalent cations may come from any of a number of different divalent cation sources depending upon availability at a particular location. Such sources include industrial wastes, seawater, brines, hard waters, rocks and minerals (e.g., lime, periclase, materials comprising metal silicates such as serpentine and olivine), and any other suitable source.

[00100] In some locations, industrial waste streams from various industrial processes provide for convenient sources of divalent cations (as well as in some cases other materials useful in the process, e.g., metal hydroxide). Such waste streams include, but are not limited to, mining wastes: fossil fuel burning ash (e.g., combustion ash such as fly ash, bottom ash, boiler slag); slag (e.g.,

iron slag, phosphorous slag); cement kiln waste; oil refinery/petrochemical refinery waste (e.g. oil field and methane seam brines); coal seam wastes (e.g. gas production brines and coal seam brine); paper processing waste; water softening waste brine (e.g., ion exchange effluent); silicon processing wastes; agricultural waste; metal finishing waste; high pH textile waste; and caustic sludge. Fossil fuel burning ash, cement kiln dust, and slag, collectively waste sources of metal oxides, further described in U.S. Patent Application No. 12/486,692, filed 17 June 2009, the disclosure of which is incorporated herein by reference. Any of the divalent cations sources described herein may be mixed and matched for the purpose of practicing the invention. For example, material comprising metal silicates (e.g. serpentine, olivine), which are further described in U.S. Patent Application No. 12/501,217, filed 10 July 2009, which application is incorporated herein by reference, may be combined with any of the sources of divalent cations described herein for the purpose of practicing the invention.

[00101] In some locations, a convenient source of divalent cations for preparation of a carbonate/bicarbonate component (e.g., a sequestering component) of the invention may be water (e.g., an aqueous solution comprising divalent cations such as seawater or surface brine), which may vary depending upon the particular location at which the invention is practiced. Suitable solutions of divalent cations that may be used include aqueous solutions comprising one or more divalent cations, e.g., alkaline earth metal cations such as  $\text{Ca}^{2+}$  and  $\text{Mg}^{2+}$ . In some embodiments, the aqueous solution of divalent cations comprises alkaline earth metal cations. In some embodiments, the alkaline earth metal cations include calcium, magnesium, or a mixture thereof. In some embodiments, the aqueous solution of divalent cations comprises calcium in amounts ranging from 50 to 50,000 ppm, 50 to 40,000 ppm, 50 to 20,000 ppm, 100 to 10,000 ppm, 200 to 5000 ppm, or 400 to 1000 ppm. In some embodiments, the aqueous solution of divalent cations comprises magnesium in amounts ranging from 50 to 40,000 ppm, 50 to 20,000 ppm, 100 to 10,000 ppm, 200 to 10,000 ppm, 500 to 5000 ppm, or 500 to 2500 ppm. In some embodiments, where  $\text{Ca}^{2+}$  and  $\text{Mg}^{2+}$  are both present, the ratio of  $\text{Ca}^{2+}$  to  $\text{Mg}^{2+}$  (i.e.,  $\text{Ca}^{2+}/\text{Mg}^{2+}$ ) in the aqueous solution of divalent cations may be between 1:1 and 1:2.5; 1:2.5 and 1:5; 1:5 and 1:10; 1:10 and 1:25; 1:25 and 1:50; 1:50 and 1:100; 1:100 and 1:150; 1:150 and 1:200; 1:200 and 1:250; 1:250 and 1:500; 1:500 and 1:1000, or a range thereof. For example, in some embodiments, the ratio of  $\text{Ca}^{2+}$  to  $\text{Mg}^{2+}$  in the aqueous solution of divalent cations may be between 1:1 and 1:10; 1:5 and 1:25; 1:10 and 1:50; 1:25 and 1:100; 1:50 and 1:500; or 1:100 and 1:1000. In some embodiments, the ratio of  $\text{Mg}^{2+}$  to  $\text{Ca}^{2+}$  (i.e.,  $\text{Mg}^{2+}/\text{Ca}^{2+}$ ) in the aqueous solution of divalent cations may be between 1:1 and 1:2.5; 1:2.5 and 1:5; 1:5 and 1:10; 1:10 and 1:25; 1:25 and 1:50; 1:50 and 1:100; 1:100 and 1:150; 1:150 and 1:200; 1:200 and 1:250; 1:250 and 1:500; 1:500 and 1:1000, or a range thereof. For example, in some embodiments, the ratio of  $\text{Mg}^{2+}$  to  $\text{Ca}^{2+}$  in the aqueous solution of divalent cations may be between 1:1 and 1:10; 1:5 and 1:25; 1:10 and 1:50; 1:25 and 1:100; 1:50 and 1:500; or 1:100 and 1:1000.

[00102] The aqueous solution of divalent cations may comprise divalent cations derived from freshwater, brackish water, seawater, or brine (e.g., naturally occurring brines or anthropogenic brines such as geothermal plant wastewaters, desalination plant waste waters), as well as other salines having a salinity that is greater than that of freshwater, any of which may be naturally occurring or anthropogenic. Brackish water is water that is saltier than freshwater, but not as salty as seawater. Brackish water has a salinity ranging from about 0.5 to about 35 ppt (parts per thousand). Seawater is water from a sea, an ocean, or any other saline body of water that has a salinity ranging from about 35 to about 50 ppt. Brine is water saturated or nearly saturated with salt. Brine has a salinity that is about 50 ppt or greater. In some embodiments, the water source from which divalent cations are derived is a mineral rich (e.g., calcium-rich and/or magnesium-rich) freshwater source. In some embodiments, the water source from which divalent cations are derived may be a naturally occurring saltwater source selected from a sea, an ocean, a lake, a swamp, an estuary, a lagoon, a surface brine, a deep brine, an alkaline lake, an inland sea, or the like. In some embodiments, the water source from which divalent cations are derived may be an anthropogenic brine selected from a geothermal plant wastewater or a desalination wastewater.

[00103] Freshwater may be a convenient source of divalent cations (e.g., cations of alkaline earth metals such as  $\text{Ca}^{2+}$  and  $\text{Mg}^{2+}$ ). Any of a number of suitable freshwater sources may be used, including freshwater sources ranging from sources relatively free of minerals to sources relatively rich in minerals. Mineral-rich freshwater sources may be naturally occurring, including any of a number of hard water sources, lakes, or inland seas. Some mineral-rich freshwater sources such as alkaline lakes or inland seas (e.g., Lake Van in Turkey) also provide a source of pH-modifying agents. Mineral-rich freshwater sources may also be anthropogenic. For example, a mineral-poor (soft) water may be contacted with a source of divalent cations such as alkaline earth metal cations (e.g.,  $\text{Ca}^{2+}$ ,  $\text{Mg}^{2+}$ , etc.) to produce a mineral-rich water that is suitable for methods and systems described herein. Divalent cations or precursors thereof (e.g. salts, minerals) may be added to freshwater (or any other type of water described herein) using any convenient protocol (e.g., addition of solids, suspensions, or solutions). In some embodiments, divalent cations selected from  $\text{Ca}^{2+}$  and  $\text{Mg}^{2+}$  may be added to freshwater. In some embodiments, monovalent cations selected from  $\text{Na}^{+}$  and  $\text{K}^{+}$  are added to freshwater. In some embodiments, freshwater comprising  $\text{Ca}^{2+}$  may be combined with combustion ash (e.g., fly ash, bottom ash, boiler slag), or products or processed forms thereof, yielding a solution comprising calcium and magnesium cations.

[00104] In some embodiments, an aqueous solution of divalent cations may be obtained from an industrial plant that is also providing a combustion gas stream. For example, in water-cooled industrial plants, such as seawater-cooled industrial plants, water that has been used by an industrial plant for cooling may then be used as water for producing precipitation material. If desired, the water may be cooled prior to entering a precipitation system of the invention. Such approaches may be employed, for example, with once-through cooling systems. For example, a city or agricultural water supply may be employed as a once-through cooling system for an industrial plant. Water from the industrial plant may then be employed for producing precipitation material, wherein output water has a reduced hardness and greater purity.

Proton-Removing Agents and Methods for Effecting Proton Removal

[00105] Methods of the invention include contacting a volume of a solution of divalent cations (e.g., an aqueous solution of divalent cations) with a source of con (to dissolve  $\text{CO}_2$ ) and subjecting the resultant solution to conditions that facilitate precipitation. In some embodiments, a volume of a solution of divalent cations (e.g., an aqueous solution of divalent cations) may be contacted with a source of con (to dissolve con) while subjecting the solution to conditions that facilitate precipitation. The dissolution of con into the solution of divalent cations produces carbonic acid, a species in equilibrium with both bicarbonate and carbonate. To produce carbonate-containing precipitation material, protons are removed from various species (e.g. carbonic acid, bicarbonate, hydronium,

etc.) in the divalent cation-containing solution to shift the equilibrium toward carbonate.

As protons are removed, more con goes into solution. In some embodiments, proton-removing agents and/or methods may be used while contacting a divalent cation-containing solution (e.g., an aqueous solution comprising divalent cations) with con to increase con absorption in one phase of the precipitation reaction, wherein the pH may remain constant, increase, or even decrease, followed by a rapid removal of protons (e.g., by addition of a base) to cause rapid precipitation of carbonate-containing precipitation material. Protons may be removed from the various species (e.g. carbonic acid, bicarbonate, hydronium, etc.) by any convenient approach, including, but not limited to use of naturally occurring proton-removing agents, use of microorganisms and fungi, use of synthetic chemical proton-removing agents, recovery of man-made waste streams, and using electrochemical means.

[00106] Naturally occurring proton-removing agents encompass any proton-removing agents found in the wider environment that may create or have a basic local environment. Some embodiments provide for naturally occurring proton-removing agents including minerals that create basic environments upon addition to solution. Such minerals include, but are not limited to, lime (CaO); periclase (MgO); iron hydroxide minerals (e.g., goethite and limonite); and volcanic ash. Methods for digestion of such minerals and rocks comprising such minerals are provided herein. Some embodiments provide for using naturally alkaline bodies of water as naturally occurring proton-removing agents. Examples of naturally alkaline bodies of water include, but are not limited to surface water sources (e.g. alkaline lakes such as Mono Lake in California) and ground water sources (e.g. basic aquifers such as the deep geologic alkaline aquifers located at Searles Lake in California). Other embodiments provide for use of deposits from dried alkaline bodies of water such as the crust along Lake Natron in Africa's Great Rift Valley. In some embodiments, organisms that excrete basic molecules or solutions in their normal metabolism may be used as proton-removing agents. Examples of such organisms are fungi that produce alkaline protease (e.g., the deep-sea fungus *Aspergillus ustus* with an optimal pH of 9) and bacteria that create alkaline molecules (e.g., cyanobacteria such as *Lyngbya* sp. from the Atlin wetland in British Columbia, which increases pH from a byproduct of photosynthesis). In some embodiments, organisms may be used to produce proton-removing agents, wherein the organisms (e.g., *Bacillus pasteurii*, which hydrolyzes urea to ammonia) metabolize a contaminant (e.g. urea) to produce proton-removing agents or solutions comprising proton-removing agents (e.g., ammonia ammonium hydroxide). In some embodiments, organisms may be cultured separately from the precipitation reaction mixture, wherein proton-removing agents or solutions comprising proton-removing agents are used for addition to the precipitation reaction mixture. In some embodiments, naturally occurring or manufactured enzymes may be used in combination with proton-removing agents to invoke precipitation of precipitation material. Carbonic anhydrase, which is an enzyme produced by plants and animals, accelerates transformation of carbonic acid to bicarbonate in solution. As such, carbonic anhydrase may be used to enhance dissolution of con and accelerate precipitation of precipitation material, as described in U.S. Provisional Patent Application 61/252,929 filed 19 October 2009, which is incorporated herein by reference in its entirety.

[00107] Chemical agents for effecting proton removal generally refer to synthetic chemical agents produced in large quantities and commercially available. For example, chemical agents for removing protons include, but are not limited to, hydroxides, organic bases, super bases, oxides, ammonia, and carbonates. Hydroxides include chemical species that provide hydroxide anions in solution, including, for example, sodium hydroxide (NaOH), potassium hydroxide (KOH), calcium hydroxide (Ca(OH)<sub>2</sub>), or magnesium hydroxide (Mg(OH)<sub>2</sub>). Organic bases are carbon-containing molecules that are generally nitrogenous bases including primary amines such as methyl amine, secondary amines such as diisopropylamine, tertiary such as diisopropylethylamine, aromatic amines such as aniline, heteroaromatics such as pyridine, imidazole, and benzimidazole, and various forms thereof. In some embodiments, an organic base selected from pyridine, methylamine, imidazole, benzimidazole, histidine, and a phosphazene may be used to remove protons from various species (e.g., carbonic acid, bicarbonate, hydronium, etc.) for precipitation of precipitation material. In some embodiments, ammonia may be used to raise pH to a level sufficient to precipitate precipitation material from a solution of divalent cations and an industrial waste stream. Super bases suitable for use as proton-removing agents include sodium ethoxide, sodium amide (NaNH<sub>2</sub>), sodium hydride (NaH), butyl lithium, lithium diisopropylamide, lithium diethylamide, and lithium bis(trimethylsilyl)amide. Oxides including, for example, calcium oxide (CaO), magnesium oxide (MgO), strontium oxide (SrO), beryllium oxide (BeO), and barium oxide (BaO) may be also suitable proton-removing agents that may be used. Carbonates for use in the invention include, but are not limited to, sodium carbonate.

[00108] In addition to comprising cations of interest and other suitable metal forms, waste streams from various industrial processes may provide proton-removing agents. Such waste streams include, but are not limited to, mining wastes; fossil fuel burning ash (e.g., combustion ash such as fly ash, bottom ash, boiler slag); slag (e.g. iron slag, phosphorous slag); cement kiln waste; oil refinery/petrochemical refinery waste (e.g. oil field and methane seam brines); coal seam wastes (e.g. gas production brines and coal seam brine); paper processing waste; water softening waste brine (e.g., ion exchange effluent); silicon processing wastes; agricultural waste; metal finishing waste; high pH textile waste; and caustic sludge. Mining wastes include any wastes from the extraction of metal or another precious or useful mineral from the earth. In some embodiments, wastes from mining may be used to modify pH, wherein the waste is selected from red mud from the Bayer aluminum extraction process; waste from magnesium extraction from seawater (e.g., Mg(OH)<sub>2</sub> such as that found in Moss Landing, California); and wastes from mining processes involving leaching. For example, red mud may be used to modify pH as described in U.S. Provisional Patent Application No. 61/161369, filed 18 March 2009, which is incorporated herein by reference in its entirety. Fossil fuel burning ash, cement kiln dust, and slag, collectively waste sources of metal oxides, further described in U.S. Patent Application No. 12/486,692, filed 17 June 2009, the disclosure of which is incorporated herein in its entirety, may be used in alone or in combination with other proton-removing agents to provide proton-removing agents for the invention. Agricultural waste, either through animal waste or excessive fertilizer use, may contain potassium hydroxide (KOH) or ammonia (NH<sub>3</sub>) or both. As such, agricultural waste may be used in some embodiments of the invention as a proton-removing agent. This agricultural waste is often collected in ponds, but it may also percolate down into aquifers, where it may be accessed and used.

[00109] Electrochemical methods may be another means to remove protons from various species in a solution, either by removing protons from solute (e.g., deprotonation of carbonic acid or bicarbonate) or from solvent (e.g., deprotonation of hydronium or water). Deprotonation of solvent may result, for example, if proton production from con dissolution matches or exceeds electrochemical proton removal from solute molecules. In some embodiments, low-voltage electrochemical methods may be used to remove protons, for example, as con is dissolved in the precipitation reaction mixture or a precursor solution to the precipitation reaction

mixture (i.e., a solution that may or may not contain divalent cations). In some embodiments, con dissolved in a solution that does not contain divalent cations may be treated by a low-voltage electrochemical method to remove protons from carbonic acid, bicarbonate, hydronium, or any species or combination thereof resulting from the dissolution of  $\text{CO}_2$ . A low-voltage electrochemical method operates at an average voltage of 2, 1.9, 1.8, 1.7, or 1.6 V or less, such as 1.5, 1.4, 1.3, 1.2, 1.1 V or less, such as 1 V or less, such as 0.9 V or less, 0.8 V or less, 0.7 V or less, 0.6 V or less, 0.5 V or less, 0.4 V or less, 0.3 V or less, 0.2 V or less, or 0.1 V or less. Low-voltage electrochemical methods that do not generate chlorine gas may be convenient for use in systems and methods of the invention. Low-voltage electrochemical methods to remove protons that do not generate oxygen gas may also be convenient for use in systems and methods of the invention. In some embodiments, low-voltage electrochemical methods generate hydrogen gas at the cathode and transport it to the anode where the hydrogen gas is converted to protons. Electrochemical methods (that do not generate hydrogen gas) may also be convenient. In some instances, electrochemical methods to remove protons do not generate any gaseous by-product. Electrochemical methods for effecting proton removal are further described in U.S. Patent Application No. 12/344,019, filed 24 December 2008; U.S. Patent Application No. 12/375,632, filed 23 December 2008; International Patent Application No. PCT/US08/088242, filed 23 December 2008; International Patent Application No. PCT/US09/32301, filed 28 January 2009; International Patent Application No. PCT/US09/48511, filed 24 June 2009; and U.S. Patent Application No. 12/541,055, filed 13 August 2009, each of which are incorporated herein by reference in their entirety.

[00110] Alternatively, electrochemical methods may be used to produce caustic molecules (e.g., hydroxide) through, for example, the chlor-alkali process, or modification thereof. Electrodes (i.e., cathodes and anodes) may be present in the apparatus containing the divalent cation-containing solution or gaseous waste stream-charged (e.g., con-charged) solution, and a selective barrier, such as a membrane, may separate the electrodes. Electrochemical systems and methods for removing protons may produce by-products (e.g., hydrogen) that may be harvested and used for other purposes. Additional electrochemical approaches that may be used in systems and methods of the invention include, but are not limited to, those described in U.S. Provisional Patent Application No. 61/081,299, filed 16 July 2008, and U.S. Provisional Patent Application No. 61/091,729, the disclosures of which are incorporated herein by reference. Combinations of the above mentioned sources of proton-removing agents and methods for effecting proton removal may be employed.

[00111] A variety of different methods may be employed to prepare the  $\text{CO}_2$ -sequestering component of the concretes of the invention from the source of con, the source of divalent cations, and the source of proton-removing agents.  $\text{CO}_2$ -sequestration protocols of interest include, but are not limited to, those disclosed in U.S. Patent Application Nos. 12/026,776 and 12/163,205; as well as US, Provisional Patent Application Nos. 61/126,776, filed 23 May 2008; 12/163,205, filed 27 June 2008; 12/344,019, filed 24 December 2008; and 12/475,378, filed 29 May 2009, as well as U.S. Provisional Patent Application Nos. 61/017,405; 61/017,419; 61/057,173; 61/056,972; 61/073,319; 61/079,790; 61/081,299; 61/082,766; 61/088,347; 61/088,340; 61/101,629; and 61/101,631, filed 28 December 2007; 61/017,419, filed 28 December 2007; 61/057,173, filed 29 May 2008; 61/056,972, filed 29 May 2008; 61/073,319, filed 17 June 2008; 61/079,790, 10 July 2008; 61/081,299, filed 16 July 2008; 61/082,766, filed 22 July 2008; 61/088,347, filed 13 August 2008; 61/088,340, filed 12 August 2008; 61/101,629, filed 30 September 2008; and 61/101,631, filed 30 September 2008; each of which are incorporated herein by reference.

[00112]  $\text{CO}_3$ -sequestering components (e.g., components comprising carbonates, bicarbonates, or a combination thereof) of the invention include carbonate compositions that may be produced by precipitating a calcium and/or magnesium carbonate composition from a solution of divalent cations. The carbonate compound compositions of the invention include precipitated crystalline and/or amorphous carbonate compounds. The carbonate compound compositions that make up the  $\text{CO}_2$ -sequestering components (e.g., components comprising carbonates, bicarbonates, or a combination thereof) of the invention include metastable carbonate compounds that may be precipitated from a solution of divalent cations, such as a saltwater, as described in greater detail below.

[00113] For convenience, the invention herein is sometimes described in terms of saltwater; however, it is to be understood that any source of water comprising divalent cations may be used. Saltwater-derived carbonate compound compositions of the invention (i.e., compositions derived from saltwater and made up of one or more different carbonate crystalline and/or amorphous compounds with or without one or more hydroxide crystalline or amorphous compounds) are derived from a saltwater. As such, they comprise compositions that are obtained from salt water in some manner, e.g., by treating a volume of a saltwater in a manner sufficient to produce the desired carbonate compound composition from the initial volume of saltwater. The carbonate compound compositions of certain embodiments may be produced by precipitation from a solution of divalent cations (e.g., a saltwater) that includes alkaline earth metal cations, such as calcium and magnesium, etc., where such solutions of divalent cations may be collectively referred to as alkaline earth metal-containing waters.

[00114] The saltwater employed in methods may vary. As reviewed above, saltwater of interest include brackish water, seawater and brine, as well as other salines having a salinity that is greater than that of freshwater (which has a salinity of less than 5 ppt dissolved salts). In some embodiments, calcium rich waters may be combined with magnesium silicate minerals, such as olivine or serpentine, in solution that has become acidic due to the addition of carbon dioxide to form carbonic acid, which dissolves the magnesium silicate, leading to the formation of calcium magnesium silicate carbonate compounds as mentioned above.

[00115] In methods of producing the carbonate compound compositions of the invention, a volume of water may be subjected to carbonate compound precipitation conditions sufficient to produce a carbonate-containing precipitation material and a mother liquor (i.e., the part of the water that is left over after precipitation of the carbonate compound(s) from the saltwater). The resultant precipitation material and mother liquor collectively make up the carbonate compound compositions of the invention. Any convenient precipitation conditions may be employed, which conditions result in the production of a carbonate compound composition sequestration product.

[00116] conditions that facilitate precipitation (i.e., precipitation conditions) may vary. For example, the temperature of the water may be within a suitable range for the precipitation of the desired mineral to occur. In some embodiments, the temperature of the water may be in a range from 5 to 70  $^{\circ}\text{C}$ , such as from 20 to 50 degrees centigrade and including from 25 to 45  $^{\circ}\text{C}$ . As such, while a given set of precipitation conditions may have a temperature ranging from 0 to 100  $^{\circ}\text{C}$ , the temperature of the water may have to

be adjusted in certain embodiments to produce the desired precipitation material.

[00117] In normal seawater, 93 percent of the dissolved CO<sub>2</sub> may be in the form of bicarbonate ions (HCO<sub>3</sub><sup>-</sup>) and 6 percent may be in the form of carbonate ions (CO<sub>3</sub><sup>2-</sup>). When calcium carbonate precipitates from normal seawater, CO<sub>2</sub> is released. In fresh water, above pH 10.33, greater than 90 percent of the carbonate is in the form of carbonate ion, and no CO<sub>2</sub> is released during the precipitation of calcium carbonate. In seawater this transition occurs at a slightly lower pH, closer to a pH of 9.7. While the pH of the water employed in methods may range from pH 5 to pH 14 during a given precipitation process in certain embodiments the pH may be raised to alkaline levels in order to drive the precipitation of carbonate compounds, as well as other compounds, e.g., hydroxide compounds, as desired. In certain of these embodiments, the pH may be raised to a level that minimizes if not eliminates CO<sub>2</sub> production during precipitation, causing dissolved CO<sub>2</sub>, e.g., in the form of carbonate and bicarbonate, to be trapped in the precipitation material. In these embodiments, the pH may be raised to 10 or higher, such as 11 or higher.

[00118] The pH of the water may be raised using any convenient approach. In certain embodiments, a proton-removing agent may be employed, where examples of such agents include oxides, hydroxides (e.g., calcium oxide in fly ash.

potassium hydroxide, sodium hydroxide, brucite Mg(OH)<sub>2</sub>, etc.), carbonates (e.g., sodium carbonate), and the like, many of which are described above. One such approach for raising the pH of the precipitation reaction mixture or precursor thereof (e.g., divalent cation-containing solution) is to use the coal ash from a coal-fired power plant, which contains many oxides. Other coal processes, like the gasification of coal, to produce syngas, also produce hydrogen gas and carbon monoxide, and may serve as a source of hydroxide as well. Some naturally occurring minerals, such as serpentine, contain hydroxide, and may be dissolved to yield a source of hydroxide. The addition of serpentine, also releases silica and magnesium into the solution, leading to the formation of silica-containing precipitation material. The amount of proton-removing agent that is added to the precipitation reaction mixture or precursor thereof will depend on the particular nature of the proton-removing agent and the volume of the precipitation reaction mixture or precursor thereof being modified, and will be sufficient to raise the pH of the precipitation reaction mixture or precursor thereof to the desired pH. Alternatively, the pH of the precipitation reaction mixture or precursor thereof may be raised to the desired level by electrochemical means as described above. Additional electrochemical methods may be used under certain conditions. For example, electrolysis may be employed, wherein the mercury cell process (also called the Castner-Kellner process); the diaphragm cell process, the membrane cell process, or some combination thereof may be used. Where desired, byproducts of the hydrolysis product, e.g., H<sub>2</sub> sodium metal, etc. may be harvested and employed for other purposes, as desired.

[00119] In yet other embodiments, the pH-elevating approach described in U.S. Provisional Patent Application Nos. 61/081,299, filed 16 July 2008, and 61/091,729, filed 25 August 2008, may be employed, the disclosures of which are incorporated herein by reference.

[00120] Additives other than pH-elevating agents may also be introduced into the water in order to influence the nature of the precipitation material produced. As such, certain embodiments of the methods include providing an additive in water before or during the time when the water is subjected to the precipitation conditions. Certain calcium carbonate polymorphs can be favored by trace amounts of certain additives. For example, vaterite, a highly unstable polymorph of CaCO<sub>3</sub>, which precipitates in a variety of different morphologies and converts rapidly to calcite, may be obtained at very high yields by including trace amounts of lanthanum as lanthanum chloride in a supersaturated solution of calcium carbonate. Other additives beside lanthanum that are of interest include, but are not limited to transition metals and the like. For instance, the addition of ferrous or ferric iron is known to favor the formation of disordered dolomite (proludolomite) where it would not form otherwise.

[00121] The nature of the precipitation material can also be influenced by selection of appropriate major ion ratios. Major ion ratios also have considerable influence of polymorph formation. For example, as the magnesium:calcium ratio in the water increases, aragonite becomes the favored polymorph of calcium carbonate over low-magnesium calcite. At low magnesium:calcium ratios, low-magnesium calcite may be the preferred polymorph. As such, a wide range of magnesium:calcium ratios may be employed, including, for example, 100:1, 50:1, 20:1, 10:1, 5:1, 2:1, 1:1, 1:2, 1:5, 1:10, 1:20, 1:50, 1:100, or any of the ratios mentioned above. In certain embodiments, the magnesium:calcium ratio may be determined by the source of water employed in the precipitation process (e.g., seawater, brine, brackish water, fresh water), whereas in other embodiments, the magnesium:calcium ratio may be adjusted to fall within a certain range.

[00122] Rate of precipitation also has a large effect on compound phase formation. The most rapid precipitation may be achieved by seeding the solution with a desired phase. Without seeding, rapid precipitation may be achieved by rapidly increasing the pH of the seawater, which results in more amorphous constituents. When silica is present, the more rapid the reaction rate, the more silica is incorporated in the carbonate-containing precipitation material. The higher the pH is, the more rapid the precipitation is and the more amorphous the precipitation material.

[00123] Accordingly, a set of precipitation conditions to produce a desired precipitation material from a solution of divalent cations includes, in certain embodiments, the water's temperature and pH, and in some instances, the concentrations of additives and ionic species in the water. Precipitation conditions may also include factors such as mixing rate, forms of agitation such as ultrasonics, and the presence of seed crystals, catalysts, membranes, or substrates. In some embodiments, precipitation conditions include supersaturated conditions, temperature, pH, and/or concentration gradients, or cycling or changing any of these parameters. The protocols employed to prepare carbonate-containing precipitation material according to the invention may be batch or continuous protocols. It will be appreciated that precipitation conditions may be different to produce a given precipitation material in a continuous flow system compared to a batch system.

[00124] In certain embodiments, the methods further include contacting the volume of water (that is subjected to the mineral precipitation conditions with a source of CO<sub>2</sub>. Contact of the water with the source of CO<sub>2</sub> may occur before and/or during the time when the water is subjected to CO<sub>2</sub> precipitation conditions. Accordingly, embodiments of the invention include methods in which the volume of water may be contacted with a source of CO<sub>2</sub> prior to subjecting the volume of saltwater to mineral precipitation conditions. Embodiments of the invention include methods in which the volume of saltwater may be contacted with a source of CO<sub>2</sub>

while the volume of saltwater is being subjected to carbonate compound precipitation conditions. Embodiments of the invention include methods in which the volume of water may be contacted with a source of a con both prior to subjecting the volume of saltwater to carbonate compound precipitation conditions and while the volume of saltwater is being subjected to carbonate compound precipitation conditions. In some embodiments, the same water may be cycled more than once, wherein a first cycle of precipitation removes primarily calcium carbonate and magnesium carbonate minerals, and leaves remaining alkaline water to which other alkaline earth ion sources may be added, that can have more carbon dioxide cycled through it, precipitating more carbonate compounds.

[00125] The source of con that may be contacted with the volume of saltwater in these embodiments may be any convenient con source, and the contact protocol may be any convenient protocol. Where the con is a gas, contact protocols of interest include, but are not limited to: direct contacting protocols, e.g., bubbling the gas through the volume of saltwater, concurrent contacting means, i.e., contact between unidirectionally flowing gaseous and liquid phase streams, countercurrent means, i.e., contact between oppositely flowing gaseous and liquid phase streams, and the like. Thus, contact may be accomplished through use of infusers, bubblers, fluidic Venturi reactor, sparger, gas filter, spray, tray, or packed column reactors, and the like, as may be convenient. For exemplary system and methods for contacting the solution of divalent cations with the source of con, see U.S. Provisional Patent Application Nos. 61/158,992, filed 10 March 2009; 61/168,166, filed 9 April 2009; 61/170,086, filed 16 April 2009; 61/178,475, filed 14 May 2009; 61/228,210, filed 24 July 2009; 61/230,042, filed 30 July 2009; and 61/239,429, filed 2 September 2009, each of which is incorporated herein by reference.

[00126] The above protocol results in the production of a slurry of a carbonate/bicarbonate precipitation material (e.g., CO<sub>2</sub>-sequestering precipitation material) and a mother liquor. Where desired, the compositions made up of the precipitation material and the mother liquor may be stored for a period of time following precipitation and prior to further processing. For example, the composition may be stored for a period of time ranging from 1 to 1000 days or longer, such as 1 to 10 days or longer, at a temperature ranging from 1 to 40 degrees centigrade such as 20 to 25 degrees centigrade.

[00127] The slurry components may then be separated. Embodiments may include treatment of the mother liquor, where the mother liquor may or may not be present in the same composition as the product. For example, where the mother liquor is to be returned to the ocean, the mother liquor may be contacted with a gaseous source of CO<sub>2</sub> in a manner sufficient to increase the concentration of carbonate ion present in the mother liquor. Contact may be conducted using any convenient protocol, such as those described above. In certain embodiments, the mother liquor has an alkaline pH, and contact with the con source may be carried out in a manner sufficient to reduce the pH to a range between 5 and 9, e.g., 6 and 8.5, including 7.5 to 8.2. In certain embodiments, the treated brine may be contacted with a source of CO<sub>3</sub>, e.g., as described above, to sequester further con. For example, where the mother liquor is to be returned to the ocean, the mother liquor may be contacted with a gaseous source of con in a manner sufficient to increase the concentration of carbonate ion present in the mother liquor. Contact may be conducted using any convenient protocol, such as those described above. In certain embodiments, the mother liquor has an alkaline pH, and contact with the con source may be carried out in a manner sufficient to reduce the pH to a range between 5 and 9, e.g., 6 and 8.5, including 7.5 to 8.2.

[00128] The resultant mother liquor of the reaction may be disposed of using any convenient protocol. In certain embodiments, it may be sent to a tailings pond for disposal. In certain embodiments, it may be disposed of in a naturally occurring body of water, e.g., ocean, sea, lake or river. In certain embodiments, the mother liquor is returned to the source of feed water for the methods of invention, e.g., an ocean or sea. Alternatively, the mother liquor may be further processed, e.g., subjected to desalination protocols, as described further in U.S. Patent Application No. 12/163,205; the disclosure of which is incorporated herein by reference.

[00129] In certain embodiments, following production of the precipitation material (e.g., con-sequestering component), the resultant material may be separated from the mother liquor to produce separated precipitation material (e.g., con-sequestering product). Separation of the precipitation material (e.g., CO<sub>2</sub>-sequestering component) may be achieved using any convenient approach, including a mechanical approach, e.g., where bulk excess water is drained from the precipitation material e.g., either by gravity alone or with the addition of vacuum, mechanical pressing, by filtering the precipitation material from the mother liquor to produce a filtrate, etc. Separation of bulk water produces, in certain embodiments, a wet, dewatered precipitation material.

[00130] The resultant dewatered precipitation material may then be dried, as desired, to produce a dried product. Drying may be achieved by air drying the wet precipitation material. Where the wet precipitation material is air dried, air drying may be at room or elevated temperature. In yet another embodiment, the wet precipitation material may be spray dried to dry the precipitation material, where the liquid containing the precipitation material is dried by feeding it through a hot gas (such as the gaseous waste stream from the power plant), e.g., where the liquid feed is pumped through an atomizer into a main drying chamber and a hot gas is passed as a co-current or counter-current to the atomizer direction. Depending on the particular drying protocol of the system, the drying station may include a filtration element, freeze drying structure, spray drying structure, etc. Where desired, the dewatered precipitation material product may be washed before drying. The precipitation material may be washed with freshwater, e.g., to remove salts (such as NaCl) from the dewatered precipitation material.

[00131] In certain embodiments, the precipitation material may be refined (i.e., processed) in some manner prior to subsequent use. Refinement may include a variety of different protocols. In certain embodiments, the product may be subjected to mechanical refinement, e.g., grinding, in order to obtain a product with desired physical properties, e.g., particle size, etc.

[00132] In some embodiments, the product may be employed as a "supplementary cementitious material" (SCM). SCMs are those materials which, though they may or may not be hydraulically cementitious in and of themselves, react to a degree with a hydraulic cement composition, such as Portland cement, to produce a cured material. Examples of common SCMs for use in Portland cement compositions include fly ash and ground granulated blast furnace slag.

[00133] In certain embodiments, the product may be utilized to produce aggregates. The resultant precipitation material may then be prepared as an aggregate, with or without drying the powders. In certain embodiments where the drying process produces particles

of the desired size, little if any additional work may be required to produce the aggregate. In yet other embodiments, further processing of the precipitation material may be performed in order to produce the desired aggregate. For example, as noted above, the precipitation material may be combined with fresh water in a manner sufficient to cause the precipitation material to form a solid product, where the metastable carbonate compounds present in the precipitation material have converted to a form that is stable in fresh water.

By controlling the water content of the wet material, the porosity, and eventual strength and density of the final aggregate may be controlled. Typically a wet cake will be 40-60 volume percent water. For denser aggregates, the wet cake will be < 50 percent water, for less dense cakes, the wet cake will be > 50 percent water. After hardening, the resultant solid product may then be mechanically processed, e.g., crushed or otherwise broken up and sorted to produce aggregate of the desired characteristics, e.g., size, particular shape, etc. In these processes the setting and mechanical processing steps may be performed in a substantially continuous fashion or at separate times. In certain embodiments, large volumes of precipitation material may be stored in the open environment where the precipitation material is exposed to the atmosphere. For the setting step, the precipitation material may be irrigated in a convenient fashion with fresh water, or allowed to be rained on naturally or order to produce the set product. The set product may then be mechanically processed as described above. Following production of the precipitation material, the precipitation material may be processed to produce the desired aggregate. In some embodiments, the precipitation material may be left outdoors, where rainwater may be used as the freshwater source, to cause the intrinsic water stabilization reaction to occur, hardening the precipitation material to form aggregate.

[00134] In an example of one embodiment of the invention, the precipitation material may be mechanically spread in a uniform manner using a belt conveyor and highway grader onto a compacted earth surface to a depth of interest, e.g., up to twelve inches, such as 1 to 12 inches, including 6 to 12 inches. The spread material may then be irrigated with fresh water at a convenient rate, e.g., of one-half gallon of water per cubic foot of precipitation material. The material may then be compacted using multiple passes with a steel roller, such as those used in compacting asphalt. The surface may be re-irrigated on a weekly basis until the material exhibits the desired chemical and mechanical properties, at which point the material may be mechanically processed into aggregate by crushing.

[00135] In an example of an additional embodiment of the invention, the carbonate compound precipitation material, once separated from the mother liquor, may be washed with fresh water, then placed into a filter press to produce a filter cake with 30-60 percent solids. This filter cake may then be mechanically pressed in a mold, using any convenient means, e.g., a hydraulic press, at adequate pressures, e.g., ranging from 5 to 1000 psi, such as 1 to 200 psi, to produce a formed solid, e.g., a rectangular brick. These resultant solids may then be cured, e.g., by placing outside and storing, by placing in a chamber within which they are subjected to high levels of humidity and heat, etc. These resultant cured solids may then be used as building materials themselves or crushed to produce aggregate. Such aggregates, methods for their manufacture and use are further described in co-pending U.S. Patent Application No. 61/056,972, filed on May 29, 2008, the disclosure of which is incorporated herein by reference.

[00136] Fig. 1 provides a schematic (flow diagram of a process for producing a carbonate/bicarbonate (e.g., CO<sub>3</sub>-sequestering component) according to an embodiment of the invention. In Fig. 1, divalent cations from source of divalent cations 110 is subjected to carbonate compound precipitation conditions at precipitation step 120. As reviewed above, saltwater refers to any of a number of different types of aqueous fluids other than freshwater, including brackish water, seawater and brine (including man-made brines, e.g., geothermal plant wastewaters, desalination waste waters, etc), as well as other salines having a salinity greater than that of freshwater. The saltwater source from which the carbonate compound composition of the cements of the invention may be derived may be a naturally occurring source, such as a sea, ocean, lake, swamp, estuary, lagoon, etc., or a man-made source,

[00137] In certain embodiments, the water may be obtained from the power plant that is also providing the gaseous waste stream. For example, in water cooled power plants, such as seawater cooled power plants, water that has been employed by the power plant may then be sent to the precipitation system and employed as the water in the precipitation reaction. In certain of these embodiments, the water may be cooled prior to entering the precipitation reactor.

[00138] In the embodiment depicted in Fig. 1, a solution of divalent cations from the source of divalent cations 110 is first charged with con to produce con-charged water, which CO<sub>3</sub> is then subjected to carbonate compound precipitation conditions. As depicted in Fig. 1, a CO<sub>2</sub>-containing gaseous stream 130 is contacted with the solution of divalent cations at precipitation step 120. The provided gaseous stream 130 is contacted with a suitable divalent-cation containing solution at precipitation step 120 to produce a CO<sub>3</sub>-charged water. CO<sub>3</sub>-charged water is water that has been in contact with con gas, where con molecules have combined with water molecules to produce, e.g., carbonic acid, bicarbonate and carbonate ion. Charging water in this step results in an increase in the "con content" of the water, e.g., in the form of carbonic acid, bicarbonate and carbonate ion, and a concomitant decrease in the pCO<sub>2</sub> of the waste stream that is contacted with the water. The CO<sub>2</sub>-charged water may be acidic, having a pH of 6 or less, such as 5 or less and including 4 or less. In certain embodiments, the concentration of con of the gas used to charge the water may be 10 percent or higher, 25 % or higher, including 50 percent or higher, such as 75 percent or even higher. contact protocols of interest include, but are not limited to: direct contacting protocols, e.g., bubbling the gas through the volume of water, concurrent contacting means, i.e., contact between unidirectionally flowing gaseous and liquid phase streams, countercurrent means, i.e., contact between oppositely flowing gaseous and liquid phase streams, and the like. Thus, contact may be accomplished through use of infusers, bubblers, fluidic Venturi reactor, sparger, gas filter, spray, tray, or packed column reactors, and the like, as may be convenient.

[00139] At precipitation step 120, carbonate compounds, which may be amorphous or crystalline, are precipitated. Precipitation conditions of interest include those that change the physical environment of the water to produce the desired precipitation material. For example, the temperature of the water may be raised to an amount suitable for precipitation of the desired carbonate compound(s) to occur. In such embodiments, the temperature of the water may be raised to a value from 5 to 70 degrees centigrade, such as from 20 to 50 degrees centigrade and including from 25 to 45 degrees centigrade. As such, while a given set of precipitation conditions may have a temperature ranging from 0 to 100 degrees centigrade, the temperature may be raised in certain embodiments to produce the desired precipitation material. In certain embodiments, the temperature may be raised using

energy generated from low or zero carbon dioxide emission sources, e.g., solar energy source, wind energy source, hydroelectric energy source, etc. While the pH of the water may range from 7 to 14 during a given precipitation process, in certain embodiments the pH may be raised to alkaline levels in order to drive the precipitation of carbonate compound as desired. In certain of these embodiments, the pH may be raised to a level that minimizes if not eliminates CO<sub>2</sub> gas generation production during precipitation. In these embodiments, the pH may be raised 10 or higher, such as 11 or higher. Where desired, the pH of the water may be raised using any convenient approach, in certain embodiments a pH-raising agent may be employed, where examples of such agents include oxides, hydroxides (e.g., sodium hydroxide, potassium hydroxide, brucite), carbonates (e.g. sodium carbonate) and the like. The amount of pH-elevating agent that is added to the saltwater source will depend on the particular nature of the agent and the volume of saltwater being modified, and will be sufficient to raise the pH of the saltwater source to the desired value. Alternatively, the pH of the saltwater source may be raised to the desired level by electrolysis of the water.

[00140] Con charging and carbonate compound precipitation may occur in a continuous process or at separate steps. As such, charging and precipitation may occur in the same reactor of a system, e.g., as illustrated in Fig. 1 at step 120, according to certain embodiments of the invention. In yet other embodiments of the invention, these two steps may occur in separate reactors, such that the water is first charged with con in a charging reactor (i.e., a gas-liquid or gas-liquid-solid contactor) and the resultant con-charged water is then subjected to precipitation conditions in a separate reactor.

[00141] Following production of the carbonate-containing precipitation material from the water, the resultant precipitation material (i.e., resultant con-sequestering component) may be separated from, some or all the mother liquor to produce separated precipitation material, as illustrated in Fig. 1 at step 140. Separation of the precipitation material may be achieved using any convenient approach, including a mechanical approach, e.g., where bulk excess water is drained from the precipitation material, e.g., either by gravity alone or with the addition of vacuum, mechanical pressing, by filtering the precipitation material from the mother liquor to produce a filtrate, etc. For exemplary system and methods for bulk water removal that may be used in the invention, see U.S. Provisional Patent Application Nos. 61/158,992, filed 10 March 2009; 61/168,166, filed 9 April 2009; 61/170,086, filed 16 April 2009; 61/178,475, filed 14 May 2009; 61/228,210, filed 24 July 2009; 61/230,042, filed 30 July 2009; and 61/239,429, filed 2 September 2009, each of which is incorporated herein by reference. Separation of bulk water produces a wet, dewatered precipitation material (i.e., dewatered CO<sub>2</sub>-sequestering component of reduced-carbon footprint concrete compositions).

[00142] The resultant dewatered precipitation material may be used directly, or the resultant dewatered precipitation material may be further dried. In some embodiments, the resultant dewatered precipitation material may be used directly. Directly using the resultant dewatered precipitation material may be convenient in applications that require some amount of water. In a non-limiting example, dewatered precipitation material may be mixed with ordinary Portland cement, wherein the dewatered precipitation material provides at least a portion of the water needed for hydration and placement of the cement mixture. In some embodiments, the dewatered precipitation material may be more than 5 percent water, more than 10 percent water, more than 20 percent water, more than 30 percent water, more than 50 percent water, more than 60 percent water, more than 70 percent water, more than 80 percent water, more than 90 percent water, or more than 95 percent water. In some embodiments, the dewatered precipitation material provides at least 5 percent of the water, at least 10 percent of the water, at least 20 percent of the water, at least 30 percent of the water, at least 40 percent of the water, at least 50 percent of the water, at least 60 percent of the water, at least 70 percent of the water, at least 80 percent of the water, at least 90 percent of the water, or at least 95 percent of the water needed for the application that the dewatered precipitation material is being used. In some embodiments, the dewatered precipitation material provides all of the water needed for the application that the dewatered precipitation material is being used. For example, the dewatered precipitation material may provide all of the water needed for hydration and placement of a cement mixture of dewatered precipitation material and ordinary Portland cement. For instance, precipitation material may be dewatered such that the dewatered precipitation material comprises nearly 70 percent water, such as 66.5 percent water. The slurry of precipitation material may then be mixed with ordinary Portland cement such that the resultant cement mixture comprises 80 percent ordinary Portland cement and 20 percent precipitation material, wherein the water to cement (i.e., ordinary Portland cement and precipitation material) ratio is about 40 percent. By controlling the amount of water that is removed from the precipitation material, the carbon footprint of the material (e.g., reduced-carbon footprint concrete) being made from the precipitation material is being controlled as well, especially if the material requires water. With this in mind, the small, neutral, or negative carbon footprint of any of the product materials described herein may be further reduced by removing only as much water as needed from the precipitation material.

[00143] As described above, the resultant dewatered precipitation material may also be dried to produce a product, as illustrated at step 160 of Fig. 1. Drying may be achieved by air-drying the filtrate. Where the filtrate is air dried, air-drying may be at room or elevated temperature. Dewatered precipitation material may be air dried to produce a precipitation material that may be less than 50 percent; water, less than 40 percent water, less than 30 percent water, less than 20 percent water, less than 10 percent water, or less than 5 percent water. For example, dewatered precipitation material may be air dried to produce a precipitation material that is 30 percent or less water. Such precipitation material may be crushed with or without additional processing (e.g., high shear mixing) and combined with other materials such as ordinary Portland cement to produce a cement mixture comprising a portion of the water needed for hydration and placement of the cement mixture. Drying may also be achieved by spray drying the precipitation material, where the liquid containing the precipitation material is dried by feeding it through a hot gas (such as the gaseous waste stream from the power plant), e.g., where the liquid feed is pumped through an atomizer into a main drying chamber and a hot gas is passed as a co-current or counter-current to the atomizer direction. Depending on the particular drying protocol of the system, the drying station may include a filtration element, freeze drying structure, spray drying structure, etc.

[00144] Where desired, the dewatered precipitation material from liquid-solid separation may be washed before drying, as illustrated at optional step 150 of Fig. 1. The precipitation material may be washed with freshwater, e.g., to remove salts (such as NaCl) from the dewatered precipitation material. Used wash water may be disposed of as convenient, e.g., by disposing of it in a tailings pond, etc.

[00145] At step 170, the dried precipitation material may be optionally refined, e.g., to provide for desired physical characteristics, such as particle size, surface area, etc., or to add one or more components to the precipitation material, such as admixtures, aggregate, supplementary cementitious materials, etc., to produce a final product 80. [00146] Figs. 4, 5, and 6 provide depictions of

additional embodiments of processes for preparing con-sequestering products. In Fig. 6, the source of con is directly from power plant flue gas. The flue gas may be dissolved into seawater, stripping the gas of con, SO<sub>x</sub>, and NO<sub>x</sub> to exhaust clean air. When dissolved, the con converts to carbonic acid and forms carbonates with divalent cations (e.g., Ca<sup>2+</sup> Mg<sup>2+</sup>) in the seawater to create SCM and aggregates, while the NO<sub>x</sub> and SO<sub>x</sub> are neutralized and sequestered as well. A slurry containing carbonates (e.g., calcium and/or magnesium carbonate) may be formed and spray dried to create the desired particle sizes. The process includes sophisticated controls on sodium chloride, avoiding corrosive effects on reinforcement bar, and generates clean air and clean water that may be easier to desalinate due to reduced hardness (e.g., reduced concentrations of calcium and magnesium). Although magnesium is viewed as undesirable in concrete, this form of MgCO<sub>3</sub> is more akin to CaCO<sub>3</sub>, rather than magnesium hydroxide (Mg(OH)<sub>2</sub>), which is typically avoided.

[00147] In certain embodiments, a system such as system 200 of Fig. 2 may be employed to perform the above methods. System 200 of Fig. 2 includes con-containing gas source 230 (e.g., flue gas from a con-fired power plant). This system also includes a conveyance structure such as a pipe, duct, or conduit, which directs the CO<sub>2</sub>-containing gas to processor 220 from con-containing gas source 230. Also shown in Fig. 2 is divalent cation-containing solution source 210 (e.g., body of water, tank of divalent cation-containing solution, etc.). In some embodiments, divalent cation-containing solution source 210 includes a conveyance structure such as a pipe, duct, or conduit, which directs the divalent cation-containing solution (e.g., alkaline earth metal ion-containing aqueous solution) to the processor (220). Where the divalent cation-containing solution source is seawater, the conveyance structure is in fluid communication with the source of seawater (e.g., the input is a pipe line or feed from ocean water to a land-based system, or the input is an inlet port in the hull of ship in an ocean-based system).

[00148] The aqueous solution of divalent cations provided to the processor or a component thereof (e.g. gas-liquid contactor, gas-liquid-solid contactor; etc.) may be recirculated by a recirculation pump such that absorption of con-containing gas (e.g., comprising con, SO<sub>x</sub>, NO<sub>x</sub>, metals and metal-containing compounds, particulate matter, etc.) is optimized within a gas-liquid contactor or gas-liquid-solid contactor within the processor. With or without recirculation, processors of the invention or a component thereof (e.g. gas-liquid contactor, gas-liquid-solid contactor; etc.) may effect at least 25 percent, 50 percent, 70 percent, or 90 percent dissolution of the CO<sub>2</sub> in the con-containing gas. Dissolution of other gases (e.g., SO<sub>x</sub>) may be even greater, for example, at least 95 percent, 98 percent, or 99 percent.

Additional parameters that provide optimal absorption of con-containing gas include a specific surface area of 0.1 to 30, 1 to 20, 3 to 20, or 5 to 20 cm<sup>2</sup>; a liquid side mass transfer coefficient (k<sub>L</sub>) of 0.05 to 2, 0.1 to 1, 0.1 to 0.5, or 0.1 to 0.3 cm/s; and a volumetric mass transfer coefficient (K<sub>1a</sub>) of 0.01 to 10, 0.1 to 8, 0.3 to 6, or 0.6 to 4.0 s<sup>-1</sup>. In some embodiments, absorption of CO<sub>2</sub>-containing gas by the aqueous solution of divalent cations causes precipitation of at least a portion of precipitation material in the gas-liquid contactor. In some embodiments, precipitation primarily occurs in a precipitator of the processor. The processor, while providing a structure for precipitation of precipitation material, may also provide a preliminary means for settling (i.e., the processor may act as a settling tank). The processor, whether providing for settling or not, may provide a slurry of precipitation material to a dewatering feed pump, which, in turn, provides the slurry of precipitation material to the liquid-solid separator where the precipitation material and the precipitation reaction mixture are separated.

[00149] The processor 220 may further include any of a number of different components, including, but not limited to, temperature regulators (e.g., configured to heat the precipitation reaction mixture to a desired temperature); chemical additive components (e.g., for introducing chemical proton-removing agents such as hydroxides, metal oxides, or fly ash); electrochemical components (e.g., cathodes/anodes); components for mechanical agitation and/or physical stirring mechanisms; and components for recirculation of industrial plant flue gas through the precipitation plant. Processor 220 may also contain components configured for monitoring one or more parameters including, but not limited to, internal reactor pressure, pH, precipitation material particle size, metal-ion concentration, conductivity, alkalinity, and pCO<sub>2</sub>. Processor 220, in step with the entire precipitation plant, may operate as batch wise, semi-batch wise, or continuously.

[00150] Processor 220, further includes an output conveyance for slurry comprising precipitation material or separated supernatant. In some embodiments, the output conveyance may be configured to transport the slurry or supernatant to a tailings pond for disposal or a naturally occurring body of water, e.g., ocean, sea, lake, or river. In other embodiments, systems may be configured to allow for the slurry or supernatant to be employed as a coolant for an industrial plant by a line running between the precipitation system and the industrial plant. In certain embodiments, the precipitation plant may be co-located with a desalination plant, such that output water from the precipitation plant is employed as input water for the desalination plant. The systems may include a conveyance (i.e., duct) where the output water (e.g., slurry or supernatant) may be directly pumped into the desalination plant.

[00151] The system illustrated in Fig. 2 further includes a liquid-solid separator 240 for separating precipitation material from precipitation reaction mixture. The liquid-solid separator may achieve separation of precipitation material from precipitation reaction mixture by draining (e.g., gravitational sedimentation of the precipitation material followed by draining), decanting, filtering (e.g., gravity filtration, vacuum filtration, filtration using forced air), centrifuging, pressing, or any combination thereof. At least one liquid-solid separator is operably connected to the processor such that precipitation reaction mixture may flow from the processor to the liquid-solid separator. Any of a number of different liquid-solid separators may be used in combination, in any arrangement (e.g., parallel, series, or combinations thereof), and the precipitation reaction mixture may flow directly to the liquid-solid separator, or the precipitation reaction mixture may be pre-treated.

[00152] System 200 also includes a washer (250) where bulk dewatered precipitation material from liquid-solid separator 240 is washed (e.g., to remove salts and other solutes from the precipitation material), prior to drying at the drying station (e.g., dryer 260).

[00153] The system may further include a dryer 260 for drying the precipitation material comprising carbonates (e.g., calcium carbonate, magnesium carbonate), bicarbonates, or a combination thereof produced in the processor. Depending on the particular system, the dryer may include a filtration element, freeze-drying structure, spray-drying structure, or the like. The system may include a conveyer (e.g., duct) from the industrial plant that is connected to the dryer so that con-containing gas (i.e., industrial plant flue gas) may be contacted directly with the wet precipitation material in the drying stage.

[00154] The dried precipitation material may undergo further processing (e.g., grinding, milling) in refining station 270 in order to obtain desired physical properties. One or more components may be added to the precipitation material during refining if the precipitation material is to be used as a building material.

[00155] The system further includes outlet conveyers (e.g., conveyor belt, slurry pump) configured for removal of precipitation material from one or more of the following: the processor, dryer, washer, or from the refining station. As described above, precipitation material may be disposed of in a number of different ways. The precipitation material may be transported to a long-term storage site in empty conveyance vehicles (e.g., barges, train cars, trucks, etc.) that may include both above ground and underground storage facilities. In other embodiments, the precipitation material may be disposed of in an underwater location. Any convenient conveyance structure for transporting the precipitation material to the site of disposal may be employed. In certain embodiments, a pipeline or analogous slurry conveyance structure may be employed, wherein these structures may include units for active pumping, gravitational mediated flow, and the like.

[00156] A person having ordinary skill in the art will appreciate that flow rates, mass transfer, and heat transfer may vary and may be optimized for systems and methods described herein, and that parasitic load on a power plant may be reduced while carbon sequestration is maximized.

## SETTABLE COMPOSITIONS

[00157] Additional aspects of the invention are settable compositions that include reduced-carbon footprint concrete compositions of the invention combined with a water. Settable compositions of the invention may be produced by combining the concrete composition and water, either at the same time or by pre-combining a cement with aggregate, and then combining the resultant dry components with water.

[00158] The liquid phase, e.g., aqueous fluid, with which the dry component may be combined to produce the settable composition, e.g., concrete, may vary, from pure water to water that includes one or more solutes, additives, co-solvents, etc., as desired. The ratio of dry component to liquid phase that is combined in preparing the settable composition may vary, and in certain embodiments ranges from 2:10 to 7:10, such as 3:10 to 6:10 and including 4:10 to 6:10.

[00159] Current cement standards such as ASTM C150 allow for the substitution of ground limestone for a portion of the clinker in making Portland cement. In the case of ASTM C150 the maximum allowable percentage is 5 percent. In some European standards there is allowance of higher percentages, often 10 percent but at times as high as 30 percent, of limestone as clinker replacement in making Portland cement. In these cases the limestone may be ground separately and blended with the Portland cement, but limestone aggregate may also be added to the clinker at the ball-milling stage and interground with the clinker and a small amount of gypsum to produce Portland cement.

[00160] The use of a calcium carbonate additive from a carbon sequestration precipitation reaction rather than natural mined limestone has several advantages for the cement producer. Assuming a 5 percent replacement of clinker with the precipitation material, the carbon footprint of the resultant cement may be reduced 7.2 percent, whereas in using ground limestone the carbon footprint may be only reduced 5 percent or less. Given the pressure on carbon footprint reduction which the Portland cement industry faces, the additional 2.2 percent further reduction in carbon footprint versus using mined limestone has considerable value.

[00161] An additional benefit of the use of a precipitated calcium carbonate as clinker replacement is that it is generally more pure than mined limestone. In many instances, impurities in the limestone limit the use of that limestone to less than the full allowed amount, due to impurities which reduce the properties of the resultant Portland cement. In certain Portland cement plants, ability to use local mined limestone is limited to perhaps 2.0 percent. The utilization of a carbon-sequestering precipitated calcium carbonate at 5 percent would result in an improvement in carbon footprint reduction of 5.2 percent, from 2.0 percent to 7.2 percent.

[00162] Reduction in carbon footprint of Portland cement by using carbon-sequestering precipitated calcium carbonate has the further advantage of potentially producing additional revenue via carbon credits. Because the material added, even if it is mined limestone, reduces the amount of clinker used, there is potential for obtaining carbon credits for emissions reduction from the cement facility. The sequestered CO<sub>2</sub> in the precipitation material may be utilized to increase the amount and value of the carbon credits available for clinker reduction.

## UTILITY

[00163] The subject concretes and settable compositions that include the same, find use in a variety of different applications, particularly as building or construction materials. Specific structures in which the settable compositions of the invention find use include, but are not limited to: pavements, architectural structures, e.g., buildings, foundations, motorways/roads, overpasses, parking structures, brick/block walls and footings for gates, fences and poles, bridges, foundations, levees, dams. Mortars of the invention find use in binding construction blocks, e.g., bricks, together and filling gaps between construction blocks. Mortars can also be used to fix existing structure, e.g., to replace sections where the original mortar has become compromised or eroded, among other uses.

[00164] Embodiments of the invention find use in reducing the amount of CO<sub>2</sub> that is generated in producing buildings and then operating buildings. Specifically, the methods of the invention can reduce CO<sub>2</sub> generation in production of building materials, e.g., concrete. In addition, the methods can reduce CO<sub>2</sub> emission in power generation, which reduces CO<sub>2</sub> emissions connected with operating a building during its life.

[00165] The subject methods and systems find use in CO<sub>2</sub> sequestration, particularly via sequestration in the built environment.

Sequestering con comprises removal or segregation of con from the gaseous stream, such as a gaseous waste stream, and fixating it into a stable non-gaseous form so that the con cannot escape into the atmosphere. CO-sequestration comprises the placement of con into a storage stable form, e.g., a component of the built environment, such as a building, road, dam, levee, foundation, etc. As such, sequestering of con according to methods of the invention results in prevention of con gas from entering the atmosphere and long-term storage of con in a manner that CO<sub>2</sub> does not become part of the atmosphere. By storage stable form is meant a form of matter that may be stored above ground or underwater under exposed conditions (i.e., open to the atmosphere, underwater environment, etc.) without significant, if any, degradation for extended durations, e.g., 1 year or longer, 5 years or longer, 10 years or longer, 25 years or longer, 50 years or longer, 100 years or longer, 250 years or longer, 1000 years or longer, 10,000 years or longer, 1,000,000 years or longer, or even 100,000,000 years or longer. As the storage stable form undergoes little if any degradation while stored, the amount of degradation if any as measured in terms of con gas release from the product will not exceed 5 percent /year. and in certain embodiments will not exceed 1 percent /year. The above-ground storage stable forms may be storage stable under a variety of different environment conditions, e.g., from temperatures ranging from -100 degrees centigrade to 600 °C, humidity ranging from 0 to 100 percent, where the conditions may be calm, windy, turbulent or stormy. The below water storage stable forms are similarly stable to with respect to underwater environment conditions. Embodiments of the methods may be used to capture all the waste con of industrial processes, e.g., power generation, cement production, chemical production, paper and steel mills, etc.

[00166] The following examples are put forth so as to provide those of ordinary skill in the art with a complete disclosure and description of how to make and use the invention, and are not intended to limit the scope of what the inventors regard as their invention nor are they intended to represent that the experiments below are all or the only experiments performed. Efforts have been made to ensure accuracy with respect to numbers used (e.g. amounts, temperature, etc.) but some experimental errors and deviations should be accounted for.

[00167] All examples and conditional language recited herein are principally intended to aid the reader in understanding the principles of the invention and the concepts contributed by the inventors to furthering the art, and are to be construed as being without limitation to such specifically recited examples and conditions. Moreover, all statements herein reciting principles, aspects, and embodiments of the invention as well as specific examples thereof, are intended to encompass both structural and functional equivalents thereof. Additionally, it is intended that such equivalents include both currently known equivalents and equivalents developed in the future, i.e., any elements developed that perform the same function, regardless of structure. The scope of the invention, therefore, is not intended to be limited to the exemplary embodiments shown and described herein as such embodiments are provided by way of example only. Indeed, numerous variations, changes, and substitutions may now occur to those skilled in the art without departing from the invention. It is intended that the following claims define the scope of the invention and that methods and structures within the scope of these claims and their equivalents be covered thereby,

## EXAMPLES

[00168] I. Components of Reduced-Carbon Footprint concrete Compositions

[00169] A. Supplementary Cementitious Mineral Admixture (SCMA)

[00170] Supplementary cementitious mineral admixture (SCMA) is a partial or full replacement for traditional SCMs that may be blended with Portland cement to significantly reduce the carbon footprint of concrete, while increasing (the quality, strength, and durability of concrete. The SCMA is a reactive admixture that can replace a high volume of cement or fly ash with increased durability without issues such as early strength loss. The SCMA may be prepared as described in U.S. Patent Application No. 12/126,776, as well as in U.S. Provisional Patent Application Nos. 61/088,347 and 61/101,626; each of which are incorporated herein by reference.

[00171] i. FTIR

[00172] The FTIR uses a laser to excite and measure bond vibrations in materials. Using this method, we can indicate which compounds are present in the materials. An unhydrated and hydrated comparison, at 7 days, is shown in Fig. 7, between ordinary Portland cement paste (OPC) and a blended paste with 20 percent SCMA and 80 percent OPC. Though varied, the SCMA may be the basis and building block for many products, and demonstrates the basic chemical composition of all the products. In the above graph, the large band centered at 1450 cm<sup>-1</sup> indicates the large presence of carbonate in the SCMA. The peaks at 3694 cm<sup>-1</sup> and 2513 cm<sup>-1</sup> are indicative of the hydration of the SCMA. For the Hydrated Blended SCMA, we see the peak at 858 cm<sup>-1</sup> diminish with the peak at 872 cm<sup>-1</sup> becoming sharper, and the slope at 712 cm<sup>-1</sup> also sharpen. These mode locations are consistent with the formation of Calcite. The 2342 cm<sup>-1</sup> peak noted above is no longer present in the cement blend, which would be expected upon re-hydration of the product. the peak at 3694 cm<sup>-1</sup> corresponding to the OH stretching vibrations for Mg(OH)<sub>2</sub> is present, however Ca(OH)<sub>2</sub> formation (peak at 3644 cm<sup>-1</sup>) appears to be inhibited compared to hydration in OPC. For the Hydrated OPC, it too has the signature CO<sub>3</sub><sup>2-</sup> modes observable at 1481 cm<sup>-1</sup> and 1426 cm<sup>-1</sup> due to carbonation of the cement. Ca(OH)<sub>2</sub> has a large peak at 3644 cm<sup>-1</sup> that corresponds to the OH stretching vibrations as well.

[00173] ii. XRD

[00174] The XRD scatters X-ray beams at different angles to measure the reflection off a sample. The reflections return a fingerprint to allow identification of a specific compound. From the XRD (See Fig. 8 and Fig. 9), a number of observations can be made for the hydrated OPC and Blended SCMA:

- Ettringite and portlandite are present in both the OPC and blended SCMA.
- The presence of calcite is shown in the SCMA, while the amount of portlandite formed is significantly reduced by 20 percent.

- After 7 days, the SCMA shows little or no sign of halite (NaCl), or brucite, meeting ACI 318 standards for sodium chloride control.
- The SCMA shows evidence of depletion of Mg in the calcite.
- The calcium silicate phases seem to be consumed faster in the SCMA as well.

[00175] iii. SEM images

[00176] SEM images (Fig. 10) show that both the Hydrated OPC and Blended SCMA pastes exhibit similar morphologies with acicular ettringite and C-S-H formation on the surface of the cement particics.

[00177] iv. X-Ray Fluorescence (XRF)

Table 1. XRF elemental analysis of an SCM of the invention.

[00178] V. Particle size analysis (PSA)

[00179] Particle size analysis of SCM of the invention indicates a median particle size of 10.86361 microns and a mean particle size of 11.26930 microns.

[00180] vi. SCMA is reactive

[00181] As demonstrated in Fig. 11, SCMA is reactive.

[00182] vii. SCM Morphologies

[00183] Fig. 12 provides SCM morphologies.

[00184] B. Carbon Reducing Admixture (CRA)

[00185] CRA is both a mineral admixture and fine aggregate with particle sizes comparable to sand. CRA sequesters CO<sub>2</sub> in concrete and gives designers the potential to create carbon neutral or carbon negative concrete by replacing a portion or all of the fine aggregates in a mix design, without any cement replacement. CRA is produced according to methods described in U.S. Provisional Patent Application No. 61/056,972; the disclosure of which is incorporated herein by reference.

[00186] C. coarse Aggregate (AGG).

[00187] coarse aggregate (AGG) may replace a portion or all of the common coarse aggregate in a mix. AGG allows designers to create carbon neutral or carbon negative concrete without replacing any cement and maintaining the strength of concrete. AGG CRA is produced according to methods described in U.S. Provisional Application No. 61/056,972; the disclosure of which is incorporated herein by reference.

[00188] D. Precipitation material from seawater

[00189] Seawater (900 gallons) was agitated and acidified by bubbling a 55 scfm. 10 percent carbon dioxide (balance air) gas stream through gas diffusers located at the bottom of a 1,000-gallon, covered plastic tank. The pH was monitored and dropped from approximately pH 8 to pH 5.5-6, at which point the gas diffusion was stopped. Magnesium hydroxide (1 g/L) from an industrial tailings pond that includes some calcite and silica was added to the acidified, agitated sea water: the pH rose to approximately pH 8. Gas diffusion re-started until the pH dropped to pH 7, after which the gas flow was arrested.

[00190] A total of 22 kg of magnesium hydroxide was added as a 10 percent slurry to the acidic sea water in incremental doses in the following repeated manner: magnesium hydroxide slurry was added to agitated sea water until the pH increased to pH 8, The 10 percent carbon dioxide gas delivery was re-started until the pH of the agitated sea water returned to pH 7. The gas delivery was arrested, and slurry added until the pH returned to pH 8. After 22 kg of magnesium hydroxide was consumed, the pH of the agitated sea water was reduced to pH 7 by diffusion with 10 percent carbon dioxide gas, after which gas delivery was stopped. Approximately 43 kg of 50 percent (w/w) NaOH (aq) was added to the agitated sea water until the pH of the sea water reached pH 10.15. The resultant precipitation material was gravity separated then vacuum filtered from the supernatant solution. The filter cake was oven-dried at 110 degrees centigrade, then ball milled.

[00191] Precipitation material characterization

[00192] X-ray fluorescence (XRF) data (Table 2) indicates that the precipitation material is mostly composed of magnesium and calcium carbonates.

[00193] X-ray diffraction (XRD) and thermogravimetric analysis (TGA/DTG) of the precipitation material indicate the presence of hydromagnesite and aragonite (CaCO<sub>3</sub>) as the major phases, and halite (NaCl) as a minor component. The XRD of the precipitation material was compared against standards for hydromagnesite, aragonite, and hydromagnesite.

The TGA/DTG indicated inflection points/peaks at 257 °C and 412 °C indicating hydromagnesite, and the TGA/DTG indicated an inflection point/peak at 707 degrees centigrade indicating aragonite. The results were also confirmed by infrared spectroscopy (IR), which was used to generate a composite plot for each of aragonite, hydromagnesite, and the precipitation material. Such precipitation material is useful in production of reduced-carbon footprint concrete compositions of the invention.

## [00194] E. Precipitation material from seawater

[00195] Seawater (900 gallons) was agitated and acidified by bubbling a 55 scfm 10 percent carbon dioxide (balance air) gas stream through gas diffusers located at the bottom of a 1,000-gallon, covered plastic tank. The pH was monitored and dropped from approximately pH 8 to pH 5.5-6, at which point the gas diffusion was stopped. Magnesium hydroxide (1 g/L) was added to the acidified, agitated sea water; the pH rose to approximately pH 8. Gas diffusion was re-started until the pH dropped to pH 7, after which the gas flow was arrested. A total of 30 kg of 50 percent (w/w) NaOH (aq) was then added to the agitated sea water in incremental doses in the following repeated manner: NaOH was added to agitated sea water until the pH increased to pH 8. The 10 percent carbon dioxide gas delivery was re-started until the pH of the agitated sea water returned to pH 7. The gas delivery was arrested, and NaOH added until the pH returned to pH 8. After 30 kg of 50 percent (w/w) NaOH (aq) was consumed, the pH of the agitated sea water was reduced to pH 7 by diffusion with 10 percent carbon dioxide gas, after which gas delivery was stopped. Approximately 37 kg of 50 percent (w/w) NaOH (aq) was added to the agitated sea water until the pH of the sea water reached pH 10.15. The resultant precipitation material was gravity separated then vacuum filtered from the supernatant solution. The filter cake was re-slurried in fresh water, spray-dried, then ball milled.

## [00196] Precipitation material characterization

[00197] X-ray fluorescence (XRF) data (Table 4) indicates that the precipitation material is mostly composed of magnesium and calcium carbonates.

[00198] X-ray diffraction (XRD) and thermogravimetric analysis (TGA/DTG) of the precipitation material indicates the presence of nesquehonite ( $\text{MgCO}_3 \cdot 3\text{H}_2\text{O}$ ) and aragonite ( $\text{CaCO}_3$ ) as the major phases, and halite ( $\text{NaCl}$ ) as a minor component. The XRD of the precipitation material was compared against standards for nesquehonite and aragonite. The TGA/DTG indicated inflection points/peaks at 132 degrees centigrade, 364 degrees centigrade, 393 degrees centigrade and 433 T indicating nesquehonite, and the TGA/DTG indicated an inflection point/peak at 697 degrees centigrade indicating aragonite. The results were also confirmed by infrared spectroscopy (IR), which was used to generate a composite plot for each of nesquehonite, aragonite, and the precipitation material. Such precipitation material is useful in production of reduced-carbon footprint concrete compositions of the invention.

## [00199] F. Precipitation material from seawater

[00200] Seawater (76,000 gallons) was mixed in a 200,000-gallon open vessel by pumping its contents through two lines with two pumps, which returned the contents into the tank with an upward, circular trajectory. Carbon dioxide gas (100 percent) was diffused into the seawater via diffusers located in the bottom of the tank to reduce the pH to about pH 5.5. Approximately 800 kg of magnesium hydroxide from a tailings pond, containing some calcite and silica, was slurried with seawater and injected into the open vessel through a recirculation device based on the operating premise of a pool sand-filter. After addition of the magnesium hydroxide, the 100 percent carbon dioxide gas delivery was arrested. Caustic (50 percent (w/w) NaOH (aq)) was then added through a recirculation line until the pH of the slurry was pH 9.5. The slurry was then transferred to a settling pond where the supernatant was decanted and the gravity-settled solids collected for spray drying. The slurry was spray-dried and collected from the main chamber of the spray dryer.

## [00201] Precipitation material characterization

[00202] X-ray fluorescence (XRF) data (not shown) indicates that the precipitation material is mostly composed of magnesium and calcium carbonates

[00203] X-ray diffraction (XRD) and thermogravimetric analysis (TGA/DTG) of the precipitation material indicates the presence of nesquehonite ( $\text{MgCO}_3 \cdot 3\text{H}_2\text{O}$ ) and monohydrocalcite ( $\text{CaCO}_3$ ) as the major phases, and aragonite ( $\text{CaCO}_3$ ) and halite ( $\text{NaCl}$ ) as a minor components. The XRD of the precipitation material was compared against standards for nesquehonite, aragonite, and monohydrocalcite. The TGA/DTG indicated inflection points/peaks at 136 degrees centigrade, 187 degrees centigrade, and 421 degrees centigrade indicating nesquehonite, and the TGA/DTG indicated an inflection point/peak at 771 degrees centigrade indicating aragonite and monohydrocalcite. The results were also confirmed by infrared spectroscopy (IR), which was used to generate a composite plot for each of nesquehonite, aragonite, monohydrocalcite, and the precipitation material. Such precipitation material is useful in production of reduced-carbon footprint concrete compositions of the invention.

## [00204] II. Carbon Footprint Comparisons

[00205] Below are mix designs with corresponding carbon footprint reductions expected from using products of the invention. The carbon footprint of concrete is determined by multiplying the pounds per cubic yard of each constituent by its per pound carbon footprint, summing these values, and adding 10.560 kg/yd<sup>3</sup> (the carbon footprint of transporting one yard of concrete 20 miles on average).

## [00206] Transportation Footprint:

- The European Commission has released figures of 160 g CO<sub>2</sub>/tonne of material/km for transportation by truck (for aggregate, cement, and concrete). The Carbon footprint of cement shipped by sea from Asia to California has been estimated to be 0.150 lb CO<sub>2</sub> per pound of ocean-freighted material.
- Assuming an average distance of 50 miles for hauling aggregate, and a production carbon footprint of 0.03 lbs CO<sub>2</sub>/lb aggregate, the average carbon footprint of aggregate is approximately 0.043 lbs CO<sub>2</sub>/lb aggregate.
- Fly ash and slag rail costs from across the nation have been estimated to be only 0.020 lbs per lbs of fly ash. Assuming an average of 100 miles of trucking from the fly ash or slag, the carbon footprint of conventional SCMs are approximately

0.045 lbs CO<sub>2</sub>/lb fly ash or slag.

[00207] Production Footprint:

- Assuming an average con release from Portland cement production of 0.86 tonnes CO<sub>2</sub>/tonne cement (as reported for California Cement Climate Action Team), each pound of Portland cement has a production carbon ootprint of 0.86 pounds. Assuming an average transportation distance of 100 miles, the transportation footprint or each pound of Portland cement would be 0.016 pounds, for a total carbon footprint of 0.876 pounds CO<sub>2</sub> per pound of Portland cement.

[00208] Carbon Reductions:

- Materials such as SCMA, CRA, and AGG have a sequestered con content of roughly 50 percent, which is -0.500 ounds of con per pound of material. Production and transportation carbon footprint (assuming trucking istance of 100 miles on average) is approximately 0.050 pounds of con per pound of material. Leaving a totalcarbon footprint of -0.450 lbs con per pound of material.

[00209]

[00210] This example of a typical 6-sack concrete mix has a carbon footprint of 630 pounds per cubic yard. To mitigate this carbon emission biologically would require growing a one-foot diameter tree 27 feet tall. Each 10 yard load equates to growing a grove of ten of these trees!

[00211] B. High Fly Ash (50 percent) Mix

[00212] This example of a typical 6-sack concrete mix with 50 percent fly ash replacement has a carbon footprint of 395 pounds per cubic yard. This is a reduction in carbon footprint of 37 percent from a straight 6-sack Portland cement mixture.

[00213]

[00214] This example of a 6-sack concrete mix with 20 percent SCMA, 20 percent fly ash and 60 percent OPC has a carbon footprint of 386 pounds per cubic yard - 2 percent lower carbon footprint than a 50 percent OPC / 50 percent fly ash mix. This mix achieves a lower carbon footprint without the set-time and early strength gain issues of 50 percent fly ash mixes, as illustrated in Fig. 3.

[00215] D. Carbon Neutral Mix with 6 sacks of OPC

[00216] This example of a carbon neutral 6-sack concrete mix uses CRA to replace a portion of the fine, aggregate.

[00217] E. Carbon Neutral Mix with High OPC Replacement and Improved Working Properties able 11. concrete composition having a carbon footprint of -3.96 lbs con/yd<sup>3</sup> concrete.

[00218] This example of a carbon-neutral 6-sack concrete mix uses CRA to replace a portion of the fine aggregate along with the use of SCMA and fly ash with each at a 20 percent replacement level.

[00219] Additional mixes of interest include:

[00220]

[00221] This carbon-sequestering concrete illustrates the potential for high-carbon capturing concrete by using materials of the invention as a replacement for both coarse and fine aggregate as well as using SCMA and fly ash each at a 20 percent replacement level. Each 10-yard load of this mix is the carbon equivalent of growing 19 trees 1-foot in diameter and 27 feet tall!

[00222] Additional High Carbon Capturing Formulations are provided below:

Table 19. concrete composition having a carbon footprint of 1,145 lbs CO<sub>2</sub>/yd<sup>3</sup> concrete.

[00223] Although the foregoing invention has been described in some detail by way of illustration and example for purposes of clarity of understanding, it is readily apparent to those of ordinary skill in the art in light of the teachings of this invention that certain changes and modifications may be made thereto without departing from the spirit or scope of the appended claims.

[00224] Accordingly, the preceding merely illustrates the principles of the invention. It will be appreciated that those skilled in the art will be able to devise various arrangements which, although not explicitly described or shown herein, embody the principles of the invention and are included within its spirit and scope. Furthermore, all examples and conditional language recited herein are principally intended to aid the reader in understanding the principles of the invention and the concepts contributed by the inventors to furthering the art, and are to be construed as being without imitation to such specifically recited examples and conditions. Moreover, all statements herein reciting principles, aspects, and embodiments of the invention as well as specific examples thereof, are intended to encompass both structural and functional equivalents thereof. Additionally, it is intended that such equivalents include both currently known equivalents and equivalents developed in the future, i.e., any elements developed that perform the same function, regardless of structure. The scope of the present invention, therefore, is not intended to be limited to the exemplary embodiments shown and described herein. Rather, the scope and spirit of present invention is embodied by the appended claims.

1. A method comprising:

a) precipitating a synthetic carbonate from a divalent cation-containing solution and an industrial waste gas comprising CO<sub>2</sub>, wherein the synthetic carbonate comprises vaterite, ikaite, amorphous calcium carbonate, magnesite, barringtonite, nesquehonite, lanfordite, amorphous magnesium calcium carbonate dolomite, huntite, sergeevite, or a combination thereof and

b) incorporating the synthetic carbonate into a reduced-carbon footprint concrete composition, wherein the reduced-carbon footprint concrete composition has a reduced carbon footprint relative to an ordinary concrete composition.

## 123. Family 44219663 (IN01454DE1997 A)

[View in PatBase](#)

### Title

[EN] SETTABLE BINDER COMPOSITION AND ARTICLE OF MANUFACTURE MADE THEREFROM

### Abstract

[EN] A dry powdered flowable cement composition magnesium calcium carbonate and a partially decarbonated hard with various organics fillers including waste products and toxic waste. The composition can be slurried with contaminated water such as sea water, mineral laden ground water and muddy watter. A high percentage of filler can be added while still having an acceptable set.

### 1st Main Claim

[EN] 1. A settable binder composition which comprises a mixture of: calcium carbonate; caustic magnesium oxide; and as optional ingredients

between 0.01 percent to 10 percent by weight of a sulphate additive such as herein described;

between 0.1 percent to 5 percent by weight of an inorganic salt such as herein described; and

between 0.01 to 5 percent by weight of a carbonate additive such as herein described

the calcium carbonate and caustic magnesium oxide mixture being selected from the group consisting of:

(a) a naturally-occurring dolomite, having between 30 percent to 65 percent by weight

of a calcium carbonate and between 30 percent to 60 percent by weight of caustic

magnesium oxide, said dolomite having been pre-heated at a temperature

within the range of 500 degrees centigrade to 800 degrees centigrade to cause preferential decarbonisation of

the magnesium carbonate by liberation of carbon dioxide whereby between

2 percent to 50 percent of the carbon dioxide is retained within the magnesium carbonate

without substantially decarbonisation of the calcium carbonate resulting in a

mixture of magnesium oxide, magnesium carbonate and calcium carbonate

(MgO, MgCO<sub>3</sub>) and CaCO<sub>3</sub>); and,

(b) a synthetic blend comprising a mixture of calcium carbonate with

preformed caustic magnesium oxide, having between 10 percent to 90 percent by weight

of calcium carbonate and between 10 to 90 percent by weight of caustic magnesium

oxide where the preformed caustic magnesium oxide is the product resulting

from the pre-heating of magnesium carbonate to partially drive off carbon

dioxide whereby between 2 percent to 50 percent of the carbon dioxide is retained within

the magnesium carbonate, and wherein the calcium carbonate retains

substantially all of its carbon dioxide, resulting in a mixture of magnesium

oxide, magnesium carbonate and calcium carbonate (MgO, MgCO<sub>3</sub>) and

CaCO<sub>3</sub>).

## 124. Family 60047750 (KR101543307 B1)

[View in PatBase](#)

### Title

[EN] METHOD OF MANUFACTURE AND ENVIRONMENT-FRIENDLY QUARRY LANDFILL FILLER OF OCCURRED IN THE CIRCULATING FLUIDIZED BED BOILER USING GAS DESULFURIZATION GYPSUM

### Abstract

[EN] The present invention relates to an environment-friendly filler to be embedded in a quarry site using a desulfurized gypsum generated in a circulating fluidized bed boiler and a manufacturing method thereof and, more specifically, to an environment-friendly filler to be embedded in a quarry site in which a desulfurized gypsum generated after petroleum cokes are used in a circulating fluidized bed boiler, a mixture for concrete, and a bonding material are mixed and to a manufacturing method thereof. The desulfurized gypsum generated in the circulating fluidized bed boiler using petroleum cokes contains anhydrite ( $\text{CaSO}_4$ ) and calcium oxide ( $\text{CaO}$ ). Thus, recycling the desulfurized gypsum is limited. According to the present invention, to stabilize the calcium oxide contained in the desulfurized gypsum and to apply a pressing method, excellent strength expression properties are obtained by mixing the calcium oxide with water in case of agitation, determining time to form a section wherein the highest temperature generated in case of agitation decreases, and increasing hydrates and densifying a fine porous structure through a steam curing process. Calcium hydroxide ( $\text{Ca(OH)}_2$ ) generated by a reaction of the calcium oxide and water in an accelerated carbonation process is reacted with carbon oxide ( $\text{CO}_2$ ) rapidly penetrated through the accelerated carbonation process so that calcium carbonate ( $\text{CaCO}_3$ ) is generated and calcium carbonate densifies the fine structure. Thus, pH is a little bit reduced and strength is increased. In addition, (a) leachate obtained by an acidic water-soaking process creates an effect of the environment-friendly filler to be embedded in a quarry site of which pH is 9 or less and which is harmless to vegetation.

### 1st Main Claim

[MT] 1. comprising the steps of: a) alone or mixed with fly ash and blast furnace slag cement and blast furnace slag used as a binder for concrete honhapjae and blended with desulfurization gypsum generated in the circulating fluidized bed boiler with petro coke; step b) was added to the mixture to blending the compounding step in the raw material and a rough mixture was stirred by a mechanical agitator to force; c) shaping the mixture material was added to the press method the press pressure of  $10 \sim 200 \text{ kgf} / \text{cm}^2$ ; d) step for applying steam curing for 6 hours at a temperature of 80 degrees centigrade the rough molded body forming step; e) the shaped body  $\text{CO}_2$  10 percent, temperature 20 degrees centigrade, promoting carbonation step to carry out 3 to 7 days at a humidity of 60 percent; f) by ionizing the formed body subjected to the normal water promotes carbonation H Ion is present and a pH of soaking for one hour the acid number of about 4-6 and then drying; g) based on the strength of the molded article and  $20 \text{ kgf} / \text{cm}^2$  above, pH values in the leachate of step to complete a fill material by keeping it below the molded article 9; Ishiyama method of producing green fill material for filling with the desulfurization gypsum generated in the circulating fluidized bed boiler, characterized in that consisting of.

**Assignees:** HANA CEMENT CO INC K



125. Family 104793071 (CN118754467 A)

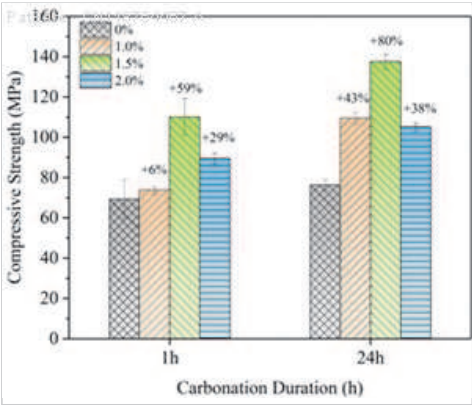
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Title

[EN] METHOD FOR PREPARING DICALCIUM SILICATE CLINKER AND CARBON SEQUESTRATION PRODUCT BY DOPING CHROMIUM IONS AS CRYSTAL FORM REGULATOR

Abstract

[EN] The invention discloses a method for preparing dicalcium silicate clinker and a carbon sequestration product by doping chromium ions as a crystal form regulator, and belongs to the technical field of carbon sequestration cementing materials. The process comprises the following steps: doping a chromium ion crystal form regulator into a raw material to prepare a mixed slurry, drying the slurry to obtain a raw material, uniformly stirring the raw material and absolute ethyl alcohol, pressing into a green body, sintering, cooling to obtain a clinker taking dicalcium silicate as a main mineral, and pressing and carbonizing the clinker to obtain a carbon sequestration product. According to the invention, by exploring a new thought that chromium ions regulate and control the fired dicalcium silicate clinker and the crystal form and synergistically sequestration carbon, the crystal form proportion of the binary calcium silicate is regulated, and the obtained carbon sequestration product has the characteristics of high mineralization rate, high carbon sequestration capacity and fast mechanical property development. According to the method, CO<sub>2</sub> is not released in the clinker sintering process, a large amount of CO<sub>2</sub> can be stored in the clinker, meanwhile, resource utilization of heavy metal ions is achieved, and a new thought is provided for CO<sub>2</sub> emission reduction and heavy metal ion safe disposal which have environmental and economic benefits.



1st Main Claim

[MT] 1. A process for the preparation of a dicalcium silicate solid carbon product by doping chromium ions as a form modifier, comprising the steps of:

- S1, mixing the chromium ion crystal form conditioner with the calcium material and the siliceous material uniformly, adding a water ball mill to obtain a mixed slurry, and drying to obtain a raw material;
- S2, mixing the raw material obtained from S1 with absolute ethanol, stirring and uniformly, and pressing into a green body, which is sintered and cooled to obtain a dicalcium silicate clinker;
- S3, the clinker from S2 added water pressure into the preformed matrix, carbonization is obtained to solidify carbon products.

Assignees: NANCHANG UNIV; UNIV NANCHANG

126. Family 44917908 (CN101694449 A)

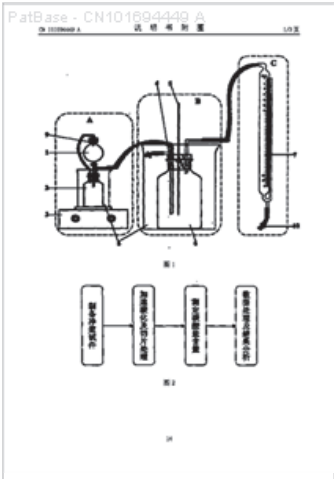
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**Title**  
[EN] Testing device for carbonization resistance of cement based materials and testing method

**Abstract**  
[EN] A testing device for carbonization resistance of cement based materials and a testing method belong to the technical field of test of carbonization resistance of concrete. The device mainly comprises a separating funnel, a reaction bottle, a magnetic stirrer and the like of a reaction part, a buffer bottle, a thermometer, a glass tee joint and the like of a buffer part, and a eudiometer and the like of a gas collection measuring part, wherein the eudiometer consists of a meter tube, a balance tube and a drain pipe which are communicated by rubber pipes. By using the device, the method completes the test of carbonization resistance of the cement based material by the following steps: preparing a clean paste test piece, speeding up carbonization and slice treatment, determining the content of carbonate and conducting data processing and result analysis. The invention is characterized by simple method, fast measuring speed, accurate test, scientific and reliable result analysis and the like. The device and the method can be widely applied to the test of carbonization resistance of the cement based materials, and also applicable to the test of the effect of various concrete admixtures, maintaining conditions, carbonization conditions and the like on the carbonization resistance of the cement based materials.

**1st Main Claim**  
[MT] CN 1. A cement-based material carbonization resistance test device, wherein the reaction section (A), the buffer portion (B) and set the gas measuring portion (C) composed by rubber therebetween tube communicating; reaction section (A) including a separating funnel (1), the reaction flask (2), a magnetic stirrer (3), separating funnel (1) by the bucket body and set standard ground upper and lower body in the bucket fighting neck that drain tubes, bucket body is spherical or pear-shaped glass container, the volume of 30~50ml, the body is placed in a hopper with dilute hydrochloric acid, rubber stopper in a bottle at the set with a through-hole (9), the through-hole insert the glass, the glass tube is inserted through a rubber tube and the reaction flask (2) bottle rubber plug (9) through holes in the glass tube communicating, fighting neck is provided with a glass piston thereon glass, fighting neck insertion reaction flask (2) bottle rubber plug (9) of the through hole, the reaction flask (2) jars or flasks with standard ground, the material for the glass, in The reaction flask (2) Place the test sample carbonized powder cement-based materials, the reaction flask (2), a volume of 50~100ml, its mouthpiece in the rubber set with a three through-hole plug (9), in which rubber stopper (9) is inserted into a hole straight through the glass tube, the tube through a rubber tube with a separating funnel (1) of the rubber stopper at the bottle (9) through holes in the glass tube communicating in another pass rectangular-shaped hole in the insert or linear-shaped glass, the glass bottle with a rubber tube and buffer (6) at the rubber bottle stopper (9) through holes in the glass tee (4) a glass communicated, in the first three through holes insert a direct funnel (1) fighting neck reaction flask (2) is placed in a water bath (8), the water bath (8) is placed on a magnetic stirrer (3) take the disc, a magnetic stirrer (3) placed on the bench; buffer section (B) including a buffer bottle (6), a glass tee (4), a thermometer (5), a buffer bottle (6) with a standard ground glass, and the volume as 500~1500ml, its bottle set with three through holes rubber stopper (9), insert the thermometer (5) in which a through hole, insert the glass tee in another through hole (4) in a glass, insert rectangular-shaped or linear-shaped glass in the third through holes, the tube through a rubber tube with gas collection measuring portion (C) in the amount of pipe (7), the upper end of the measuring tube glass interface connectivity, the buffer bottle (6) placed in the water bath (8), the water bath (8) placed on the bench, a glass tee (4) in a glass bottle insertion buffer (6) mouthpiece rubber stopper (9) in which a through-hole, and another glass tube inserted through the rubber reaction flask (2) bottle rubber plug (9) through holes in the glass tube in communication, and the third glass and rubber tubes communicating and set on a rubber tube wire clamp (10); gas collection measuring portion (C) by measuring tubes, pipes and vent pipes balance amount constituted pipe (7), when used in an amount within the interior pipe with liquid injection, measuring tube with a scale value The glass tube is customized according to national standards, the 0 scale line starting from the top down reading increases, the minimum scale value of 0. 1ml, the range is 50ml, set a standard interface to the upper end of the glass measuring tube, Its interface is inserted through a rubber tube and buffer bottle (6) bottle rubber plug (9) through holes in a rectangular-shaped or straight tube communicating the lower end of the tube and vent pipes and balance measuring tube communicating, fine balance tube the upper end of the glass tube, the position of the measuring tube parallel to the opening balance tube, the lower end of the lower end of the measuring tube communicating together to form a U-shaped connected device, the upper end of the opening balance tube and measuring tube 0 tick is flat, vent pipes located in the measuring tube bottom and balanced composition of the U-shaped tube communicating vessels, and the measuring tube and balance pipe communication is a standard glass interface, which communicates with the rubber tube and set the wire clamp (10) on the rubber tube.

**Assignees:** UNIV CHONGQING; CHONGQING UNIV



127. Family 102101576 (US2024376002 AA)

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Title

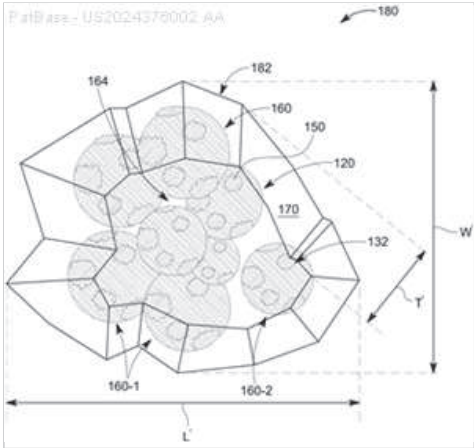
[EN] SAND TREATMENT METHOD AND SYSTEM FOR CONCRETE APPLICATIONS

Abstract

[EN] A sand aggregate includes plural aggregate grains, wherein at least one aggregate grain of the plural aggregate grains includes, desert sand grains that are too small to be used in concrete applications, carbonate particles distributed on an external surface of the desert sand grains, and a sand-based glue that aggregates the desert sand grains together. The at least one aggregate grain has a size comparable to river sand grains, while the desert sand grains have a size smaller than the river sand grains so that the at least one aggregate grain is suitable for concrete applications.

1st Main Claim

[EN] 1. A sand aggregate comprising:  
plural aggregate grains,  
wherein at least one aggregate grain of the plural aggregate grains includes,  
desert sand grains that are too small to be used in concrete applications;  
carbonate particles distributed on an external surface of the desert sand grains; and  
a sand-based glue that aggregates the desert sand grains together,  
wherein the at least one aggregate grain has a size comparable to river sand grains, while the desert sand grains have a size smaller than the river sand grains so that the at least one aggregate grain is suitable for concrete applications.



**Assignees:** UNIV KING ABDULLAH SCI AND TECH; KING ABDULLAH UNIV OF SCIENCE AND TECHNOLOGY

## 128. Family 108448234 (WO25127739 A1)

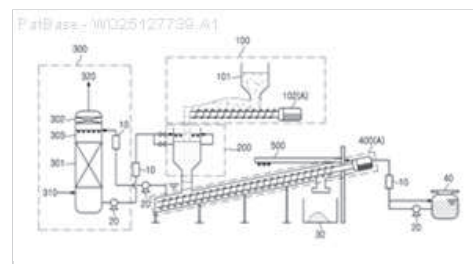
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### Title

[EN] APPARATUS FOR CONTINUOUS MINERAL CARBONATION BASED ON DIRECT CARBONATION AND METHOD FOR CONTINUOUS MINERAL CARBONATION USING SAME

### Abstract

[EN] The present invention relates to an apparatus for continuous mineral carbonation based on direct carbonation and a method for continuous mineral carbonation using same and, more specifically, to an apparatus for continuous mineral carbonation and a method for continuous mineral carbonation using same, wherein the apparatus comprises: an absorption tower that absorbs CO<sub>2</sub> from a CO<sub>2</sub>-containing exhaust gas by means of an alkaline absorbent solution, discharges purified exhaust gas, and discharges a CO<sub>2</sub>-containing absorbent solution; a slag feeding device that feeds industrial by-products containing calcium oxide (CaO) into a carbonization reactor; the carbonation reactor in which a carbonation reaction occurs between the CO<sub>2</sub>-containing absorbent solution discharged from the absorption tower and the industrial by-products containing calcium oxide (CaO); and a conveying unit that continuously conveys, to a storage unit, a mixture discharged from the carbonization reactor.



### 1st Main Claim

[MT] An absorption tower that absorbs CO<sub>2</sub> in flue gas containing CO<sub>2</sub> with an alkaline absorbent, discharges purified flue gas, and discharges an absorbent containing CO<sub>2</sub>;

A slag feeding device that feeds industrial by-products containing calcium oxide (CaO) into a carbonation reactor;

A carbonation reactor in which a carbonation reaction of an absorbent liquid containing CO<sub>2</sub> discharged from the absorption tower and an industrial by-product containing calcium oxide (CaO) occurs; and

A continuous mineral carbonation device, comprising a conveying unit for continuously conveying a mixture discharged from a carbonation reactor to a storage unit.

**Assignees:** POSCO HOLDINGS INC

## 129. Family 62972295 (KR20160086797 A)

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### Title

[EN] FUNCTIONAL BENTOTEX, BENTOSHEET AND BENTOTEXSHEET

### Abstract

[EN] The present invention relates to a cutoff material, a waterproof material, a cutoff layer, a gas layer, a molding layer, a drainage layer, and a purifying layer, which comprise a functional bentotex, bentosheet, and bentotexsheet in which an expansion function, a binding gel function, a hydro gel function, and a purifying function are combined. Also, the present invention relates to a bentotex, a bentosheet, and a bentotexsheet in a cutoff material, a waterproof material, a cutoff layer, and a waterproof layer in which one or more materials among an expansion function material, a binding gel function material, a hydro gel function material, a purifying function material, a material for general water, a material for flow water, a material for salt water, a material for contaminated water, and a material for other water at a ratio among ten ratios of 0-10 wt percent, 11-20 wt percent, 21-30 wt percent, 31-40 wt percent, 41-50 wt percent, 51-60 wt percent, 61-70 wt percent, 71-80 wt percent, 81-90 wt percent, 91-100 wt percent are used. When the expansion function material, the binding gel function material, the hydro gel function material, and the purifying function material are used, the bentotex, the bentosheet, and the bentotexsheet of an expansion type, a binding gel type, a hydro gel type, and a purifying type, respectively, are individually formed. The bentotex, the bentosheet, and the bentotexsheet are manufactured by a device comprising one or more units among a material storage, a material input hopper, a fabric pulling device, a material injector, a roller compressor, and a roll product, wherein the bentotex, bentosheet, and the bentotexsheet are formed of a material, a fabric, a nonwoven fabric, and an HDPE sheet.



### 1st Main Claim

[MT] 1. A) a) will be one of quality woven and after a certain material purchases between the nonwoven sichimjil, homjil, darning, sangchim quality, sewing, punching, needle punching, sewing, sewn, kkwemaemjil, stapler, b) the material, a woven fabric, a nonwoven fabric was manufactured by using 2~20mm thickness by the material reservoir, the material input hopper, stirrer materials, non-woven po seolgi, spreaders material, non-woven fabric laying machine, needle punching machine, roll device consisting of one or more of the group, c) the material is stored in the material reservoir, wherein the material reservoir when the material is 2 or more kinds is provided with two or more it is, that the material, or the stored material is added to the material input hopper, wherein the material, or stored material has when two or more kinds material feed hopper are at least two are provided, that the materials or stored material, or injected material being stirred in the material with a stirrer, 1) is laid woven fabric from the straight-Po seolgi, 2) the top of the laid fabric wherein the stirred material by a material spreader being sprayed on, and 3) a non-woven fabric is laid by groups nonwoven fabrics laid on top of the spray material, the above 1), 2), 3) at least one step the primary or secondary of the or or n-ary performed, or the above 1), 2), 3), 2) and 3) are performed first or second or n-th step of the net, the cost installed in the material or its upper installed in the woven and non-woven fabric is integrated with the needle punching by a needle punching machine, while one of the things that are said needle punched manufacturing is a roll-market by groups roll, B) a) is  $1 \times 10$  permeability or hydraulic conductivity ( $-5$ )  $\sim 1 \times 10$  ( $-10$ ) representing the primary or incomplete range of impervious cm / sec Liner, liner, b) the permeability or hydraulic conductivity is  $1 \times 10$  ( $-7$ )  $\sim 1 \times 10$  ( $-15$ ) cm / sec water shield that indicates or fully impervious range, in the Bento-Tex utilized waterproof layer, one of said predetermined material is expanded functional material, binding gel functional materials, hydrogel-functional material, purified functional materials, general receiving material, receiving the material flow, yeomsuyong material, contamination receiving material, other acceptable material is one or more materials from 0 to 10 percent by weight each such that the total of 100 percent by weight, 11-20 percent by weight, 21-30 percent by weight, 31-40 percent by weight, 41-50 weight percent, 51-60 weight percent, 61-70 weight percent, 71-80 weight percent, 81-90 weight percent, 91-100 weight percent, or 5 wt percent, 15 wt percent, 20 wt percent, 40 weight percent, 60 wt percent of functional bentonite, used in a proportion of 80 percent by weight of one of the, composition, mixed, form, composition, mixture, mixed, characterized in that one of the mixed-Tex

**Assignees:** KOREA PARAMOUNT CO LTD; TECHOECO CO LTD

## 130. Family 11518043 (DE4337789 A1)

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### Title

[EN] METHOD OF REPROCESSING ASH FORMED IN THE COURSE OF WASTE (REFUSE) INCINERATION, PARTICULARLY DOMESTIC WASTE INCINERATION, FOR USE IN ROAD CONSTRUCTION

### Abstract

[EN] This is a method of reprocessing waste incineration ash in such a way that the waste incineration ash is suitable for use in road construction and in earthworks. For this purpose, the dominant, water-soluble calcium sulphate has to be bound in such a way that threshold values prescribed for water resources compatibility can be adhered to. This is achieved by the ash being stored with exclusion of air to prevent the formation of monocarbonate, resulting in complete binding of the calcium sulphate in ettringite.

### 1st Main Claim

[MT] 1 Procedures for processing of in the way of waste incineration, especially Hausmuellverbrennung, accruing Muellverbrennungsasche for use in road construction, which Muellverbrennungsasche from existing crystal of anhydrous calcium sulfate ( $\text{CaSO}_4$ ) - anhydrite - with the addition of water ( $\text{H}_2\text{O}$ ), gypsum ( $\text{CaSO}_4 \times 2\text{H}_2\text{O}$ ) and the gypsum in the presence of aluminum, calcium and water during a sufficiently long storage ettringite ( $3\text{CaO} \times \text{Al}_2\text{O}_3 \times 3\text{CaSO}_4 \times 32\text{H}_2\text{O}$ ) and under the influence of carbon dioxide ( $\text{CO}_2$ ) caused the air monocarbonate ( $3\text{CaO} \times \text{Al}_2\text{O}_3 \times \text{CaCO}_3 \times 32\text{H}_2\text{O}$ ), wherein that to prevent the formation of monocarbonate and thus (nearly) complete binding of calcium sulfate in the ettringite storing the Muellverbrennungsasche is made of air.

**Assignees:** KRAS KLAUS PROF DR; SCHELLENBERG PETER DIPL ING

131. Family 94436055 (CN115340311 A)

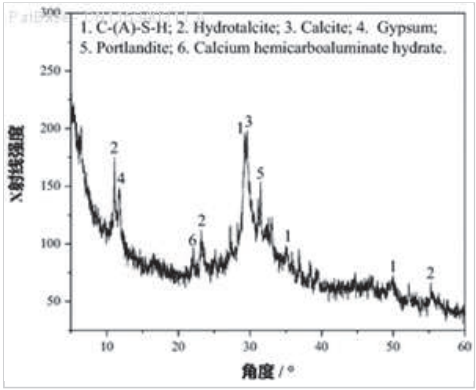
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Title

[EN] ACTIVATED CONCRETE MIXED POWDER, STEAM-CURED BRICK AS WELL AS PREPARATION METHOD AND APPLICATION OF STEAM-CURED BRICK

Abstract

[EN] The invention discloses activated concrete mixed powder, a steam-cured brick and a preparation method and application of the steam-cured brick. The preparation method of the activated concrete mixed powder comprises the following steps: (1) uniformly mixing waste concrete powder with water, and then introducing carbon dioxide gas into the obtained mixed solution, so that carbon dioxide reacts with the waste concrete fine powder to be absorbed and cured, thereby obtaining carbonized concrete for later use; and (2) drying the carbonized concrete, mixing the dried carbonized concrete with an alkaline solid, and carrying out mechanical grinding treatment to obtain the activated concrete mixed powder. The steam-cured brick comprises the following components in parts by weight: 40-70 parts of activated concrete mixed powder, 50-150 parts of a cementing material, 40-100 parts of cement, 6-20 parts of an exciting material, 40-70 parts of a filling material and 20-50 parts of water. According to the technology, the waste concrete powder is used as a carbon dioxide absorbing material, and the carbon dioxide is captured and sealed by fully utilizing the calcium-rich and alkali-rich characteristics of the waste concrete powder.



1st Main Claim

[MT] 1. A method of preparing an activated concrete hybrid powder, characterized by comprising the steps of:

- (1) Mixing the waste concrete powder uniformly with water, and then introducing carbon dioxide gas into the resulting mixed liquor, so that the carbon dioxide reacts with the waste concrete fines and is absorbed and solidified, so as to obtain carbonized concrete, ready to use;
- (2) The carbonized concrete is dried and mixed with alkaline solids and subjected to a mechanical grinding treatment, so as to obtain an activated concrete mixed powder after completion.

**Assignees:** ANHUI UNIV OF SCIENCE AND TECHNOLOGY; UNIV ANHUI SCI AND TECHNOLOGY

132. Family 101206041 (CN117540929 A)

[View in PatBase](#)

**Title**  
[EN] CALCULATION METHOD FOR CARBON EMISSION OF COMPOSITE CEMENT

**Abstract**  
[EN] The invention discloses a method for calculating carbon emission of composite cement. The method comprises the following steps: 1, calculating the mass of coal ash in a raw material ratio; 2, calculating the mass of fuel consumed in the cement clinker calcining process; 3, calculating power consumption and carbon emission in the raw material mining process; 4, calculating oil consumption and carbon emission in the raw material transportation process; 5, calculating power consumption and carbon emission in the raw material preparation process; 6, calculating carbon emission generated by carbonate decomposition and fuel combustion in the clinker calcination process; 7, calculating power consumption and carbon emission of clinker and auxiliary cementing material grinding; and 8, calculating the carbon emission generated in the cement production process. According to the method, the carbon emission in the composite cement production process can be calculated, so that the carbon reduction efficiency of the composite cement is evaluated.



**1st Main Claim**  
[MT] 1. A method for calculating carbon emissions from composite cement, characterized in that it is applied to a production line consisting of a raw material mining apparatus, a raw material transportation means, a raw material preparation apparatus, a preheater, a calcining apparatus, a cooler and a grinding apparatus, And comprising the following steps:

- Step 1: Calculate the mass of coal ash in the raw material ratio:
- Step 1.1: Calculate the raw material mass based on the mass fraction of oxides in the clinker;
- Step 1.2: Calculate the clinker formation heat based on the mass fraction of oxides in the clinker;
- Step 1.3: Calculate the mass of fuel required for calcination of clinker per mass;
- Step 2: Calculate the clinker calcined raw material ratio using equation (27):

$$\begin{bmatrix} m_1 \\ m_2 \\ m_3 \end{bmatrix} = \begin{bmatrix} C_1 & C_2 & C_3 \\ S_1 & S_2 & S_3 \\ A_1 & A_2 & A_3 \end{bmatrix}^{-1} \begin{bmatrix} C_C - C_V m_{fuel} A^f \\ S_C - S_V m_{fuel} A^f \\ A_C - A_V m_{fuel} A^f \end{bmatrix} \quad (27)$$

In equation (27),  $m_1$  The mass of limestone consumed for the unit mass of clinker calcination,  $m_2$  The mass of clay consumed per unit mass of clinker calcination,  $m_3$  The mass of other raw materials consumed for the calcination of clinker per unit mass,  $C_1$  The mass fraction of CaO in limestone consumed for clinker calcination,  $C_2$  The mass fraction of CaO in the clay consumed for clinker calcination,  $C_3$  The mass fraction of CaO in other raw materials consumed for clinker calcination,  $C_C$  And  $C_V$  The mass fraction of CaO in cement clinker and fuel ash,  $S_1$   $S_2$   $S_3$   $S_C$  And  $S_V$  The mass fraction of SiO<sub>2</sub> in limestone consumed for clinker calcination,  $S_1$  The mass fraction,  $S_2$  SiO<sub>2</sub> in clay consumed for clinker calcination,  $S_3$  SiO<sub>2</sub> in other raw materials consumed for clinker calcination,  $S_C$  And  $S_V$  SiO<sub>2</sub> in cement clinker and fuel ash,  $A_1$  For clinker calcination consumption of limestone in Al<sub>2</sub>O<sub>3</sub> The mass fraction,  $A_2$  For clinker calcination consumption of clay in Al<sub>2</sub>O<sub>3</sub> The mass fraction,  $A_3$  Al in other raw materials consumed for clinker calcination,  $A_C$  And  $A_V$  Al in cement clinker and fuel ash respectively,  $A^f$  The mass fraction of ash in the fuel;

Step 3: Calculate the power consumption E of raw material mining using equation (28)<sub>Exploit</sub>:

$$E_{exploit} = \sum_{v=1}^V m_v \times \frac{P_v}{\eta_v} \quad (28)$$

In equation (28),  $m_v$  The mass of the v-th raw material consumed for the production unit mass of the composite cement;  $P_v$  Power of the equipment for the production of the v-th raw material;  $\eta_v$  For the production capacity of the plant for the production of raw

materials of the v-th type, V denotes the kind of raw materials consumed in the production of the composite cement;

Step 4: Calculate fuel consumption and carbon emissions for raw material transport:

Step 4.1 : Calculate the fuel consumption V of the raw material transport using equation (29)<sub>Fuel</sub>:

$$V_{fuel} = \sum_{v=1}^V 2 \times L \times V_0 \times \frac{m_v}{M_0} \quad (29)$$

In equation (29), 2 is the air transport coefficient; L is the transport distance; V<sub>0</sub> Fuel consumption per unit distance at full load; M<sub>0</sub> The mass of the vehicle fully loaded;

Step 4.2 : Calculate the carbon emissions M resulting from the transportation of raw materials using equation (30)<sub>Tran</sub>:

$$M_{Tran} = V_{Fuel} \times E_{Fuel} \quad (30)$$

In equation (30), E<sub>Fuel</sub> A carbon emission factor that is fuel consumption;

Step 5: Calculate the electric consumption E of raw material preparation using equation (31)<sub>Grid-raw</sub>:

$$E_{grid-raw} = \sum_{v=1}^V m_v \times \frac{P'_v}{\eta'_v} \quad (31)$$

In formula (31), P'<sub>v</sub> Power of the processing equipment for the v-th raw material; eta'<sub>v</sub> Production of processing equipment for the v-th raw material;

Step 6: Calculate the carbon emissions of fuel combustion M using equation (32)<sub>Fuel</sub>:

$$M_{fuel} = m'_{fuel} \times \mu \times \frac{44}{12} \quad (32)$$

In formula (32), m'<sub>Fuel</sub> The quantity of fuel consumed per unit mass of cement production;

Step 7: Calculate the carbon emissions of the clinker and auxiliary gelling material milled:

Step 7.1 : Calculate the power consumption W per unit mass of the u-th gelling material when pulverized using Equation (33)<sub>U</sub>:

$$W_u = w_u \left( \frac{10}{\sqrt{P_{80}^u}} - \frac{10}{\sqrt{F_{80}^u}} \right) A_1^u A_2^u A_3^u A_4^u A_5^u \quad (33)$$

PatBase

$$P_{80}^u$$

In equation (33),  $w_{UBond}$  work index milled for the  $u$ th gelling material;

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$$F_{80}^u$$

For the  $u$ -th gelling material feed the particle size of the mill material; //

PatBase

$$A_1^u$$

The particle size of the gelling material mill product for the  $u$ -th; //

PatBase

$$A_2^u$$

Correction factor for the  $u$ -th gelling material micro-grinding; //

PatBase

$$A_3^u$$

Correction factor for the diameter of the  $u$ -th gelling material; //

PatBase

$$A_4^u$$

Correction factor for the reduction ratio of the  $u$ -th gelling material; //

PatBase

$$A_5^u$$

Feed oversize factor for the  $u$ -th gelling material; //

A correction factor for the  $u$ th gelling material grinding mode;

Step 7.2: Calculate the electric consumption E of the cement mill for the production of cement per unit mass using equation (34)<sub>Grid</sub>:

PatBase

$$E_{grid} = \sum_{u=1}^U \alpha_u \times W_u \tag{34}$$

In equation (34),  $\alpha_u$  is the mass fraction of the  $u$ th cementitious material;  $U$  is the kind of cementitious material in the cement composition;

Step 8: Calculate the total carbon emissions of the composite cement production process;

Step 8.1: Calculate the carbon emissions M generated by the electric consumption in the production of composite cement using Equation (35)<sub>Ele</sub>:

PatBase

$$M_{Ele} = (E_{Exploit} + E_{Grid-raw} + E_{Grid} - E_{Residuals\ heat}) \times E_{Ele} \tag{35}$$

In equation (35),  $E_{Residuals\ heat}$  Electric power generated for the residual heat of the clinker calcination process;  $E_{Ele}$  A carbon emission factor that is electrical energy;

Step 8.2 : Calculate the total carbon emissions M of the composite cement production using equation (36)<sub>Total</sub>:

PatBase

$$M_{Total} = M_{Ele} + M_{Tran} + M_{Dec} + M_{Fuel} \tag{36}.$$

**Assignees:** UNIV HEFEI TECHNOLOGY; ANHUI CONCH GROUP CO LTD; HEFEI UNIV OF TECHNOLOGY

## 133. Family 99496192 (US2025171353 AA)

[View in PatBase](#)

### Title (EP4265580 A1)

[EN] PROCESS FOR PRODUCING CALCINED MINERAL BINDER MATERIAL WITH REDUCED CARBON FOOTPRINT

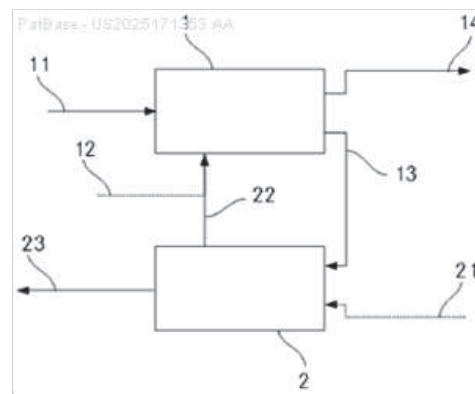
### Abstract (EP4265580 A1)

[EN] A method to produce a calcined mineral binder material comprises the steps of: a) Providing a source material comprising a mineral binder material, carbonating the source material with carbon dioxide such that the mineral binder material is at least partially, in particular essentially completely, carbonated to produce a carbonated product; b) Calcining a carbonate-containing material to produce a calcined mineral binder material and carbon dioxide as side product; whereby in step a) the carbon dioxide side product of step b), optionally in combination with further carbon dioxide from a different source, is used as the carbon dioxide for carbonation of the source material; and in step b) the carbonate-containing material comprises the carbonated product of step a), and optionally other material.

### 1st Main Claim (EP4265580 A1)

[EN] 1. Method to produce a calcined mineral binder material comprising the steps of:

- a) Providing a source material comprising a mineral binder material, carbonating the source material with carbon dioxide such that the mineral binder material is at least partially, in particular essentially completely, carbonated to produce a carbonated product;
- b) Calcining a carbonate-containing material to produce a calcined mineral binder material and carbon dioxide as side product; whereby in step a) the carbon dioxide side product of step b), optionally in combination with further carbon dioxide from a different source, is used as the carbon dioxide for carbonation of the source material; and in step b) the carbonate-containing material comprises the carbonated product of step a), and optionally other material.



**Assignees:** SIKA TECH AG

## 134. Family 106476839 (CN119371157 A)

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### Title

[EN] WEAR-RESISTANT HIGH-TOUGHNESS CONCRETE MATERIAL SUITABLE FOR FABRICATED PAVEMENT SLAB AND PREPARATION METHOD OF WEAR-RESISTANT HIGH-TOUGHNESS CONCRETE MATERIAL

### Abstract

[EN] The invention discloses a wear-resistant high-toughness concrete material suitable for a fabricated pavement slab and a preparation method of the wear-resistant high-toughness concrete material, and belongs to the technical field of preparation of concrete materials. The concrete material is prepared from the following components in parts by weight: 200 to 300 parts of calcined clay, 100 to 200 parts of limestone, 220 to 350 parts of cement clinker, 100 to 300 parts of regenerated micro powder, 5 to 15 parts of fiber, 150 to 250 parts of water, 5 to 15 parts of polyacrylamide and 5 to 15 parts of CaO. The preparation method has the beneficial effects that the limestone and the calcined clay are added to replace traditional Portland cement clinker, so that carbon dioxide emission and energy consumption in the traditional cement production process are remarkably reduced; the recycled micro powder is adopted as the fine aggregate, the cost problem is solved, meanwhile, aragonite formed after carbonization is agglomerated around the recycled micro powder, the edges and corners are clear compared with quartz sand, and the abrasion resistance of the material can be better improved.

### 1st Main Claim

[MT] 1. A wear-resistant high-tough concrete material suitable for use in fabricated road panels, characterized by comprising, in parts by weight, calcined clay 200 to 300 parts, limestone 100 to 200 parts, cement clinker 220 to 350 parts, recycled fine powder 100 to 300 parts, fibers 5 to 15 parts. Water 150-250 parts, polyacrylamide 5-15 parts, 5-15 parts CaO.

**Assignees:** CHANGSHA UNIV OF SCIENCE AND TECHNOLOGY; UNIV CHANGSHA SCIENCE AND TECH

## 135. Family 62660007 (US2017362491 AA)

[View in PatBase](#)

### Title

[EN] SYSTEM AND RELATED METHOD TO SEAL FRACTURED SHALE

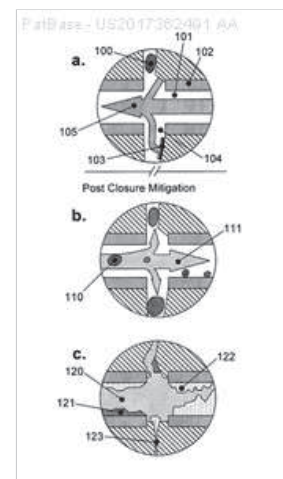
### Abstract

[EN] A method of pumping a fluid and reactive solid into a mineral formation includes the fluid reacting with the mineral formation to produce a nucleation product. The method may be used in shale formations to seal fissures and prevent leakage. The fluid used in this method may comprise CO<sub>2</sub> and the nucleation products may be the products of carbonation reactions. A cement formed by reacting CO<sub>2</sub> with a reactive solid under deep geological formation conditions is also disclosed.

### 1st Main Claim

[EN] 1. A method comprising pumping a fluid and reactive solid into a mineral formation, wherein said fluid reacts with said solid to produce a solid reaction product.

**Assignees:** UNIV OF VIRGINIA PATENT FOUNDATION D B A UNIV OF VA LICENSING AND VENTURES GROUP; TAO ZHIYUAN; CLARENS ANDRES F; FITTS JEFFREY P



## 136. Family 79078867 (US2022002203 AA)

[View in PatBase](#)

### Title

[EN] CEMENTITIOUS MATERIALS AND METHODS OF MAKING AND USING THEREOF

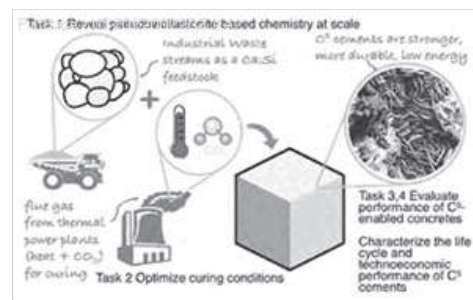
### Abstract

[EN] Disclosed are cementitious materials as well as methods of forming cured cementitious materials. In one aspect, provided are methods of forming a cured cementitious material that comprise (a) contacting a cementitious material comprising a calcium silicate precursor with water and carbon dioxide under conditions effective to form crystalline calcium silicate hydrates within the cementitious material; and (b) allowing the cementitious material to harden to form the cured cementitious material.

### 1st Main Claim

[EN] **1.** A method of forming a cured cementitious material, the method comprising:  
(a) contacting a cementitious material comprising a calcium silicate precursor with water and carbon dioxide under conditions effective to form crystalline calcium silicate hydrates within the cementitious material; and  
(b) allowing the cementitious material to harden to form the cured cementitious material.

**Assignees:** CLARENS ANDRES F; PLATTENBERGER DAN A; UNIV VIRGINIA PATENT FOUNDATION; UNIV OF VIRGINIA PATENT FOUNDATION



137. Family 15682370 (CN1321852 A)

[View in PatBase](#)

Title

[EN] Antiscaling process for ash-water pipeline of heat and power plant

Abstract

[EN] The anti-scaling process for conveying ash water of steam powder plant is characterized by that before the ash water is conveyed, the ash water is treated, at inlet plate of ash pump a softening pool is set, the furnace smoke drawn from outlet of induced draught fan of the boiler is undergond the processes of washing with water to removed dust, cooling and mixing with air, then blown into the softening pool, when the ash water is flowed through the softening pool, it can be neutralized by mixed furnace smoke, and its pH value is reduced to 8.5-9.2 from 11-12, and the Ca(OH<sub>2</sub>) being in the ash water can be completely formed into CaCO<sub>3</sub>, and precipitated, then the softened ash water can be conveyed into ash storage field by means of ash pump.

1st Main Claim

[MT] 00108523.9 clams: Page 1/1 2 1, fire power plant ash water delivery anti-fouling of new technology, is a gray water treatment before delivery, characterized in that: (1) in the mortar pump inlet disposed near the bottom of the pool softening softening pools, inflatable tube, inflatable tube evenly distributed only in parallel with the blower outlet; (2) from the boiler fan withdrawn at the outlet of the flue gas furnace, furnace flue gas dust by washing, after cooling into the Roots blower, air controlled by a valve from the valve control from another pipe into the Roots blower; (3) when the water flow through the ash softening pool is Roots blower drum into the mixing furnace flue gas CO<sub>2</sub>, and when the PH meter indicates the gray water PH value of 8.5 to 9.2 is mortar pump exports to the ash field.

Assignees: YU HAIRONG



## 138. Family 60553606 (KR20150114771 A)

[View in PatBase](#)

### Title

[EN] STABILIZER COMPOSITION OF INDUSTRIAL WASTES MODIFIED UTILIZING THE CARBONATION FOR SOFT GROUND

### Abstract

[EN] The present invention relates to a solidifier composition for the soft ground using an industrial by-product which uses an industrial by-product which does not produce a secondary air pollution at all as well as using a general industrial by-product when processing the soft ground, sludge soil, construction remaining soil, an inorganic sludge of the floor of a river, etc. as an eco-friendly solidifier using an industrial by-product (slag, fly ash, bottom ash, and paper ash), an industrial by-product (slag, fly ash, bottom ash, and paper ash) used in a carbonation reaction process with the purpose of reducing carbon dioxide (CO<sub>2</sub>), and calcium carbonate (CaCO<sub>3</sub>) which is a carbonation reaction by-product by a rapid carbonation. A desirable embodiment of the present invention forms the solidifier composition including the slag, the fly ash, and the paper ash which are the carbonated-improved industrial by-products, and comprises: 40 to 50 wt percent of the slag; 15 to 25 wt percent of the fly ash; 15 to 20 wt percent of the paper ash; 3 to 7 wt percent of the CaCO<sub>3</sub>; and 1 to 3 wt percent of an alkali catalyst.

### 1st Main Claim

[MT] 1. Industrial by-product slag, but form a high fire compositions, including fly ash and the paper ash, slag, 40 to 50 percent by weight; 15 to 25 percent by weight of fly ash; Paper 15 to 20 percent by weight ash; 3 to 7 percent by weight of calcium carbonate; 1 to 3 percent by weight of an alkali promoter; The composition for the soft ground and the fire using the industrial by-products, characterized in that composed of.

**Assignees:** JOOYOUNG STS CO LTD

## 139. Family 70083720 (US2020087207 AA)

[View in PatBase](#)

### Title (EP3551406 B1)

[EN] LANDSCAPING PRODUCT AND METHOD OF PRODUCTION THEREOF

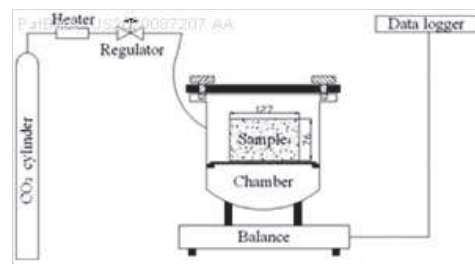
### Abstract

[EN] The present subject-matter relates to landscaping product comprising steel slag and optionally cement, compositions and processes for preparing same.

### 1st Main Claim (EP3551406 B1)

[EN] 1. A process for preparing landscaping products, such as a paver, comprising:

- i) mixing a dry part; and a liquid part; wherein said dry part is comprising an aggregate and a binder, wherein said binder is consisting of steel slag and optionally cement; and wherein said liquid part is comprising water and a chemical admixture selected from water repellents, water reducers, air entraining admixture and efflorescence reducing/controlling admixture, wherein said water reducers are meeting the requirements of ASTM C494;
- ii) molding and compacting the mixture of step i) to a shaped product having an initial water to slag ratio W/S;
- iii) optionally reducing the initial water to slag ratio W/S of said shaped product of step ii) to provide a shaped product having a pre-carbonation water to slag ratio W/S; and
- iv) curing the shaped product of step ii) or iii) with carbon dioxide to provide said landscaping products.



**Assignees:** ROYAL INSTITUTION FOR ADVANCEMENT OF LEARNING MCGILL UNIV; CARBICRETE INC; CARBYCRETE INC

## 140. Family 53988546 (WO13079732 A1)

[View in PatBase](#)

### Title

[EN] AIR SETTING METHOD FOR OBTAINING PREFABRICATED PARTS WITH BINDING MATRICES, MATRICES AND PREFABRICATED PARTS THUS OBTAINED AND USE THEREOF

### Abstract

[EN] The invention relates to a method, accelerated by forced autoclaved carbonation, for the air setting of prefabricated parts with binding matrices including calcium hydroxide, using hydraulic and/or non-hydraulic limes, preferably carbide nano-limes, in which the setting rate is increased in relation to known processes by means of the addition of carbonic anhydrase as a catalytic carbonation accelerator. In order to promote ultra-rapid carbonation, once the parts have been sufficiently hardened and removed from the mould, they are introduced into an autoclave and the air is extracted therefrom by means of vacuum and replaced with CO<sub>2</sub> and water vapour until the carbonation thereof. In addition to ultra-rapid air setting, the method can also be used for the industrial production of prefabricated parts having good early-age mechanical properties.

### 1st Main Claim

[MT] 1. Method for obtaining prefabricated parts with uado frag cementitious matrices, including the following steps: i. Mixture consisting of solid materials such materials in cementitious matrices that include calcium hydroxide, from hydraulic limes and/or over-the-air, and carbonic anhydrase and subsequent kneading with water; *ii*. Dump the mixture thus obtained in molds of prefabricated and, once reached a sufficient hardness, extraction of the part from the mold and dried in air until in equilibrium in an environment whose relative humidity does not exceed 85 percent; *iii*. Once hardened and the EPRD water l iqu ida by drying, preferably after seven days of drying air, insertion of the parts in an autoclave and degassing for depression by vacuum at a maximum of 760 mm Hg; iv. In the autoclave steam injection of water from distilled water, distilled water mist or of a saturated aqueous solution of micronized calcium hydroxide until the chamber is depressurized to 500 - (200) mm Hg, v. Injection of CO<sub>2</sub> in the autoclave until this is depressurized and reaches 760 mm Hg of pressure inside, remaining parts inside the prefabricas until at least 50 percent of the calcium hydroxide of prefabricated parts has been transformed into calcium carbonate; vi. Depressurizing the autoclave, unloading and storage of the finished pieces.

**Assignees:** RODRIGUEZ NAVARRO CARLOS; ELERT KERSTIN; RUIZ AGUDO ENCARNACION; GEOSILEX TRENZA METAL S L; BERMEJO SOTILLO MIGUEL

141. Family 67370006 (GB2566460 A1)

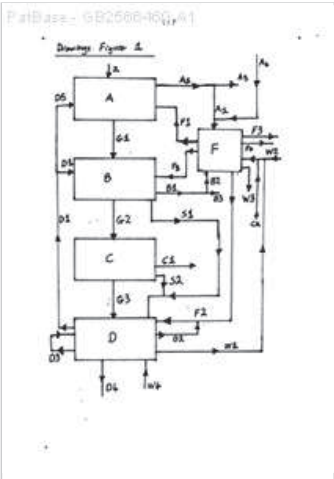
[View in PatBase](#)

**Title**  
[EN] A DESIGN FOR AN EFFICIENT SYMBIOTIC ENERGY PLANT

**Abstract**  
[EN] A power station is fueled by fossil fuels or biomass increases efficiency and reduces harmful emissions. Electrolysis may separate water into hydrogen and oxygen, with a calcium carbonate (CaCO3) slurry remaining. Renewable energy, such as solar energy, may power the electrolysis. The oxygen may be used to increase combustion efficiency in the power station's main furnace. The hydrogen may react with the carbon dioxide (CO2) produced by the main furnace, in a Sabatier reaction, to make methane (CH4), to provide further fuel for burning. The calcium carbonate may be reacted with sulfur dioxide (SO2) to form calcium sulfate (CaSO4), which may be used for cement.

**1st Main Claim**  
[EN] 1) That this energy system offers greater thermal and electrical power generation efficiency than current combustion electricity production technology.

**Assignees:** JACKSON JOHN; JOHN JACKSON



142. Family 66266082 (KR20170075252 A)

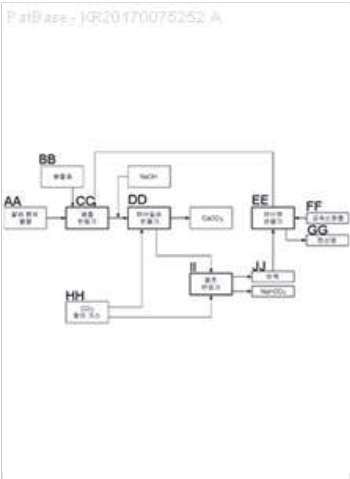
[View in PatBase](#)

Title

[EN] FACILITY FOR PRODUCING SODIUM HYDROGEN CARBONATE AND CALCIUM CARBONATE, AND METHOD OF PRODUCING SODIUM HYDROGEN CARBONATE AND CALCIUM CARBONATE

Abstract

[EN] An embodiment of the present invention provides a facility for producing sodium hydrogen carbonate and calcium carbonate, and a method of producing sodium hydrogen carbonate and calcium carbonate using the facility. The facility comprises: an elution reactor which elutes calcium ions from a calcium-containing material by an eluent to produce an aqueous calcium salt solution; a calcium carbonate reactor to which a carbon dioxide-containing gas, the aqueous calcium salt solution and sodium hydroxide (NaOH) are supplied, and which produces calcium carbonate (CaCO<sub>3</sub>) by the reaction; a sodium hydrogen carbonate reactor to which the carbon dioxide-containing gas, and a filtrate remained after recovering calcium carbonate are supplied, and which produces sodium hydrogen carbonate (NaHCO<sub>3</sub>) by the reaction; and a carbonate reactor to which a metal oxide, and a filtrate remained after recovering sodium hydrogen carbonate from the sodium hydrogen carbonate reactor are supplied, and which produces carbonate by the reaction, wherein the carbonate reactor supplies a filtrate remained after recovering the carbonate to the elution reactor. Accordingly, the present invention has an effect of minimizing discharge of carbon dioxide and wastewater and remarkably reducing production costs of calcium carbonate and sodium hydrogen carbonate by stably fixing carbon dioxide to the carbonate that is a mineral using steel slag, natural minerals, or the like.



1st Main Claim

[MT] 1. Calcium containing material from by the eluent to elute the calcium ions to produce a calcium salt solution; carbon dioxide-containing gas, the reactor eluted calcium salt solution and an aqueous sodium hydroxide (NAOH) is supplied, the reaction bygenerating a calcium carbonate (CACO3), calcium carbonate, carbon dioxide-containing gas, and the carbonation reactor; calcium carbonate in reactor to recover the remaining filtrate is supplied by the reactionof sodium bicarbonate to produce a crude reactor; and a metal oxide, and wherein the tank reactor to recover the sodium hydrogen carbonate in the reaction, the remaining liquid is supplied to generate a carbonate carbonate by the reactor reactor to recover the carbonate and bicarbonate remaining filtrate to article of the eluate supplying to the reactor, and calcium carbonate production facility.

**Assignees:** RES INST IND SCIENCE AND TECH; POSCO; RESEARCH INST OF INDUSTRIAL SCIENCE AND TECHNOLOGY; POHANG IRON AND STEEL CO

## 143. Family 83437960 (US2021070656 AA)

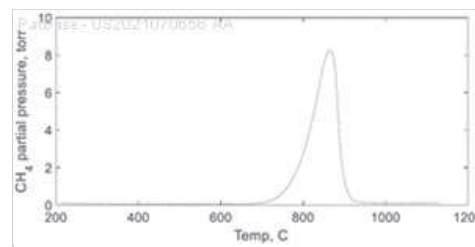
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### Title (EP4013726 A1)

[EN] PROCESS TO MAKE CALCIUM OXIDE OR ORDINARY PORTLAND CEMENT FROM CALCIUM BEARING ROCKS AND MINERALS

### Abstract (EP4013726 A1)

[EN] Aspects of the invention include a method of producing a cement material comprising step of: first reacting a calcium-bearing starting material with a first acid to produce an aqueous first calcium salt; second reacting the aqueous first calcium salt with a second acid to produce a solid second calcium salt; wherein the second acid is different from the first acid and the second calcium salt is different from the first calcium salt; and thermally treating the second calcium salt to produce a first cement material. Preferably, but not necessarily, during the second reacting step, reaction between the first calcium salt and the second acid regenerates the first acid.



### 1st Main Claim (EP4013726 A1)

[EN] 1. A method of producing a cement material, the method comprising steps of: first reacting a calcium-bearing starting material with a first acid to produce an aqueous first calcium salt; second reacting the aqueous first calcium salt with a second acid to produce a solid second calcium salt; wherein the second acid is different from the first acid and the second calcium salt is different from the first calcium salt; and thermally treating one or more calcium salts to produce a first cement material.

**Assignees:** CALIFORNIA INST OF TECHN; CALIFORNIA INST OF TECH; BRIMSTONE ENERGY INC; CALIFORNIA SCIENCE AND ENG COLLEGE; SULFUR ENERGY STOCK LTD CO

144. Family 105749456 (CN119118546 A)

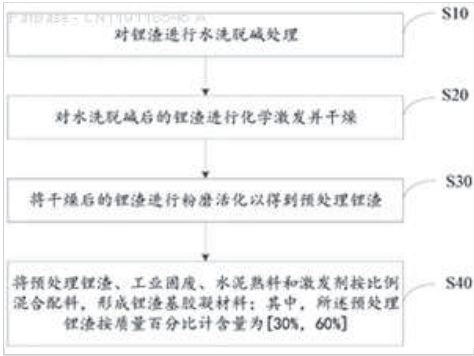
[View in PatBase](#)

Title

[EN] LITHIUM SLAG-BASED CEMENTING MATERIAL AND PREPARATION METHOD THEREOF

Abstract

[EN] The invention provides a lithium slag-based cementing material and a preparation method thereof. The preparation method of the lithium slag-based cementing material comprises the following steps: carrying out water washing dealkalization treatment on lithium slag; carrying out chemical excitation on the lithium slag subjected to water washing and dealkalization, and drying; grinding and activating the dried lithium slag to obtain pretreated lithium slag; mixing the pretreated lithium slag, industrial solid waste, cement clinker and an exciting agent in proportion to form a lithium slag-based cementing material; wherein the content of the pretreated lithium slag is [30 percent, 60 percent ] in percentage by mass. The problems of low hydration activity, high alkali content, large component fluctuation and the like of the lithium slag are solved through pretreatment of water washing dealkalization, chemical excitation and mechanical activation of the lithium slag, and recycling, high-performance and harmless utilization of the large-mixing-amount lithium slag in the process of preparing a cementing material is achieved. And moreover, the lithium slag-based cementing material is used for replacing Portland cement, so that the CO2 emission is reduced while the lithium slag solid waste is recycled.



1st Main Claim

[MT] 1. A method for preparing a lithium residue-based gelling material, comprising:

A water elution base treatment of the lithium slag;

The lithium slag after water elution base is chemically excited and dried;

Pulverizing the dried lithium slag to obtain a pretreated lithium slag;

The pretreated lithium slag, industrial solid waste, cement clinker and excitant are mixed proportionally to form a lithium slag-based cementitious material; wherein the pretreated lithium slag is [30%, 60%] by mass.

Assignees: YIFENG JIULING LITHIUM IND CO LTD

## 145. Family 108380880 (CN120136462 A)

[View in PatBase](#)

### Title

[MT] A KIND OF DICALCIUM SILICATE-IRON PHASE CEMENT CLINKER AND ITS PREPARATION METHOD AND APPLICATION

### Abstract

[MT] [0001] The present invention proposes a dicalcium silicate-iron phase cement clinker and its preparation method and application. The cement clinker includes, by mass percentage: C<sub>2</sub>S 59-75 percent, iron phase 20-40 percent, impurity phase 1-5 percent; the above-mentioned components are obtained by the following oxides according to their corresponding mass fractions, including: CaO 58-61 parts, SiO<sub>2</sub> 23-28 parts, Al<sub>2</sub>O<sub>3</sub> 4-8 parts, Fe<sub>2</sub>O<sub>3</sub> 7-13 parts. The cement clinker provided by the present invention is mainly composed of low-calcium minerals, and by reducing the proportion of high-calcium minerals, the high temperature conditions required during the calcination process are significantly reduced, thereby greatly reducing the emission of carbon dioxide. At the same time, the present invention uses carbonized steel slag as a raw material. Compared with CaCO<sub>3</sub> in limestone, the carbonized CaCO<sub>3</sub> is smaller in size, and Ca<sup>2+</sup> is more likely to migrate, which can effectively promote the formation of minerals, reduce the calcination temperature, increase the hydration activity of clinker, and improve the strength of composite cement.

### 1st Main Claim

[MT] 1. A dicalcium silicate-iron phase cement clinker, characterized in that it comprises the following components by mass percentage: C<sub>2</sub>S 59-75 percent, iron phase 20-40 percent, and impurity phase 1-5 percent;

The components are obtained from the following oxides according to their corresponding mass fractions, including: 58-61 parts of CaO, 23-28 parts of SiO<sub>2</sub>, 4-8 parts of Al<sub>2</sub>O<sub>3</sub>, and 7-13 parts of Fe<sub>2</sub>O<sub>3</sub>.

**Assignees:** WUHAN UNIV OF TECHNOLOGY

146. Family 83423107 (US2022332655 AA)

[View in PatBase](#)

**Title (EP4010301 B1)**  
[EN] A PROCESS FOR A CARBONATED COMPOSITE

**Abstract**

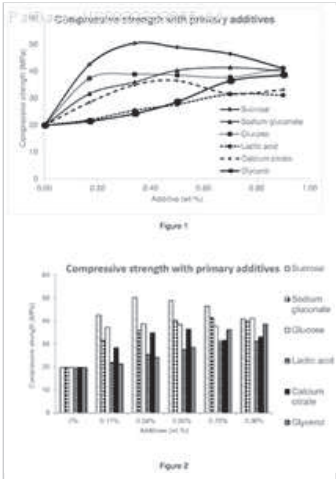
[EN] The invention relates to a process for producing a composite comprising:

- a. providing a particulate material, wherein the particulate material comprises minerals having a content of at least 30 percent m/m of calcium, magnesium, aluminium, silicon, potassium or iron, or a combination of two or more thereof.
- b. providing an aggregate,
- c. providing a primary additive, wherein the primary additive comprises a sugar or derivative thereof, a polyol or derivative thereof, an organic acid, an organic acid salt or an inorganic acid, or any combination of two or more thereof,
- d. mixing the particulate material, the aggregate and the primary additive with water to form a mixture, and
- e. carbonating the mixture in the presence of carbon dioxide, wherein the concentration of carbon dioxide is greater than about 2 vol percent.

**1st Main Claim (EP4010301 B1)**

[EN] 1. A process for producing a concrete composite comprising:

- a. providing a particulate material, wherein the particulate material comprises minerals having a content of at least 30 percent m/m of calcium, magnesium, aluminium, silicon, potassium or iron, or a combination of two or more thereof.
- b. providing an aggregate,
- c. providing a primary additive, wherein the primary additive comprises a sugar or derivative thereof, a polyol or derivative thereof, an organic acid comprising a carboxylic acid, or an organic acid salt comprising a carboxylate salt, or any combination of two or more thereof, wherein the carboxylic acid containing compound or carboxylate salt containing compound comprises citric acid, sodium gluconate, sodium citrate, calcium nitrate, acetic acid, sodium acetate, calcium acetate, formic acid, glyceric acid, ascorbic acid, tartaric acid, oxalic acid, malic acid or lactic acid, or any combination of two or more thereof, wherein the primary additive is provided in the in the form of a solution, a colloidal suspension, or a powder,
- d. mixing the particulate material, the aggregate and the primary additive with water to form a mixture, wherein the mixture is shaped using a mold or a support, wherein the mixture remains in the mold or on the support for a period of from 1 s to 2 hours and is then separated from the mold or the support prior to step (e), and
- e. carbonating the mixture in the presence of carbon dioxide for a period of from 6 hours to 36 hours, wherein the concentration of carbon dioxide is greater than 2 vol percent.



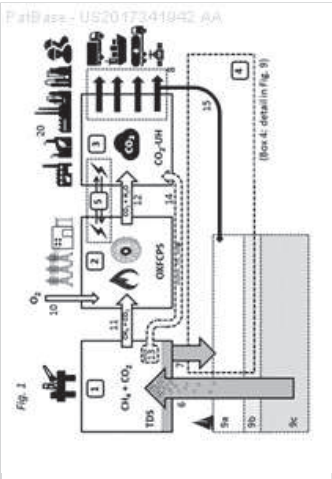
**Assignees:** CRH GROUP SERVICES LTD; CRH NEDERLAND BV

147. Family 67652842 (US2017341942 AA)

[View in PatBase](#)

**Title**  
[EN] METHODS AND SYSTEMS FOR LARGE SCALE CARBON DIOXIDE UTILIZATION FROM LAKE KIVU VIA A CO<sub>2</sub> INDUSTRIAL UTILIZATION HUB INTEGRATED WITH ELECTRIC POWER PRODUCTION AND OPTIONAL CRYO-ENERGY STORAGE

**Abstract**  
[EN] Lake Kivu contains ~50 million tonnes (MT) dissolved biomethane. Efficient use is problematic from massive associated CO<sub>2</sub>: ~600 MT. Conventional extraction scrubs CO<sub>2</sub> with ~50 percent overall CH<sub>4</sub> loss, and returns ~80 percent CO<sub>2</sub> into the deep lake, preserving a catastrophe hazard threatening >2 M people. Methods and systems are disclosed coupling: (1) efficient CH<sub>4</sub>+CO<sub>2</sub> degassing; (2) optional oxyfuel power generation and CO<sub>2</sub> power cycle technologies; and (3) CO<sub>2</sub> capture, processing, storage and use in a utilization hub. The invention optimally allows power production with >2x improved efficiency plus cryo-energy storage and large-scale greentech industrialization. CO<sub>2</sub>-utilizing products can include: Mg-cements/building materials, algal products/biofuels, urea, bioplastics and recycled materials, plus CO<sub>2</sub> for greenhouse agriculture, CO<sub>2</sub>-EOR/CCS, off-grid cooling, fumigants, solvents, carbonation, packaging, ores-, biomass-, and agro-processing, cold pasteurization, frack and geothermal fluids, and inputs to produce methanol, DME, CO, syngas, formic acid, bicarbonate and other greentech chemicals, fuels, fertilizers and carbon products.



**1st Main Claim**  
[EN] 1. A method for obtaining and utilizing carbon dioxide gas from a body of water containing dissolved carbon dioxide gas and methane gas, said method comprising the steps of:  
(a) extracting water from at least one extraction depth of the body of water to obtain extracted water;  
(b) degassing the extracted water in at least one stage of degassing so as to provide degassed water and extracted gases comprising carbon dioxide gas and methane gas in at least one flow;  
(c) optionally combusting the extracted gases with oxygen to provide an exhaust gas comprising carbon dioxide and water; and  
(d) feeding to a utilization hub the carbon dioxide gas from at least one of step (b) and step (c), wherein the utilization hub is configured to collect the carbon dioxide gas for storage, distribution, processing and/or utilization.

**Assignees:** HARPER BIOTECH LLC; HARPER BIOTECH LLC D B A SIMBUKA ENERGY LLC

## 148. Family 60689962 (KR101564853 B1)

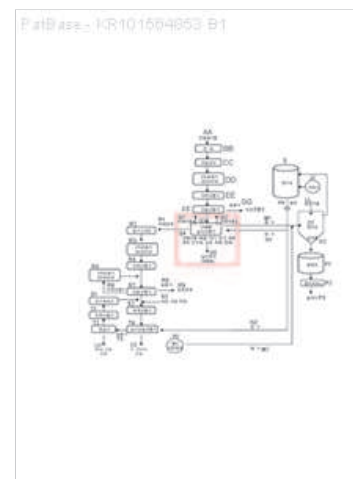
[View in PatBase](#)

### Title

[EN] ELECTRO WET SEPARATOR AND TREATMENT METHOD OF CONSTRUCTION WASTE BY IT

### Abstract

[EN] The present invention relates to a method for treating construction waste by using an electrolytic wet-type sorter. According to the present invention, when performing one among treatment, intermediate treatment, final treatment, and recycling treatment of construction waste, when treating construction waste through at least one among pulverization, sorting, distribution, and recycling, or when producing recycled aggregate from construction waste, an inner type or an outer type electrolytic device composed of one or more among an electrolysis tank, an electrolysis instrument, an anode, a cathode, a perforated cover, a rectifier, a wire, a supply pipe, and a distributor is mounted with further a perforated belt conveyor on one or more among the inner side and the outer side of one among a wet-type sorter, a gravity sorter, and a buoyancy sorter in a wet-type sorting process, a gravity sorting process, and a buoyancy sorting process, respectively. Accordingly, the electrolytic device performs one or more electrolytic sorting among bubble sorting, aeration sorting, aerobic sorting, vortex sorting, washing sorting, carbonation sorting, sterilization sorting, decomposition sorting, purification sorting. In addition, the electrolytic device performs an electrolytic sorting which allows one or more foreign materials among fine particles, intermediate materials, larger particles, organic impurities, inorganic impurities, mortar materials, calcium impurities, salt impurities, bacteria impurities, and contaminants to be sorted, separated or removed. Furthermore, the electrolytic device performs one or more among perforation sorting in which materials are sorted into one passing through and the other not passing through perforations on a perforated belt conveyor, and buoyancy sorting in which materials are separated into buoyant materials and precipitates by undercurrent water.



### 1st Main Claim

[MT] 4. The construction of waste treatment, intermediate treatment, final treatment, as one of the recycling process and handles the construction waste crushing, screening, grading, one of the recycling, processing and production of recycled aggregates from construction waste; Wet Separators, weight sorter, buoyancy grading, sorting processes, wet screening process, gravity sorting process, electrolysis devices in one unit of buoyancy screening process, purchase, installation, mounting, and the electrolyzed electrolytic material in the process generated by the device, injection, put the inlet, supply, distribution, diffusion, aeration least one of which is selectively delivered to the type of waste or object is committed to the production of electrolytic process, electrolysis-type wet screening process is applied; The delivery device is an internal type, external type, complex type of the selected one, and; The electrolysis inside the type of device is the electrolyzer (positive, negative), a rectifier, an electric wire, is composed of one or more of the perforated cover, separator, a wet separator, gravity separator, a group introduced to one of the inside of the buoyancy separator (anode, cathode), wires, one of the perforated lid or more pieces, and the electrolyzer from the rectifier power is supplied to the (positive, negative) the inside, an anode, a cathode, an electrolytic material separator produced in at least one of between thereof, the wet separator, gravity separator, it is introduced inside one of the buoyancy separator; The electrolyte external type of device is the electrolytic cell, electrolyzer (positive, negative), rectifiers, power lines, a supply pipe, is composed of one or more of spreader, separator, a wet separator, gravity separator, one of the buoyant separator in the electrolytic cell is installed on the external inside the anode, cathode, one or more, and embedded in the wire, the electrolyzer from the rectifier inside of the electrolytic cell power is supplied to the (positive, negative), the positive electrode, negative electrode, generated electrolytic material supply pipe in at least one of between its Through Separators, Wet Separators, Separators share, through the embedded balancer inside one of the buoyancy Separators Separators, Wet Separators, Separators gravity, buoyancy is introduced inside one of the selector; Will apply to the delivery of the hybrid device that combines the internal type and an external type, the positive electrode, a negative electrode is provided on the inner tinged mutual predetermined distance or more in one pair, wherein the predetermined distance is 0.1cm, 0.5 cm, 1 cm, 1.5 cm, 2 cm, 5 cm, of 10 cm, 0.1~10cm, and one of the electric field forming distance, the electric field effect interval, the anode, through a wire connected to the cathode, an anode, a cathode mounted in the cathode booth, the booth negative power, electricity, voltage, current of one is supplied via the connected wires on the rectifier to supply the positive electrode, a negative electrode, the power in at least one of the wires, electric voltage, one of the current, converts the alternating current into direct current to supply direct current to the, as a direct current into an alternating current is converted to alternating current to the supply, as to supply a constant voltage (constant voltage) in the one of the constant current to supply (constant current), and the; The perforated cover electrolyzer, an anode, a pitcher castle door with perforated holes that are installed on top of the anode, covers, mesh, wire, mesh, fabric, fibers, woven and non-woven fabrics, and one of the perforated plate, perforated plate, the supply pipe a separator material delivered generated in the electrolytic bath, a wet separator, gravity separator, is to supply to the spreader which is embedded inside one of the buoyancy separator, the balancer separator material delivered is supplied through the supply pipe, a wet separator, weight sorter, introduced inside one of the buoyancy and the selectors; The perforated cover waste, through material, precipitated material, the foreign material one or more of the electrolyzer, an anode, a cathode of the group electrolytic sitting down on at least a positive electrode, that is between the negative electrode to prevent the clogging of the plate is perforated hole formed, fibers, and its shape is hat-shaped, funnel-shaped, dome-shaped roof-like, which is between the positive electrode, is installed on top of the cathode an anode, a foreign substance enters between the cathode anode, between the anode by blocking the positive and negative is for preventing the electrolytic action is reduced, and the balancer diffusers, dispersion pipe, the pipe is perforated; The electrolytic material is a liquid electrolyte material, weather electrolytes, electrolysis and separated by other materials; The liquid electrolytes are electrolytic, acidic, alkaline water, and one or more of deionized water, carbonated water, and the gaseous electrolytes is oxygen gas, hydrogen gas, carbon gas, chlorine gas, at least one of brown gas, the material of the rest electrolytic radical, OH radical, construction waste processing method is applied to the electrolytic type liquid separator, characterized in that at least one of chayeom.

**Assignees:** DAE GIL ES CO LTD

149. Family 53957664 (WO13077892 A2)

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Extended Family Number: 42613795

Title

[EN] CONCRETE COMPOSITIONS AND METHODS

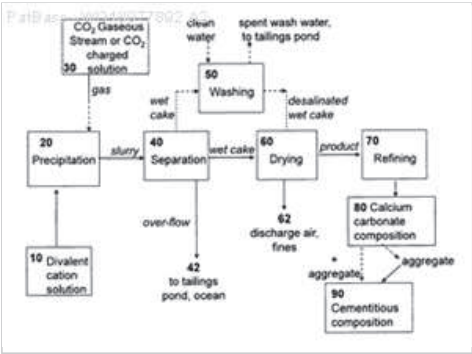
Abstract

[EN] Provided herein are compositions, methods, and systems for cementitious compositions containing calcium carbonate compositions and aggregate. The compositions find use in a variety of applications, including use in a variety of building materials and building applications.

1st Main Claim

[EN] 1. A cementitious composition, comprising: between 10-55 wt percent of a composition comprising calcium carbonate, wherein between 50-100 wt percent of the calcium carbonate is in a metastable polymorphic form comprising vaterite, and wherein the calcium carbonate has a  $\delta^{13}\text{C}$  value of between -12 to -30 percent o; and between 45-90 wt percent of aggregate, wherein the cementitious composition after combination with water sets and hardens into cement where the calcium carbonate binds to the aggregate and the cement has a compressive strength of at least 2000 psi.

Assignees: CALERA CORP



**150. Family 80802470 (WO20173906 A1)**

[View in PatBase](#)

**Title (EP3930932 A1)**

[EN] A COMPOSITE

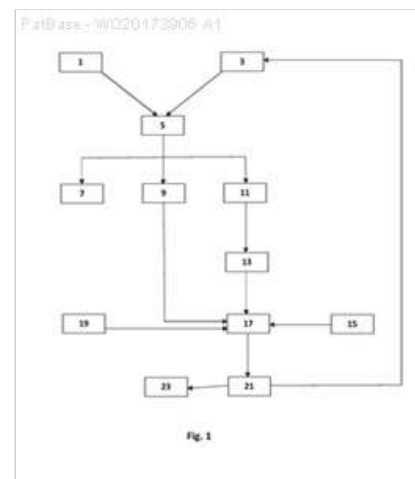
## Abstract

[EN] The invention relates to a process of producing a composite comprising: a) providing a particulate material, b) providing an organic waste material, c) mixing the particulate material and the organic waste material to form a mixture, and d) carbonating the mixture in the presence of carbon dioxide, wherein the particulate material comprises calcium oxide, calcium hydroxide, calcium silicate or combinations of two or more thereof.

## 1st Main Claim

[EN] 1. A process of producing a composite comprising: a) providing a particulate material, b) providing an organic waste material, c) mixing the particulate material and the organic waste material to form a mixture, and d) carbonating the mixture in the presence of carbon dioxide, wherein the particulate material comprises calcium oxide, calcium hydroxide, calcium silicate or combinations of two or more thereof.

**Assignees:** CRH NEDERLAND BV; CALDURAN KALKZANDSTEEN BV



## 151. Family 97602509 (WO24213888 A1)

[View in PatBase](#)

### Title

[EN] METHODS FOR REPURPOSING PLASTIC FOR USE IN THE BUILDING INDUSTRY

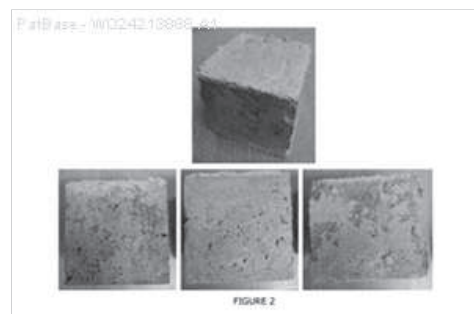
### Abstract

[EN] The present invention relates to a method of manufacturing a carbonated plastic aggregate comprising the steps of: (i) mixing plastic particles and at least one cementitious binder comprising at least one metal oxide or metal silicate to form a first composition, (ii) providing a second composition comprising water; (iii) mixing together the first and second compositions to form a pre-mixture; (iv) agglomerating the pre-mixture to form a plastic aggregate; and (v) carbonating the at least one metal oxide or metal silicate by means of an active carbonation process to obtain the carbonated plastic aggregate.

### 1st Main Claim

[EN] 1. A method of manufacturing a carbonated plastic aggregate comprising the steps of: (i) mixing plastic particles and at least one cementitious binder comprising at least one metal oxide or metal silicate to form a first composition, wherein the plastic is derived from plasticbased foam; (ii) providing a second composition comprising water; (iii) mixing together the first and second compositions to form a pre-mixture; (iv) agglomerating the pre-mixture to form a plastic aggregate; and (v) carbonating the at least one metal oxide or metal silicate by means of an active carbonation process to obtain the carbonated plastic aggregate.

**Assignees:** LOW CARBON MAT LTD



## 152. Family 93093742 (CN114961845 A)

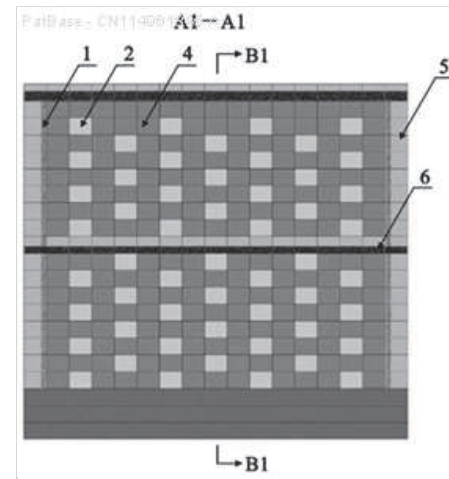
[View in PatBase](#)

### Title

[EN] GOAF CARBON SEQUESTRATION METHOD BASED ON LAYERED DRIFT TAILING CEMENTED FILLING MINING

### Abstract

[EN] The invention relates to a goaf carbon sequestration method based on layered drift tailing cemented filling mining, and belongs to the field of carbon dioxide sequestration of metal mines. Mining the side wall of the current layered ore body according to the concentric-square-shaped drift, and sealing the side wall except the connection roadway by using an airtight material; mining an internal ore body by using a layered drift filling method, filling the reserved goaf at intervals by using a tailing cemented filling body in a downward layering method, and filling the reserved goaf at intervals by using a tailing cemented filling body and waste rocks in an upward layering method; when the current layered operation is finished, a CO<sub>2</sub> pipeline from the goaf or the barren rock filling area to the segmented transportation roadway is erected in the connection roadway, and the connection roadway is sealed through airtight materials; when the current middle section operation is finished, the captured CO<sub>2</sub> is injected into a goaf or a barren rock filling area through a pipeline arranged along an air return path, and the CO<sub>2</sub> is stored for a long time from a gas state to a supercritical state along with the increase of mining depth and ground temperature. The method is easy to operate and low in cost, and has important significance on sustainable utilization and green mining of the underground space of the mine.



### 1st Main Claim

[MT] 1. A method of carbon sequestration of a mined area based on layered approach tailings filling mining, characterized in that, on the basis of layered approach tailings filling mining, a sealing layer at the boundary of an ore body (12) of a metal ore is constructed with an airtight material (1), and a higher-strength tailings filling body (5), Artificial fake tops (6) or artificial fake bottoms (7) and space-filled tail sands cementitious packs (4) within the evacuation zone support the overall frame of the evacuation zone, leaving a CO<sub>2</sub> sequestered empty zone (2) or a high porosity CO<sub>2</sub> sequestered waste stone pack zone (3) in the evacuation zone according to the field conditions, Initially charge CO<sub>2</sub> into the CO<sub>2</sub>-sequestering empty zone (2) or the CO<sub>2</sub>-sequestering waste stone filling zone (3) with piping, and seal CO<sub>2</sub> within the extraction zone by means of an airtight material (1) on the boundary of the ore body (12), as the CO<sub>2</sub> sequestered in the empty zone diffuses into the tailgate cementing packing body (4), Reacting with the base tail sand and cement hydration products in the tail sand cementitious filler body (4), consuming CO<sub>2</sub> while producing high strength calcium carbonate CaCO<sub>3</sub> and silica gel SiO<sub>2</sub> · nH<sub>2</sub>O with gelling, thereby improving the overall strength and airtightness of the tail sand cementitious filler body (4), reducing the porosity of the tail sand cementitious filler body (4) and achieving substantial, long-term and safe carbon sequestration;

The specific steps are as follows:

Step 1. the current layered ore body side is mined in a return shape, the current tiered ore body side is blocked with airtight material (1), leaving the mine contact lane (10) and the stratified contact lane (11) serving the currently mined tiers;

Step 2. mining of an internal ore body (12) other than a bezel by layerwise approach fill mining, mining of the ore body (12) by using a downward-tiered approach fill mining, spacing filling of the emptied inlet path using a tailgate cementing packing body (4), leaving CO<sub>2</sub> a sequestered empty space (2) by using a tailgate cementing packing body (4) and a sequestered empty inlet path using a tailgate cementing packing body (4) and a sequestered empty inlet path;

Step 3. after the end of the current tiered job, install CO<sub>2</sub> ducting (9) from CO<sub>2</sub> sequestered empty area (2) or CO<sub>2</sub> sequestered waste stone filled area (3) to staged transport lane (8) in the mine contact lane (10) and staged contact lane (11) using airtight material (1);

Step 4. repeating steps 1 – 3 layer-by-layer in a layered mining order until the end of the current mid-stage operation, injecting trapped CO<sub>2</sub> into the CO<sub>2</sub> sequestering empty zone (2) or the CO<sub>2</sub> sequestering waste stone filling zone (3) through a CO<sub>2</sub> duct disposed along the return air path while the mining operation is transferred to the next mid-stage, with the CO<sub>2</sub> sequestering long-term in gaseous to supercritical state as the depth of production and earth temperature increases.

**Assignees:** CHINA UNIV OF MINING AND TECHNOLOGY; UNIV CHINA MINING AND TECH

## 153. Family 60687134 (KR20150121734 A)

[View in PatBase](#)

### Title

[EN] COMPOSITION OF POLYMER REPAIRING AND REINFORCING MORTAR

### Abstract

[EN] The present invention relates to a polymer mortar composition for repairs and reinforcement including: 3-12 parts by weight of calcium sulfonate aluminate (CSA) based rapid hardening cement; 4-18 parts by weight of a calcium sulfonate aluminate (CSA) based expansion agent; 1-6 parts by weight of slaked lime; 0.6-6 parts by weight of a polyvinyl alcohol (PVA) resin; 0.002-0.006 parts by weight of aluminum powder; 0.4-1.2 parts by weight of a dispersant; and 100-180 parts by weight of fine aggregates with respect to 100 parts by weight of cement.

### 1st Main Claim

[MT] 1. Cement 100 parts by weight of calcium on part sulfo aluminate (CSA) type steel cement 3 to 12 parts by weight of calcium sulfo aluminate (CSA) type expandable from 4 to 18 parts by weight of calcium hydroxide of 1 to 6 parts by weight of polyvinyl alcohol (PVA) 0.6 to 6 parts by weight of resin, aluminum powder, from 0.002 to 0.006 parts by weight of a dispersant from 0.4 to 1.2 parts by weight of fine aggregate 100 to 180 parts by weight polymer comprising a complement, reinforcing mortar composition.

**Assignees:** FINE CHEM CO LTD; KMB CO LTD; P S CONSTRUCTION ENGINEERING DEV CO LTD

## 154. Family 46715041 (KR20100095685 A)

[View in PatBase](#)

### Title

[EN] COMPOSITION OF ASPHALT CONCRETE APPLICABLE AT MID TEMPERATURE AND METHOD FOR MANUFACTURING THE COMPOSITION

### Abstract

[EN] PURPOSE: An asphalt concrete composition and a manufacturing method thereof are provided to reduce the discharge amount of carbon dioxide by decreasing the consumption of heating fuel. CONSTITUTION: A manufacturing method of an asphalt concrete composition capable of constructing at middle temperature comprises a step of mixing 1 parts of aggregate by weight heated to 100~135 deg C, 0.01~0.08 parts of asphalt by weight heated to 120~165 deg C, 0.04~0.10 parts of filler by weight, and 0.003~0.03 parts of middle temperature asphalt additive by weight to make the temperature of the total mixture into 100~135 deg c. The middle temperature asphalt additive is a pine resin.

### 1st Main Claim

[MT] 1. Heated to 100 ~ 135 °C, the surface layer is a base layer, double layer, for flow, grain size, wheat, the particle size of the aggregate drainage aspartic concrete, asphalt (relative to 1 ~165 bitumen) heated to 120 °C °C, and mixing the filler as 0.01~0.08 parts, stone dust, at least one of CaCO<sub>3</sub>, cement, hydrated lime, parts by weight of mixture of 0.04~0.10 additives as 0.003~0.03 asphalt asphalt mixture by adding parts by weight, so that the temperature of the medium temperature 100 ~ 135 °C, method of producing a composition of asphalt concrete construction possible in

**Assignees:** HWANG IK HYUN

155. Family 69529910 (US9957196 BA)

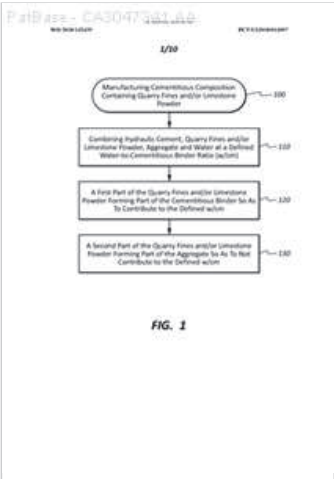
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**Title**  
[EN] PARTICLE SIZE OPTIMIZED WHITE CEMENTITIOUS COMPOSITIONS

**Abstract**  
[EN] A cementitious composition includes (i) white Portland cement having a Blaine fineness between about 350 m<sup>2</sup>/kg and about 550 m<sup>2</sup>/kg, a D90 between about 11 micro m and about 50 micro m, and a total combined iron oxide, manganese oxide, and chromium oxide content of less than 1.0 percent by weight and (ii) a light color ground granulated blast furnace slag (GGBFS) having a Blaine fineness greater than the Blaine fineness of the white Portland cement, a D90 less than the D90 of the white Portland cement, and a total combined iron oxide, manganese oxide, and chromium oxide content of less than 2.0 percent by weight. The cementitious composition may optionally include at least one of additional SCM, aggregate, fibers, or admixture. The cementitious composition can be a dry blend, a fresh cementitious mixture, or hardened cementitious composition. The cementitious composition can be precast concrete, stucco, GFRC, UHPC or SCC.

**1st Main Claim**  
[EN] 1. A cementitious composition comprising a dry blend of:  
white Portland cement having a Blaine fineness between about 350 m<sup>2</sup>/kg and about 550 m<sup>2</sup>/kg, a D90 between about 11 micro m and about 50 micro m, and a total combined iron oxide, manganese oxide, and chromium oxide content of less than 1.0 percent by weight;  
a ground granulated blast furnace slag (GGBFS) having a Blaine fineness greater than the Blaine fineness of the white Portland cement, a D90 less than the D90 of the white Portland cement, and a total combined iron oxide, manganese oxide, and chromium oxide content of less than 2.0 percent by weight; and  
optionally one or more additional components.

**Assignees:** ROMAN CEMENT LLC



## 156. Family 83180091 (CN112299466 A)

[View in PatBase](#)

### Title

[EN] PREPARATION METHOD OF NANO CALCIUM CARBONATE FOR CEMENT MORTAR

### Abstract

[EN] The invention relates to a preparation method of nano calcium carbonate for cement mortar. The preparation method is characterized in that a mixture of sodium tripolyphosphate, sodium dimer acid, zinc sulfate and sodium sulfate is used as a crystal form control agent, sodium polycarboxylate and maleated rosin are used as modifiers, and the nano calcium carbonate for the cement mortar is prepared through carbonization, surface modification and depolymerization, wherein the mass ratio of the crystal form control agent sodium tripolyphosphate to the sodium dimer acid to the zinc sulfate to the cane sugar is 1: 2: 1: 1 in sequence, and the mass ratio of the modifier sodium polycarboxylate to the maleated rosin is 3: 2. The prepared nano active carbonic acid is large in specific surface area, small in particle size, not prone to agglomeration, good in dispersity in cement concrete slurry and obvious in micro-aggregate effect, the interface performance can be obviously improved, the flowability, the mechanical property and the durability of cement concrete are improved, and the setting time is shortened.

### 1st Main Claim

[MT] 1. A cement mortar with nano calcium carbonate preparation, characterized in that: The preparation method using sodium tripolyphosphate, dimer acid sodium, zinc sulfate and sucrose mixture of crystalline form control agent sodium polycarboxylate and maleic rosin as a modifier, through carbonization, surface modification and the depolymerized to prepare a cement mortar with the nano-calcium carbonate, the specific process is:

The refining Ca (OH) 2 slurry was aged 18-24h, the shaker and the hydrocyclone 6-stage slag, to adjust its concentration to 10 percent to 20 percent, the temperature to 20 to 35 degrees centigrade and Ca(OH)<sub>2</sub> added mass of 0.5 percent to 1.5 percent of crystalline form control agent, mixing evenly, then pass into a volume concentration of 20 percent to 40 percent of the CO<sub>2</sub> gas for carbonation bubbling reaction until the slurry PH of 6.5 to 7 carbide end to give mass concentration of 10 percent to 20 percent cooked pulp; The cooked slurry after slag, stirring heated, the temperature reaches 65 ~ 85 degrees centigrade of 3 percent by mass was added Ca (OH) 2 to 7% of sodium polycarboxylate and maleic rosin-modified agent, adjusting the PH value of 7 ~ 9, stirring modified 60 ~ 90min; To obtain a modified nano calcium carbonate suspension was dewatered by pressure filtration, drying, to obtain a particle size of 30 ~ 40nm depolymerization of cement mortar with the nano-calcium carbonate; The crystalline form control agent sodium tripolyphosphate, dimer acid sodium, zinc sulfate and sucrose were mass ratio of 1:2:1:1, the modifier sodium polycarboxylate and maleic rosin mass ratio of 3:2.

**Assignees:** JIANGXI HUAMING NANO CALCIUM CARBONATE CO LTD

## 157. Family 10578766 (JP5286783 A2)

[View in PatBase](#)

### Title

[EN] METHOD FOR CURING HYDRAULIC SUBSTANCE AND PRODUCTION THEREOF

### Abstract

[EN] PURPOSE: To inhibit whitening by curing hydraulic substance at artificial low evaporation velocity in such a range that whitening is not caused or vaporizing and curing the hydraulic substance until gelatinized water is made absent and carbonating the hydraulic substance by reaction of both CO<sub>2</sub> substituted by vaporization of water and a whitening component.

CONSTITUTION: Cement, aggregate, a water-reducing agent and water are mixed at the prescribed weight. The obtained hydraulic substance is placed in a formwork or thereon. Then, a whitening component of the inside is not migrated on the surface by curing the hydraulic substance at artificial low vaporization velocity in such a range that whitening is not caused. Air is replaced by slowly vaporized water and approached to the inside. The whitening component reacts with CO<sub>2</sub>, contained in the air and thereby dense CaCO<sub>3</sub> is formed to the inside from the surface. Therefore, the hydraulic substance is made difficult water-absorption and secondary whitening is made difficult to be caused. Further, hydraulic substance is left to stand and cured until capillary water is made absent. When the hydraulic substance is vaporized and cured until gelatinized water is made absent, the whitening component of the inside is not migrated on the surface layer because gelatinized water is joined to gel. The hydraulic substance is carbonated in the inside and secondary whitening is made difficult to be caused.

### 1st Main Claim

[MT] 1. mold was Da<sub>設</sub> to medium or self-indulgent formwork on, after removal from the mold, or after removal from the mold to suppress secondary efflorescence try to fix a surface provided with a gas-barrier material cut off from evening the cured hydraulic hydraulic-based material-based material, (a) secondary efflorescence of the portion to be to suppress the capillary water is lost is not generated until the range efflorescence artificial low evaporation rate, (b) curing, or curing the hard-based material on the water subjected to the water, or it is not allowed to stand up to the capillary water hardness, the gel was aged-based material evaporation or water is eliminated, until the efflorescence curing range that does not occur, low curing and artificial evaporation rate of evaporation of water in the reaction of the components carbon dioxide and efflorescence desired thickness, characterized in that carbonate to suppress-based material, a secondary efflorescence water hardness regimen.

**Assignees:** MITSUO MITSUKO; MITSUO HIROSHI; MITSUO KOJI

## 158. Family 62926692 (KR20160086313 A)

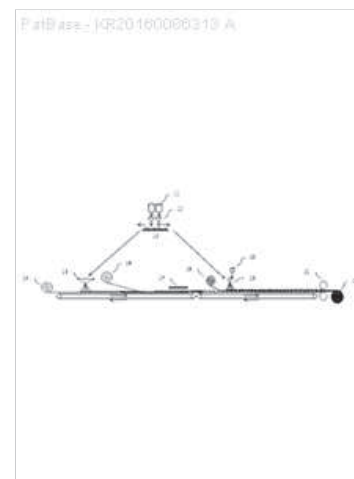
[View in PatBase](#)

### Title

[EN] FUNCTIONAL DRAIN, GAS, COVER LAYER AND MATERIAL

### Abstract

[EN] The present invention relates to a functional drain layer, a gas layer, and a cover layer which are applied to a drainage layer, a gas layer, and a molding layer and are formed in a waste landfill comprising: a) a bottom underground water drainage layer on the bottom, a cutoff layer on the bottom underground water drainage layer, and a leachate drainage layer on the cutoff layer; b) a slope underground water drainage layer on a slope, the cutoff layer on the slope underground water drainage layer, and the leachate drainage layer on the cutoff layer; and c) waste in an final covering soil, the gas layer on the waste, the cutoff layer on the gas layer, the drainage layer on the cutoff layer, and the molding layer on the drainage layer. One or more materials among an expansion function material, a binding gel function material, a hydro gel function material, a purification function material, a material for general water, a material for flowing water, a material for salt water, a material for contaminated water, and a material for other water are used at a ratio among a low ratio of 0-20 wt percent, a middle and low ratio of 21-40 wt percent, a middle ratio of 41-60 wt percent, a high and middle ratio of 61-80 wt percent, and a high ratio of 81-100 wt percent or the low ratio of 10 wt percent, the middle and low ratio of 30 wt percent, the middle ratio of 50 wt percent, the high and middle ratio of 70 wt percent, and the high ratio of 90 wt percent.



### 1st Main Claim

[MT] 1. A) waste leachate drainage layer, c) the last-applied to the waste landfill of a) the floor to the bottom ground water drainage layer, liner in its upper portion, the leachate drainage layer on its top, b) inclined-surface ground water drainage layer to the surface, the liner in its upper portion, the upper, gas layer on its top, liner thereon, drainage layer on its top, as applied to the one configuration forming a boktocheung in the upper drainage layer, B) a) after a certain material embedded between the woven fabric and the nonwoven fabric sichimjil, homjil, darning, sangchim quality, those sewing, punching, needle punching, sewing, sewn, kkwemaemjil, one of the quality stapler, b) using the materials, woven, non-woven materials storage, materials input hopper, material agitator, straight-Popo seolgi, manufactured using 2~20mm thickness by a spreader material, non-woven fabric laying machine, needle punching machine, the device consisting of at least one of the roll groups, c) if the material is stored in the material reservoir, wherein the material is two or more, where jong material reservoir is two or more is provided, that the materials or stored material being added to the material feed hopper, the material, or if the stored material is two or more jong material feed hopper, where is provided with two or more is, the material, or stored material or injected material is stirred in the material with a stirrer, 1) is woven from said straight-Po seolgi being laid, 2) the stirred material by the material spreader is sprayed on top of the laid fabric, 3) of the spray material and non-woven fabric is laid by groups nonwoven fabrics laid on top, the above 1), 2), 3) at least one step is a primary or secondary or or n-order force, or the first medium), 2), 3), 2), 3) the order of the process the first or second or n th order is performed, the nonwoven fabric laid on the material or the top-installed in the woven fabric are integrated is needle punched by a needle punching machine, a roll product of the needle punching groups commercialized as a product of the roll is manufactured by a, C) a) to the exclusion of gas layer, one of the exhaust, an outlet, b) a hydraulic conductivity or permeability  $\times 10^{-4}$  to  $10^{-1}$  cm / sec range or needle punched drainage layer one-pervious drain layer, thus belonging to the drain layer, roll commercialized drainage layer, a drain layer, mat-type drainage layer, a drain layer, a double one other title drain boards, eco drain boards, in the bio drain boards, eco drain layer, echo drainage layer, bio-drain layer, bio-drainage layer, a drain mat, eco drain mat, bio drain mat, eco-drainage mats, one of the bio-drainage mat, the constant material expansion functional materials, binding function gel material, of the hydrogel-functional materials, functional materials purification, general receiving material, the flow receiving material, yeomsuyong material, contamination receiving material, 0 to 20 wt percent one or more other acceptable ingredients of the material is such that the total of 100 percent by weight lower-rate, medium and low rates of 21-40 percent by weight, the proportion of 41-60 percent by weight, gojung ratio of 61-80 percent by weight, the low ratio of the highest proportion of 81-100 percent by weight or 10 percent by weight, of 30 percent by weight by medium and low rates, the ratio of the 50 percent by weight, gojung ratio of 70 percent by weight, used as a proportion of the highest proportion of 90 percent by weight, configuration, mixed, form, composition, mixture, mixed, characterized in that one of the mixed functional drain layer

That

**Assignees:** KOREA PARAMOUNT CO LTD; TECHOECO CO LTD

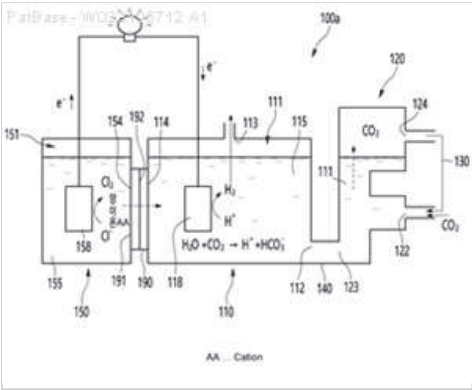
159. Family 99332844 (WO23195712 A1)

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**Title**  
[EN] CARBON DIOXIDE UTILIZATION SYSTEM

**Abstract**  
[EN] The present invention relates to a secondary battery for producing hydrogen from a neutral aqueous solution containing chlorine ions (Cl<sup>-</sup>), and a combined power generation system comprising same. The present invention has the advantage of producing various carbonates and hydrogen, an eco-friendly fuel, with high purity by using seawater, a sustainable raw material, and carbon dioxide, a greenhouse gas, as raw materials.

**1st Main Claim**  
[MT] A cathode portion including a first aqueous solution including potassium hydroxide accommodated in a first accommodation space , and a cathode in which at least a portion is immersed in the first aqueous solution ;



Chlorine ions accommodated in the second accommodation space (Cl<sup>-</sup>) A second aqueous solution including a first aqueous solution and an anode of a metal , at least a portion of which is immersed in the second aqueous solution ;

A connecting portion including a connecting passage that allows the first accommodating space and the second accommodating space to communicate with each other , and a cation exchange membrane located in the connecting passage

And a carbon dioxide processing unit communicating with the first accommodating space and including a first aqueous solution accommodated in a third accommodating space ,

During discharge, the anode part is formed by chlorine ions (Cl<sup>-</sup>) Is oxidized to chlorine gas (Cl<sub>2</sub>) And electrons (e<sup>-</sup>) And a carbon dioxide gas is introduced into the first aqueous solution in the third receiving space to react the first aqueous solution with hydrogen ions ( H.<sup>+</sup>) And bicarbonate ions (HCO<sub>3</sub><sup>-</sup> ) of the hydrogen ion ( H ) ; and the cathode portion is formed by using the hydrogen ion ( H.<sup>+</sup> ) and electrons of the cathode are combined to form hydrogen gas (H<sub>2</sub> ) of the secondary battery according to claim 1 , wherein the secondary battery is characterized in that the secondary battery is generated .

**Assignees:** DRM CATALYST INC

## 160. Family 99904173 (CN117069395 A)

[View in PatBase](#)

### Title

[EN] CARBON SEQUESTRATION TYPE COMPOSITE CEMENTING MATERIAL AS WELL AS PREPARATION METHOD AND APPLICATION THEREOF

### Abstract

[EN] The invention discloses a carbon sequestration type composite cementing material as well as a preparation method and application thereof. The composite gel material is prepared from the following components in parts by mass in a solvent-free manner: 20 to 80 parts of regenerated micro powder, 20 to 50 parts of mixing plant sludge powder, 10 to 40 parts of steel slag powder, 5 to 20 parts of carbide slag, 2 to 10 parts of calcined nano attapulgite, 2 to 8 parts of ethylenediamine tetraacetic acid, 1 to 3 parts of magnesium chloride and 2 to 6 parts of chitosan. According to the carbon-sequestration composite cementing material, industrial solid waste resources can be fully utilized, emission of CO<sub>2</sub> is reduced, and a building material product prepared by replacing traditional Portland cement with the carbon-sequestration composite cementing material is subjected to carbonization maintenance under a certain condition, so that excellent mechanical properties can be obtained in the early stage; compared with a common Portland cement cementing material, the cement has the characteristics of low carbon and environmental protection, can shorten the strength increasing process and improve the production efficiency, and has remarkable environmental and economic benefits.

### 1st Main Claim

[MT] 1. A carbon-fixing type composite ceiling material, characterized in that it comprises the following components, in parts by mass, on a solvent-free basis: 20 to 80 parts of regenerated fine powder, 20 to 50 parts of sludge powder for stirring station, 10 to 40 parts of slag powder, 5 to 20 parts of electroslog, Calcined nano-attapulgite 2-10 parts, ethylenediaminetetraacetic acid 2-8 parts, chlorinate magnesium 1-3 parts and chitosan 2-6 parts.

**Assignees:** HUAXIN CEMENT CO LTD

## 161. Family 103295619 (US2024208868 AA)

[View in PatBase](#)

### Title

[EN] USE OF NATURAL POZZOLANS IN A METHOD OF MAKING CEMENTITIOUS COMPOSITIONS

### Abstract

[EN] Provided herein, inter alia, are compositions of cementitious products using recycled materials including natural pozzolans, manmade pozzolans, and/or desalinated waste products and seawater, the methods of preparing, and uses thereof.

### 1st Main Claim

[EN] **1.** An artificial, stonelike material set by pouring a cementitious mixture, the poured cementitious mixture comprising:

- (a) a natural pozzolan;
- (b) a manmade pozzolan;
- (c) an aqueous solution;
- (d) one or more accelerant; and,
- (e) optionally at least one aggregate.

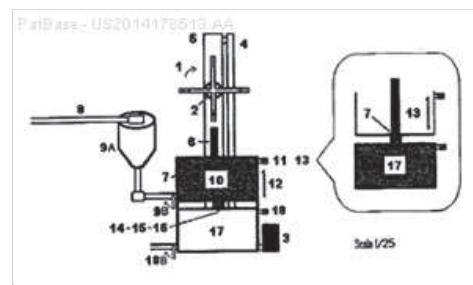
**Assignees:** PARTANNA GLOBAL INC; PATANA INT INC

## 162. Family 56783456 (US2014178513 AA)

[View in PatBase](#)

### Title

[EN] NON IONIC/ELECTROLYTE, LIQUID/GASEOUS, MECHANICALLY REFINED/NANOPARTICLE DISPERSION BUILDING MATERIALS/HIGH WEAR-HEAT RESISTANT PART BRUSHES, WINDINGS, BATTERY CELLS, BRAKE PADS, DIE CAST MOLDING, REFRIGERATION, POLARIZED/INTEGRATED OPTICAL, SPECTROMETRIC PROCESSORS, CENTRAL PROCESSOR UNIT PROCESSORS, ELECTRONIC STORAGE MEDIA, ANALOGOUS SERIES/PARALLEL CIRCUIT GENERATORS/TRANSCIEVERS, PARTICULATE MATTER PM CARBONACEOUS-POLYAMIDE, CRYSTALLINE SILICA, AND CELLULOSIC FILAMENT EXTRACTION/MINERS SUIT



### Abstract

[EN] The variable hydraulic press and distillation reservoir process scientific formula non ionic or electrolyte mechanically refined and nanoparticle dispersion preform slurry extrusion with or without ionic suspension Preform slurry high wear-heat resistant parts electronic composite coils, windings, annealing, drawn, spun, coils, windings, wire, woven textile mesh, shielding, parts brushes, inductors, antinode couplers, electric rheostats, starters, motors, alternators, generators, ionic suspension enhanced composite coils, composite windings, spun wound coils and windings beryllium Be<sub>4</sub>, magnesium Mg<sub>12</sub>, copper Cu<sub>29</sub> and carbon nanofoam C<sub>6</sub>, electronic parts capacitors, ionic suspension circuit battery cells, electronic parts rheostats, resistors, transformers, transducers, rectifiers, power supplies, or heat sinks Preform slurry high wear-heat resistant parts aerospace, automotive, and transportation brake calipers, rotors, pads, and bushings Preform slurry non ionic or electrolyte mechanically refined and nanoparticle high wear-heat resistant parts precision casting molds 2.5 phase die cast molding Building Materials fine concrete, mortar, brick, and tiles.

### 1st Main Claim

[EN] 1. A cool complete vacuum area less than atmospheric gaseous draws any one particulate matter while fluxing gaseous suspension creates the partial vacuum causing atmospheric suspension particulate matter diffusion equal particle distribution or saturation. Suspension electrolysis positive and negative voltage charges of readymade particulate matter electron valences form molecular diffusion covalent bonding in suspension efficient particle distribution. Number 1. A prepared heated specification particulate matter partial vacuum fluxing suspension distillation reservoir continually extracting expanded higher temperature particulate matter melts the instantaneous creation of particulate matter parts of any one, two or more particulate matter materials resultant compound particulate matters. Number 2. The specification making of particulate matter molten diffusion melts and Liquids of condensation metals, paste, gels and vapour gels including extremely high optical grade silicon filtered and non filtered, high optical grade allotropes of carbonaceous-silicon particulate matter, high optical grade allotropes of carbonaceous-silicon particulate matter polyamides synthetic resins, high optical grade silicon filtered and non filtered polyamides synthetic resins, potassium ash and feldspar K 19, zirconium Zr 40, S 16 quartz-bearing basalt Ca 20, cobalt Co 27, silica dioxide Si CO<sub>2</sub>, sodium oxide Na<sub>2</sub>O, calcium oxide CaO, Aragonite crystalline mineral CaCO<sub>3</sub>, calcium carbonate CaCO<sub>3</sub>, Potassium Selenite K<sub>2</sub>SeO<sub>3</sub>, Calcium sulfate CaSO<sub>4</sub>, Gypsum hydrate CaSO<sub>4</sub> 2H<sub>2</sub>O, 2-methyl-1,3-butadiene, acrylonitrile, cellulose acetate, methyl methacrylate, polyamides, polyethylene, poly ethylene terephthalate, polyesters, polymeric sulfur polyphosphazenes NPCl<sub>2</sub>, polypropylene, polystyrene, silicones, toluene diisocyanate polyurethane, copolymer based polyacrylic and polyacrylonitrile sodium polyacrylate, tetrafluoroethene, vinyl acetate, vinyl/poly vinyl chloride, synthetic polymer resins, hybrid allotropes of carbon, molecular silica hybrid allotropes of carbon molecular dioxide Si C O<sub>2</sub>, molecular sodium oxide Na<sub>2</sub>O compound, molecular calcium oxide Ca O, alkalines with or without magnesium Mg powdered resins, beryllium Be<sub>4</sub> inductor, magnesium Mg<sub>12</sub> inductor, carbon C<sub>6</sub> nanoparticle conductor, copper Cu<sub>29</sub> conductor and alternate carbon nanofoam C<sub>6</sub> inductor ACNFI, molecular and nanoparticle alumina Al<sub>13</sub>, Filtered and Non Filtered Beads and Gels, Group 17 the Halogens, Noble Gases, Chlorophyll A, Chlorophyll B, Sulfate SO<sub>4</sub>, Methane CH<sub>4</sub>, Ammonia NH<sub>3</sub>, Sulfuric acid H<sub>2</sub>SO<sub>4</sub>, Sodium potassium Na K, polymer of isoprene 2-methyl-1 3-butadiene, Acrylonitrile, Cellulose acetate, Methyl methacrylate, Polyamides, Polyethylene, Poly ethylene terephthalate, Polyesters, Polymeric sulfur polyphosphazenes NPCl<sub>2</sub>, Polypropylene, Polystyrene, Silicones, Toluene diisocyanate polyurethane, Copolymer based polyacrylic and polyacrylonitrile sodium polyacrylate, Tetrafluoroethene, Vinyl acetate, Vinyl/poly vinyl chloride, Sodium chloride NaCl, Ammonium chloride NH<sub>4</sub>Cl, Phosphorus chlorides PCl<sub>3</sub>, POCl<sub>3</sub> and PCl<sub>5</sub>, Phosphorus pentachloride P<sub>4</sub>O<sub>10</sub>, Sodium hydrogen carbonate NaHCO<sub>3</sub>, Sodium hydroxide NaOH, Sodium sulfate Na<sub>2</sub>SO<sub>4</sub>, saturated aqueous solution Boric oxide B<sub>2</sub>O<sub>3</sub>, Hydrochloric acid HCl, chemical non ionic groups of amphoteric polysaccharide linear or branched alkyl compounds or electrolyte ionic melts, ionic fluids, and/or fused, and/or catalyst acid and bases, actual catalyst, and/or catalyst reservoir with or without ionic suspension element Specification 56 elements and/or Specification 57 alloys, 1-H-Hydrogen, 2-He-Helium, 3-Li-Lithium, 4-Be-Beryllium, 5-B-Boron, 6-C-Carbon, 7-N-Nitrogen, 8-O-Oxygen, 9-F-Fluorine, 10-Ne-Neon, 11-Na-Sodium, 12-Mg-Magnesium, 13-Al-Aluminum, 14-Si-Silicon, 15-P-Phosphorus, 16-S-Quartz, 17-Cl-Chlorine, 18-Ar-Argon, 19-K-Potassium, 20-Ca-Calcium, 22-Ti-Titanium, 24-Cr-Chromium, 25-Mn-Manganese, 26-Fe-Iron, 27-Co-Cobalt, 28-Ni-Nickel, 29-Cu-Copper, 30-Zn-Zinc, 31-Ga-Gallium, 40-Zr-Zirconium, 41-Nb-Niobium, 42-Mo-Molybdenum, 47-Ag-Silver, 48-Cd-Cadmium, 49-In-Indium, 50-Sn-Tin, 51-Sb-Antimony, 55-Cs-Cesium, 74-W-Tungsten, 78-Pt-Platinum, 79-Au-Gold, specially high heat resistant highly pure metals and alloys, Specification 56 elements, natural cellulosic polyamides resins, natural cellulosic polyamide rubber resins, natural carbonaceous resins, allotropes of carbonaceous nanoparticles, and natural cellulosic fiberaceous resins, allotropes of carbonaceous-silicon particulate matter cement clinkers and sands, high tensile strength heat resistant allotropes of carbonaceous-metals, allotropes of carbonaceous-polyamides synthetic resins, extremely hard heat resistant heavy mineral cement clinkers and sands, fine minerals and sands, ceramic red brick clay impedance matching load or signal insulators, and complex alkaline and acid powders. Starch hydrolyzed polyacrylonitrile superabsorbent non ionic Polysaccharide tool steel and super alloy extrusion in a continuous linearized drawing annealing spinning supersaturated Liquid gel vapours gel into rubbery consistency and resiliency of Polymeric Sulfur molten diffusion melts temperatures 100 degrees centigrade melts sulfur polymer will turn red color and viscous melts Greater than Less than >159 degrees centigrade Less than viscous melts Greater than Less than >175 degrees centigrade 178 degrees centigrade 250 degrees centigrade Less than viscous melts into yellow color And 0 degrees centigrade or 32 degrees Fahrenheit Liquids of condensation And melts may 2 0 2 oxidation enrichment non ionic Polysaccharide And ionic suspension

electrolyte Phosphate Sodium carbon nanoparticle C 6 P 3 S 3 Na 3, Nitronium carbon C 6 NC 4, Hydrogen chloride carbon C 6 HCl, Phosphorus chlorides carbon C 6 PCl<sub>3</sub>, POCl<sub>3</sub> and PCl<sub>5</sub>, Phosphorus pentachloride carbon C 6 P<sub>4</sub>O<sub>10</sub>, Nitronium chloride carbon C 6 PCl<sub>3</sub> 2 NO<sub>2</sub>Cl, Chloride carbon C 6 Cl 4, Hydrocarbon C 6 HC 4, Methane carbon C 6 CH 4, Ammonia carbon C 6 NH 3, Sulfuric acid carbon C 6 H<sub>2</sub>SO 4 And Sodium potassium carbon C 6 Na K form supercooled below zero freezing Greater than <0 degrees centigrade or 32 degrees Fahrenheit Liquids of condensation formula condensation nuclei particulate matter partial and complete suspension above and below normal atmospheric pressure including supercritical+/-positive pressurization and negative vacuum pump in atmospheres and bars of pressure The Liquids of condensation negative partial diffusion gaseous and may complete suspension interface tool steel and super alloy molten melts Polymeric sulfur Greater than Less than> consistency and resiliency of Polymeric Sulfur hot melt pour drawn into plumbing in a continuous stream, drawing, may annealing, spinning sulfur polymer gel forming solution under and above normal atmospheric pressure including supercritical+/-positive and negative in atmospheres and bars of pressure The Liquids of condensation negative partial diffusion gaseous and may complete suspension supercooled interface tool steel and super alloy drawn into plumbing sulfur polymer forms into yellow color rubbery fibers of the Polymeric sulfur gel in a continuous stream drawing annealing spinning gel sulfur polymer yellow color may hydraulic fracturing for optical purity or purified enrichment into optical sulfur polymer molecules forming eight member arrangement Polymeric sulfur SO 4, Polymeric sulfur silicon SO 4 SiO<sub>2</sub> silicon gels and crystalline gels potassium ash and feldspar K 19, zirconium Zr 40, S 16 quartz-bearing basalt Ca 20, cobalt Co 27, silica dioxide Si CO<sub>2</sub>, sodium oxide Na<sub>2</sub>O, calcium oxide CaO, Aragonite crystalline mineral CaCO<sub>3</sub>, calcium carbonate CaCO<sub>3</sub>, Potassium Selenite K<sub>2</sub>SeO<sub>3</sub>, Calcium sulfate CaSO<sub>4</sub>, Gypsum hydrate CaSO<sub>4</sub> 2H<sub>2</sub>O, 2-methyl-1,3-butadiene, acrylonitrile, cellulose acetate, methyl methacrylate, natural cellulosic particulate matter C 6 carbonaceous-polyamide, polyethylene, poly ethylene terephthalate, polyesters, polymeric sulfur polyphosphazenes NPCl<sub>2</sub>, polypropylene, polystyrene, silicones, toluene diisocyanate polyurethane, copolymer based polyacrylic and polyacrylonitrile sodium polyacrylate, tetrafluoroethene, vinyl acetate, vinyl/poly vinyl chloride, synthetic polymer resins, hybrid allotropes of carbon and molecular dioxide C O<sub>2</sub> compound, molecular silica hybrid allotropes of carbon molecular dioxide Si C O<sub>2</sub> compound, molecular sodium oxide Na<sub>2</sub>O compound, and molecular calcium oxide Ca O And may Natural cellulosic polymer of isoprene 2-methyl-1 3-butadiene gel Liquids of condensation nuclei type particulate matter non ionic Alkali and ionic Liquid gel And Crystalline mineralization optical beads gels pellets paste spinning yarn optical gel cable sheet and line annealing drawing spinning optical cable sheet and line and forged extrusions gel forming casting rod or plate drop into drawing annealing spinning or draw anneal and turn spun pressed roll any turn, full, two, one, one half and one quarter turns form cable sheet and line fiber optical visor full view panel visual display up VDU and heads up display HUD All integrated and polarized spectrometry and processors. Liquids of condensation nuclei type particulate matter non ionic Alkali And Ionic suspension electrolyte including Salts, Sulfosalts and Sulfides Liquid condensation metal may 2 0 2 oxidation enrichment non ionic Polysaccharide And ionic suspension electrolyte Phosphate Sodium carbon C 6 P 3 S 3 Na 3 particulate matter condensation metal and/or ceramic alkali and clay, Hexafluorophosphate carbon C 6 PF 6 particulate matter condensation metal and/or ceramic alkali and clay, Nitronium carbon C 6 NC 4 particulate matter condensation metal and/or ceramic alkali and clay, Hydrogen chloride carbon C 6 HCl particulate matter condensation metal and/or ceramic alkali and clay, Phosphorus chlorides carbon C 6 PCl<sub>3</sub>, POCl<sub>3</sub> and PCl<sub>5</sub> particulate matter condensation metal and/or ceramic alkali and clay, Phosphorus pentachloride carbon C 6 P<sub>4</sub>O<sub>10</sub> particulate matter condensation metal and/or ceramic alkali and clay, Nitronium chloride carbon C 6 PCl<sub>3</sub> 2 NO<sub>2</sub>Cl particulate matter condensation metal and/or ceramic alkali and clay, Chloride carbon C 6 Cl 4 particulate matter condensation metal and/or ceramic alkali and clay, Hydrocarbon C 6 HC 4 particulate matter condensation metal and/or ceramic alkali and clay, Methane carbon C 6 CH 4 particulate matter condensation metal and/or ceramic alkali and clay, Ammonia carbon C 6 NH 3 particulate matter condensation metal and/or ceramic alkali and clay, Sulfuric acid carbon C 6 H<sub>2</sub>SO 4 particulate matter condensation metal and/or ceramic alkali and clay And Sodium potassium carbon C 6 Na K particulate matter condensation metal and/or ceramic alkali and clay form Liquid condensation metal alkali and clay C 6 carbon nanoparticle, cesium, chromate, silver, gold, platinum, titanium, tungsten, niobium, manganese, steel, tin, copper, aluminum, gallium, nickel, cadmium, zinc, potassium, magnesium, lithium, indium, salts, sulfosalts, sulfides, antimonide, halide, alkalide, and acid complex enriched solidified powder condensation particulate matter Liquid condensation metals include Polymeric sulfur copper Cu carbon C 6 SO 4 And Hexafluorophosphate copper Cu<sub>29</sub> carbon C 6 PF 6 And nanoparticle alumina Al<sub>13</sub>. Liquids of condensation paste, gels, vapour gels form ionic suspension element battery cell or liquid metal series and parallel processor printed circuits, drawing, annealing, spinning yarn, wire, sheet flat strips, cable Line, shielding interwoven and composite mesh light makeweight high tensile strength form convex and right angle shapes up to three dimensional design Building Materials and Formed Fabrication. Number 3. The specification making of supersaturated particulate matter under and above normal atmospheric pressure measured in atmospheres and bars of pressure one, two or more particulate matter materials supercooled 0 degrees centigrade or 32 degrees Fahrenheit interface tool steel, and specification acid, bases, and alkyls gaseous partial and complete suspensions of preform slurry non ionic or electrolyte forming as a naturally occurring phenomenon named cloud condensation nuclei or CCNs also known as cloud seeds are small particles typically 0.2 micro m, or 1/100th the size of the average cloud droplet. The liquid vapour requires a non-gaseous surface to make the transition from a vapour to a liquid. The supercooled liquids of condensation nuclei particulate matter one, two or more condensation nuclei particulate matter materials resultant condensation nuclei particulate matters maybe electrolysis spun drawn evaporated dispersed casted extruded and formed into resin powders. The liquids of condensation crystalline mineralization formula superfine and ultrafine nuclei particulate matter are derived at the mineral specific density and supersaturating crystallization mineralization specification supercooled temperature and crystallization pressure. The liquids of condensation nuclei particulate matter materials maybe continuously solution processed into silicon gels and crystalline gels potassium ash and feldspar K 19, zirconium Zr 40, S 16 quartz-bearing basalt Ca 20, cobalt Co 27, silica dioxide Si CO<sub>2</sub>, sodium oxide Na<sub>2</sub>O, calcium oxide CaO, Aragonite crystalline mineral CaCO<sub>3</sub>, calcium carbonate CaCO<sub>3</sub>, Potassium Selenite K<sub>2</sub>SeO<sub>3</sub>, Calcium sulfate CaSO<sub>4</sub>, Gypsum hydrate CaSO<sub>4</sub> 2H<sub>2</sub>O, 2-methyl-1,3-butadiene, acrylonitrile, cellulose acetate, methyl methacrylate, polyamides, polyethylene, poly ethylene terephthalate, polyesters, polymeric sulfur polyphosphazenes NPCl<sub>2</sub>, polypropylene, polystyrene, silicones, toluene diisocyanate polyurethane, copolymer based polyacrylic and polyacrylonitrile sodium polyacrylate, tetrafluoroethene, vinyl acetate, vinyl/poly vinyl chloride, synthetic polymer resins, hybrid allotropes of carbon and molecular dioxide C O<sub>2</sub> compound, molecular silica hybrid allotropes of carbon molecular dioxide Si C O<sub>2</sub> compound, molecular sodium oxide Na<sub>2</sub>O compound, and molecular calcium oxide Ca O, alkalines with or without magnesium Mg powdered resins, beryllium Be<sub>4</sub> inductor, magnesium Mg<sub>12</sub> inductor, carbon C<sub>6</sub> nanoparticle conductor, copper Cu<sub>29</sub> conductor and alternate carbon nanofoam C<sub>6</sub> inductor ACNFI, molecular and nanoparticle alumina Al<sub>13</sub>, Filtered and Non Filtered Beads and Gels, Group 17 the Halogens, Noble Gases, Chlorophyll A, Chlorophyll B, Sulfate SO 4, Methane CH 4, Ammonia NH<sub>3</sub>, Sulfuric acid H<sub>2</sub>SO<sub>4</sub>, Sodium potassium Na K, polymer of isoprene 2-methyl-1 3-butadiene, Acrylonitrile, Cellulose acetate,

Methylmethacrylate, Polyamides, Polyethylene, Poly ethylene terephthalate, Polyesters, Polymeric sulfur polyphosphazenes NPCl<sub>2</sub>, Polypropylene, Polystyrene, Silicones, Toluene diisocyanate polyurethane, Copolymer based polyacrylic and polyacrylonitrile sodium polyacrylate, Tetrafluoroethene, Vinyl acetate, Vinyl/poly vinyl chloride, Sodium chloride NaCl, Ammonium chloride NH<sub>4</sub>Cl, Phosphorus chlorides PCl<sub>3</sub>, POCl<sub>3</sub> and PCl<sub>5</sub>, Phosphorus pentachloride PCl<sub>5</sub>O<sub>10</sub>, Sodium hydrogen carbonate NaHCO<sub>3</sub>, Sodium hydroxide NaOH, Sodium sulfate Na<sub>2</sub>SO<sub>4</sub>, saturated aqueous solution Boric oxide B<sub>2</sub>O<sub>3</sub>, Hydrochloric acid HCl, chemical non ionic groups of amphoteric polysaccharide linear or branched alkyl compounds or electrolyte ionic melts, ionic fluids, and/or fused, and/or catalyst acid and bases, actual catalyst, and/or catalyst reservoir with or without ionic suspension element Specification 56 elements and/or Specification 57 alloys, 1-H-Hydrogen, 2-He-Helium, 3-Li-Lithium, 4-Be-Beryllium, 5-B-Boron, 6-C-Carbon, 7-N-Nitrogen, 8-O-Oxygen, 9-F-Fluorine, 10-Ne-Neon, 11-Na-Sodium, 12-Mg-Magnesium, 13-Al-Aluminum, 14-Si-Silicon, 15-P-Phosphorus, 16-S-Quartz, 17-Cl-Chlorine, 18-Ar-Argon, 19-K-Potassium, 20-Ca-Calcium, 22-Ti-Titanium, 24-Cr-Chromium, 25-Mn-Manganese, 26-Fe-Iron, 27-Co-Cobalt, 28-Ni-Nickel, 29-Cu-Copper, 30-Zn-Zinc, 31-Ga-Gallium, 40-Zr-Zirconium, 41-Nb-Niobium, 42-Mo-Molybdenum, 47-Ag-Silver, 48-Cd-Cadmium, 49-In-Indium, 50-Sn-Tin, 51-Sb-Antimony, 55-Cs-Cesium, 74-W-Tungsten, 78-Pt-Platinum, 79-Au-Gold, specially high heat resistant highly pure metals and alloys, Specification 56 elements, natural cellulosic polyamides resins, natural cellulosic polyamide rubber resins, natural carbonaceous resins, allotropes of carbonaceous nanoparticles, and natural cellulosic fiberaceous resins drawn annealing print rolled film sheet cut strip drawing annealed spun wound wrapped wire coil interwoven shielding cable line spinning yarn and thread insulates spools and woven textile mesh. The supercooled liquids of condensation nuclei particulate matter one, two or more condensation nuclei particulate matter materials resultant condensation nuclei particulate matters natural polymer, natural polyamide, natural cellulosic rubber, silicon, specification 56 elements, specification 57 alloys, alumina nanoparticle and carbon nanoparticle supersaturated deceleration liquid and vapour fluid transfer into synthetic polymer melt molten diffusion hydraulic forged molding rod and plate cast one half turn spin, drop, drawing, annealing, spinning, rolled and cut yarn, sheet, film and strip. The supercooled liquids of condensation nuclei particulate matter one, two or more condensation nuclei particulate matter materials resultant condensation nuclei particulate matters polymer, polyamide, silicon, specification 56 elements, alumina nanoparticle and carbon nanoparticle supersaturated deceleration liquid and vapours fluid transfer into specification formula acid, base and alkyl electron valences into plumbing drawing and spinning solution including silicon, natural polymer, natural polyamide, natural polymer, natural cellulosic rubber, specification 56 elements, alumina nanoparticle and carbon nanoparticle tool steel interface fluid timed supercooling deceleration specification of continuous linear dispersion gel electron valences into plumbing drawing, annealing, spinning and rolled cut yarn, sheet, film and strip. The supercooled liquids of condensation nuclei particulate matter one, two or more condensation nuclei particulate matter materials resultant condensation nuclei particulate matters polymer, polyamide, silicon, specification 56 elements, alumina nanoparticle and carbon nanoparticle supersaturated deceleration liquid and vapour fluid transfer into supercritical supercooled deceleration hydraulic forged molding rod and plate dispersion cast one half turn spin, drop, drawing, annealing, spinning, rolled and cut yarn, sheet, film and strip. Preform slurry non ionic or electrolyte mechanically refined and nanoparticle dispersion allotropes of carbon made by variable hydraulic preform slurry non ionic or electrolyte mechanically refined and nanoparticle dispersion high wear-heat resistant parts press The variable hydraulic press and distillation reservoir manufacture process scientific formula non ionic or electrolyte mechanically refined and nanoparticle, allotropes of carbon dispersion preform slurry extrusion, with or without ionic suspension element for manufactured preform slurry high wear-heat resistant parts electronic component composite coils beryllium Be<sub>4</sub>, magnesium Mg<sub>12</sub>, copper Cu<sub>29</sub> and carbon nanofoam C<sub>6</sub>, spun wound windings beryllium Be<sub>4</sub>, magnesium Mg<sub>12</sub>, copper Cu<sub>29</sub> and carbon nanofoam C<sub>6</sub> annealing, drawn, spun, coils, windings, wire, woven textile mesh, shielding, brushes, inductors, antinode couplers, electric rheostats, starters, motors, alternators, generators, ionic suspension element enhanced composite coils, composite windings, spun wound coils beryllium Be<sub>4</sub>, magnesium Mg<sub>12</sub>, copper Cu<sub>29</sub> and carbon nanofoam C<sub>6</sub>, spun wound windings beryllium Be<sub>4</sub>, magnesium Mg<sub>12</sub>, copper Cu<sub>29</sub> and carbon nanofoam C<sub>6</sub> annealing, drawn, spun, coils, windings, wire, woven textile mesh, shielding, brushes, capacitors, battery cells, rheostats, electronic resistors, transformers, transducers, rectifiers, power supplies, or heat, preform slurry high wear-heat resistant parts aerospace, automotive, and transportation brake calipers, rotors, pads, and bushings, preform slurry non ionic or electrolyte mechanically refined and nanoparticle high wear-heat resistant parts precision casting molds 2.5 phase die cast molding and covalent bonding sequence drawing and spinning formula solutions mechanically refined and nanoparticle dispersion fine concrete, mortar, brick, and tiles. The variable hydraulic preform slurry non ionic or electrolyte mechanically refined and nanoparticle dispersion high wear-heat resistant parts press with FIG. 1 numbers **1** to **18** specific components that conform to specified requirements to unique American Society for Testing and Materials International Standards Worldwide Identifiers. Variable hydraulic preform slurry non ionic or electrolyte mechanically refined and nanoparticle dispersion high wear-heat resistant parts press the center of the utility patent application specification slurry formula in three scientific forms of **6-Solids**, **7-Liquids** and **8-Gases** Noble gaseous element Argon and other gaseous element specified scientific formula liquid and gaseous mechanically refined and nanoparticle dispersion preform slurry non ionic or electrolyte, solids, liquids and/or gases, heated, chilled, or room temperature chemical non ionic groups of amphoteric polysaccharide linear or branched alkyl compounds or electrolyte ionic melts, ionic fluids, and/or fused, and/or catalyst acid and bases, actual catalyst, and/or catalyst reservoir with or without ionic suspension element Specification 56 elements and/or Specification 57 alloys manufactured preform slurry non ionic or electrolyte mechanically refined and nanoparticle high wear-heat resistant parts. The variable hydraulic preform slurry non ionic or electrolyte mechanically refined and nanoparticle dispersion high wear-heat resistant parts press FIG. 1 numbers **1** to **18**. The **1-Hydraulic** control wheel is connected to the **2-Electronic** servo processor and allows the operator to expand and contract **7-Slurry** non ionic and electrolyte tool steel press plate primarily to expand the **10-Slurry** non ionic and electrolyte tool steel reservoir by moving the **1-Hydraulic** control wheel in a fully counter clockwise fashion. This allows the operator to initiate a separate machine to pump Slurry non ionic and electrolyte into the **8-Slurry** non ionic and electrolyte tool steel line in, subsequently to the **9-Gravity** feed collector line out and finally to the **10-Slurry** non ionic and electrolyte tool steel reservoir. Slurry non ionic and electrolyte is defined here as specified scientific formula liquid and gaseous mechanically refined and nanoparticle dispersion preform slurry non ionic or electrolyte, solids, liquids and/or gases, heated, chilled, or room temperature chemical non ionic groups of amphoteric polysaccharide linear or branched alkyl compounds or electrolyte ionic melts, ionic fluids, and/or fused, and/or catalyst acid and bases, actual catalyst, and/or catalyst reservoir with or without ionic suspension element Specification 56 elements and/or Specification 57 alloys manufactured preform slurry non ionic or electrolyte mechanically refined and nanoparticle high wear-heat resistant parts. After the **10-Slurry** non ionic and electrolyte tool steel reservoir is filled the operator can electronically disengage or manually remove the manual stop control release pull pin. The operator then closes the **9B-Tool** steel control to prepare for the extrusion. The operator would proceed by rotating the **1-Hydraulic** control wheel in a clockwise fashion contracting the **7-Slurry** non ionic and electrolyte tool steel press plate and forcing the Slurry non ionic and electrolyte comprised of non ionic or electrolyte mechanically refined and nanoparticle slurry formula into

the **17-Tool steel extrusion die cast design internal cavity**. The specified amount of Slurry non ionic and electrolyte is compressed to preform slurry non ionic or electrolyte mechanically refined and nanoparticle specification pressure measured in millibars Mb until the specified Slurry non ionic and electrolyte required to fill the **17-Tool steel extrusion die cast design internal cavity** has been reached. The **1-Hydraulic control wheel** is then locked until the **17-Tool steel extrusion die cast design internal cavity** has been removed. The **2-Electronic servo processor** sends an electrical signal to the **3-Hydraulic pump** of the **7-Slurry non ionic and electrolyte tool steel press plate position** that is calibrated to the **1-Hydraulic control wheel**. The **3-Hydraulic pump** receives an electrical signal from the **2-Electronic servo processor** of the **7-Slurry non ionic and electrolyte tool steel press plate position** that is calibrated to the **1-Hydraulic control wheel**. The **3-Hydraulic pump** pumps fluids to the **4-Hydraulic pipe**. The **4-Hydraulic pipe** receives fluids from the **3-Hydraulic pump** and conveys the fluids to the **5-Hydraulic actuator**. The **5-Hydraulic actuator** receives fluids from the **4-Hydraulic pipe** and the force from the fluids is transferred through the actuator as vertical up-and-down movement to an affixed **6-Hydraulic arm**. The **6-Hydraulic arm** moves vertically up-and-down and forces the **7-Slurry non ionic and electrolyte tool steel press plate** to expand and contract. The **7-Slurry non ionic and electrolyte tool steel press plate** is forced by the **6-Hydraulic arm** to expand and contract. The **8-Slurry non ionic and electrolyte tool steel line in** receives Slurry non ionic and electrolyte from an external pump and conveys them to the **9A-Gravity feed tool steel collector**. The **8-Slurry non ionic and electrolyte tool steel line in** can be ionic process tool steel interface positive or negative electrode electronically charged for enhanced formulation. The **9A-Gravity feed tool steel collector** receives Slurry non ionic and electrolyte from the **8-Slurry non ionic and electrolyte tool steel line in** and conveys them to the **10-Slurry non ionic and electrolyte tool steel reservoir**. The **10-Slurry non ionic and electrolyte tool steel reservoir** receives Slurry non ionic and electrolyte from the **9A-Gravity feed tool steel collector line out**. After the **10-Slurry non ionic and electrolyte tool steel reservoir** is filled the **9B-Tool steel control** is utilized to close the opening to prepare for the extrusion and may be provisionally locked and stopped at any position. The **11-Slurry non ionic and electrolyte reservoir regulated tool steel carbonaceous-polyamide, polyamide and nanoparticle c 6 waste filtration and may liquids and gaseous removes waste from the 10-Slurry non ionic and electrolyte tool steel reservoir while it is being filled with Slurry non ionic and electrolyte from common recovery distillation heated interface tool steel and thermometer gauge, ordinary atmospheric pressure, vacuum pump barometric pressure measured in millibars Mb, and fractional distillation all waste gases are processed to flu gas detoxification system.** The **12-Slurry non ionic and electrolyte reservoir expanded.** The **13-Slurry non ionic and electrolyte reservoir contracted.** The **14-Slurry non ionic and electrolyte reservoir brass or tool steel aperture and 15-Tool steel extrusion die cast design brass or tool steel fitting connects directly and conveys Slurry non ionic and electrolyte to the 17-Tool steel extrusion die cast design internal cavity.** The **18-Tool steel extrusion die cast design internal cavity regulator carbonaceous-polyamide, polyamide and nanoparticle c 6 waste filtration and may liquids and gaseous and 18B-Tool steel vacuum release control and portal works in unison with the press plate drawing expanding and contracting Slurry non ionic and electrolyte removing waste from the 17-Tool steel extrusion die cast design internal cavity while it is being filled with Slurry non ionic and electrolyte from common recovery distillation heated interface tool steel and thermometer gauge, ordinary atmospheric pressure, vacuum pump barometric pressure measured in millibars Mb, and fractional distillation all waste gases are processed to flu gas detoxification system.** The **17-Tool steel extrusion die cast internal cavity is designed as a tool steel extrusion die cast mold for each highly pure naturally occurring carbon and allotropes of carbon filler and adhesive insulator part comprised of two master extrusion tool steel halves. This is accomplished by first utilizing engineering drafting and computer aided design with the most advanced tool steel part manufacture process and tool steel part machining techniques and/or by utilizing replacement ceramic molds specification number 36 to supplement the development of extrusion die cast master molding may L1 L2 processor design L1 L2 processor master fabrication design, construction engineering, box framing casting preform tool steel hydraulic preform modular high purity preform, And tool steel die cast molds. Highly pure naturally occurring carbon, hybrid allotropes of carbon, and beryllium Be4 inductor, magnesium Mg12 inductor, carbon C6 nanoparticle conductor, copper Cu29 conductor and alternate carbon nanofoam C6 inductor ACNFI filler and adhesive insulator vacuum control of nitrogen, hydrogen, chlorine, ether, amino acid, or element dispersion brake pads, electronic brushes and parts require two master extrusions tool steel mold halves for each specification part. Highly pure naturally occurring carbon, hybrid allotropes of carbon, and beryllium Be4 inductor, magnesium Mg12 inductor, carbon C6 nanoparticle conductor, copper Cu29 conductor and alternate carbon nanofoam C6 inductor ACNFI filler and adhesive insulator parts precision casting molds requires a minimum two and a maximum of six master extrusion tool steel mold halves for each specification part. Highly pure naturally occurring carbon, hybrid allotropes of carbon, and beryllium Be4 inductor, magnesium Mg12 inductor, carbon C6 nanoparticle conductor, copper Cu29 conductor and alternate carbon nanofoam C6 inductor ACNFI filler and adhesive insulator parts precision casting molds are utilized to manufacture highly pure metal, super alloy, halide, alkalide, antimonide, ceramic, acid solid, alkaline, integrated or polarized molten diffusion forged crystalline silica optical with or without natural polyamide, natural rubber polyamide, allotropes of C6 carbon, alumina al13, synthetic polymers, natural polymers, or natural polymers rubber filtered and non filtered beads, gels, cables, lenses, glasses, up to or greater>1.25 inch left to right vertical and horizontal picture resolution integrated and polarized photogray, photocolor and photochemical light filtered light identification photo chemically active electron molecule film mirrors, visors, panels, and windshields, spectra No<sub>3</sub>-diamond dust mineralization transceiver integrated or polarized beads, beryllium Be4 inductor, magnesium Mg12 inductor, carbon C6 nanoparticle conductor, copper Cu29 conductor and alternate carbon nanofoam C6 inductor ACNFI filler and adhesive insulator 1.0 to 2.5 phase extrusions and two to six master highly pure naturally occurring carbon, hybrid allotropes of carbon, and beryllium Be4 inductor, magnesium Mg12 inductor, carbon C6 nanoparticle conductor, copper Cu29 conductor and alternate carbon nanofoam C6 inductor ACNFI filler and adhesive insulator mold halves per specification part. The manufacture process of 1.0 to 2.5 phase extrusions and die cast design for highly pure metal, super alloy, halide, alkalide, antimonide, ceramic, acid solid, alkaline, integrated or polarized molten diffusion forged crystalline silica optical with or without natural polyamide, natural rubber polyamide, allotropes of C6 carbon, alumina all 3, synthetic polymers, natural polymers, or natural polymers rubber filtered and non filtered beads, gels, cables; lenses, glasses, up to or greater>1.25 inch left to right vertical and horizontal picture resolution integrated and polarized photogray, photocolor and photochemical light filtered light identification photo chemically active electron molecule film mirrors, visors, panels, and windshields, spectra No<sub>3</sub>-diamond dust mineralization transceiver integrated or polarized beads, beryllium Be4 inductor, magnesium Mg12 inductor, carbon C6 nanoparticle conductor, copper Cu29 conductor and alternate carbon nanofoam C6 inductor ACNFI filler and adhesive insulator requires two to six master extrusion tool steel halves for each two to six reciprocal highly pure naturally occurring carbon, hybrid allotropes of carbon, and beryllium Be4 inductor, magnesium Mg12 inductor, carbon C6 nanoparticle conductor, copper Cu29 conductor and alternate carbon nanofoam C6 inductor ACNFI filler and adhesive insulator master precision casting molds parts allowing two A and B highly pure metal, super alloy, halide, alkalide, antimonide, ceramic, acid solid, alkaline, integrated or polarized molten diffusion forged crystalline silica optical with or without natural polyamide, natural**

rubber polyamide, allotropes of C6 carbon, alumina al13, synthetic polymers, natural polymers, or natural polymers rubber filtered and non filtered beads, gels, cables, lenses, glasses, up to or greater>1.25 inch left to right vertical and horizontal picture resolution integrated and polarized photogray, photocolor and photochemical light filtered light identification photo chemically active electron molecule film mirrors, visors, panels, and windshields, spectra No<sub>3</sub>-diamond dust mineralization transceiver integrated or polarized beads, beryllium Be4 inductor, magnesium Mg12 inductor, carbon C6 nanoparticle conductor, copper Cu29 conductor and alternate carbon nanofoam C6 inductor ACNFI filler and adhesive insulator to be combined. The 0.5 phase extrusion equals two die cast mold halves both equal to or less than one half 0.5 phase extrusion molten pour. The utility patent application specification concrete control room and monitoring station manufacturing in a complete vacuum area less than atmospheric gaseous and gases produced or added comprise the partial vacuum and may supply rich oxygen from capillary feeders at varying points to the specified highly pure metal, super alloy, halide, alkalide, antimonide, ceramic, acid solid, alkaline, integrated or polarized molten diffusion forged crystalline silica optical with or without natural polyamide, natural rubber polyamide, allotropes of C6 carbon, alumina al13, synthetic polymers, natural polymers, or natural polymers rubber filtered and non filtered beads, gels, cables, lenses, glasses, up to or greater>1.25 inch left to right vertical and horizontal picture resolution integrated and polarized photogray, photocolor and photochemical light filtered light identification photo chemically active electron molecule film mirrors, visors, panels, and windshields, spectra No<sub>3</sub>-diamond dust mineralization transceiver integrated or polarized beads, beryllium Be4 inductor, magnesium Mg12 inductor, carbon C6 nanoparticle conductor, copper Cu29 conductor and alternate carbon nanofoam C6 inductor ACNFI filler and adhesive insulator part molten fill A and B fills up to four pours. The highly pure naturally occurring carbon, ACNFI filler and adhesive insulator half shell or 0.5 phase extrusion are designed and utilized for state of the art manufacture process when combining highly pure metal, super alloy, halide, alkalide, antimonide, ceramic, acid solid, alkaline, integrated or polarized molten diffusion forged crystalline silica optical with or without natural polyamide, natural rubber polyamide, allotropes of C6 carbon, alumina al13, synthetic polymers, natural polymers, or natural polymers rubber filtered and non filtered beads, gels, cables, lenses, glasses, up to or greater>1.25 inch left to right vertical and horizontal picture resolution integrated and polarized photogray, photocolor and photochemical light filtered light identification photo chemically active electron molecule film mirrors, visors, panels, and windshields, spectra No<sub>3</sub>-diamond dust mineralization transceiver integrated or polarized beads, beryllium Be4 inductor, magnesium Mg12 inductor, carbon C6 nanoparticle conductor, copper Cu29 conductor and alternate carbon nanofoam C6 inductor ACNFI filler and adhesive insulator in combination of layered foundry fills, parts may be sprayed and dipped non conductive adhesives insulator films, and all waste gases are processed to flu gas detoxification system. The highly pure metal, super alloy, halide, alkalide, antimonide, ceramic, acid solid, alkaline, integrated or polarized molten diffusion forged crystalline silica optical with or without natural polyamide, natural rubber polyamide, allotropes of C6 carbon, alumina al13, synthetic polymers, natural polymers, or natural polymers rubber filtered and non filtered beads, gels, cables, lenses, glasses, up to or greater>1.25 inch left to right vertical and horizontal picture resolution integrated and polarized photogray, photocolor and photochemical light filtered light identification photo chemically active electron molecule film mirrors, visors, panels, and windshields, spectra No<sub>3</sub>-diamond dust mineralization transceiver integrated or polarized beads, beryllium Be4 inductor, magnesium Mg12 inductor, carbon C6 nanoparticle conductor, copper Cu29 conductor and alternate carbon nanofoam C6 inductor ACNFI filler and adhesive insulator is a layered greater than 0 percent to less than 100 percent alloy component A and greater than 0 percent to less than 100 percent alloy component B part that is created in combination of layered foundry fills by utilizing two to six master highly pure naturally occurring carbon, hybrid allotropes of carbon, and beryllium Be4 inductor, magnesium Mg12 inductor, carbon C6 nanoparticle conductor, copper Cu29 conductor and alternate carbon nanofoam C6 inductor ACNFI filler and adhesive insulator parts precision casting molds per specification part by pouring molten fill as a layered alloying component highly pure metal, super alloy, halide, alkalide, antimonide, ceramic, acid solid, alkaline, integrated or polarized molten diffusion forged crystalline silica optical with or without natural polyamide, natural rubber polyamide, allotropes of C6 carbon, alumina al13, synthetic polymers, natural polymers, or natural polymers rubber filtered and non filtered beads, gels, cables, lenses, glasses, up to or greater>1.25 inch left to right vertical and horizontal picture resolution integrated and polarized photogray, photocolor and photochemical light filtered light identification photo chemically active electron molecule film mirrors, visors, panels, and windshields, spectra No<sub>3</sub>-diamond dust mineralization transceiver integrated or polarized beads, beryllium Be4 inductor, magnesium Mg12 inductor, carbon C6 nanoparticle conductor, copper Cu29 conductor and alternate carbon nanofoam C6 inductor ACNFI filler and adhesive insulator four molten metal or other fill pours equal to 1.0 to 2.5 phase extrusions. The highly pure metal, super alloy, halide, alkalide, antimonide, ceramic, acid solid, alkaline, integrated or polarized molten diffusion forged crystalline silica optical with or without natural polyamide, natural rubber polyamide, allotropes of C6 carbon, alumina al13, synthetic polymers, natural polymers, or natural polymers rubber filtered and non filtered beads, gels, cables, lenses, glasses, up to or greater>1.25 inch left to right vertical and horizontal picture resolution integrated and polarized photogray, photocolor and photochemical light filtered light identification photo chemically active electron molecule film mirrors, visors, panels, and windshields, spectra No<sub>3</sub>-diamond dust mineralization transceiver integrated or polarized beads, beryllium Be4 inductor, magnesium Mg12 inductor, carbon C6 nanoparticle conductor, copper Cu29 conductor and alternate carbon nanofoam C6 inductor ACNFI filler and adhesive insulator is a layered greater than 0 percent to less than 100 percent highly pure metal, super alloy, halide, alkalide, antimonide, ceramic, acid solid, alkaline, integrated or polarized molten diffusion forged crystalline silica optical with or without natural polyamide, natural rubber polyamide, allotropes of C6 carbon, alumina al13, synthetic polymers, natural polymers, or natural polymers rubber filtered and non filtered beads, gels, cables, lenses, glasses, up to or greater>1.25 inch left to right vertical and horizontal picture resolution integrated and polarized photogray, photocolor and photochemical light filtered light identification photo chemically active electron molecule film mirrors, visors, panels, and windshields, spectra No<sub>3</sub>-diamond dust mineralization transceiver integrated or polarized beads, beryllium Be4 inductor, magnesium Mg12 inductor, carbon C6 nanoparticle conductor, copper Cu29 conductor and alternate carbon nanofoam C6 inductor ACNFI filler and adhesive insulator A component part, and greater than 0 percent to less than 100 percent highly pure metal, super alloy, halide, alkalide, antimonide, ceramic, acid solid, alkaline, integrated or polarized molten diffusion forged crystalline silica optical with or without natural polyamide, natural rubber polyamide, allotropes of C6 carbon, alumina al13, synthetic polymers, natural polymers, or natural polymers rubber filtered and non filtered beads, gels, cables, lenses, glasses, up to or greater>1.25 inch left to right vertical and horizontal picture resolution integrated and polarized photogray, photocolor and photochemical light filtered light identification photo chemically active electron molecule film mirrors, visors, panels, and windshields, spectra No<sub>3</sub>-diamond dust mineralization transceiver integrated or polarized beads, beryllium Be4 inductor, magnesium Mg12 inductor, carbon C6 nanoparticle conductor, copper Cu29 conductor and alternate carbon nanofoam C6 inductor ACNFI filler and adhesive insulator B component part created in combination of layered fills of two to six master highly pure naturally occurring carbon, hybrid

allotropes of carbon, and beryllium Be4 inductor, magnesium Mg12 inductor, carbon C6 nanoparticle conductor, copper Cu29 conductor and alternate carbon nanofoam C6 inductor ACNFI filler and adhesive insulator extrusion die cast mold halves equal to 1.0 to 2.5 phase extrusions. Distillation reservoir and recovery basin made of super alloy, and/or ceramic, and/or allotropes of carbon or beryllium Be4 inductor, magnesium Mg12 inductor, carbon C6 nanoparticle conductor, copper Cu29 conductor and alternate carbon nanofoam C6 inductor ACNFI filler and adhesive insulator including variable hydraulic press plate for specification distillation processing. Polarized windshields, optical glass, polymers gels distillation positively and negatively charging electrolysis of molten glass, optical glass, reflective beads, polymer gels, lenses, up to or greater >1.25 inch left to right vertical and horizontal picture resolution integrated and polarized photogray, photocolor and photochemical light filtered light identification photo chemically active electron molecule film mirrors, polarized windshield casted or molten diffusion forged, and molten specification materials 1.0 to 2.0 phase casted or extruded and distillation processing of specification highly pure metal, super alloy, ceramic, and alkaline. Windshield and specification materials are chemically surface treated distillation processed with specification acid and bases and Specification 56 elements or mechanically refined and nanoparticle specification acid and bases dispersions. Molten diffusion-plating with or without electrolysis of mechanically refined and nanoparticle Specification 56 elements, Specification 57 alloys, copper nanoparticles, colloidal gold, silver nanoparticles, iron nanoparticles, molecular tool steel, molecular super alloy, element nanoparticles, platinum nanoparticles printed circuits, super alloy including allotropes of carbon printed circuits, allotropes of carbon printed circuits, beryllium Be4 inductor, magnesium Mg12 inductor, carbon C6 nanoparticle conductor, copper Cu29 conductor and alternate carbon nanofoam C6 inductor ACNFI printed circuits, allotropes of carbon ionic suspension element printed circuits nickel, cadmium, lithium, magnesium, and nanoparticle alumina molecular ionic dispersion or molecular ionic covalent bonding series, parallel printed circuits, random access memory RAM and writable random access memory WRAM. Electrolysis distillation positively and negatively charged electron molecules allotropes of carbon, beryllium Be4 inductor, magnesium Mg12 inductor, carbon C6 nanoparticle conductor, copper Cu29 conductor and alternate carbon nanofoam C6 inductor ACNFI, nanoparticle alumina, Specification 56 elements, and Specification 57 alloys with greater and lesser than normal atmospheric pressure, super heating, super cooling scientific molecular diffusion, and fractional distillation are accomplished. Distillation processing mechanically refined particles measure in microns Symbol micro lower-case letter mu metric SI equivalent silica mineral, mineral sands, heavy minerals, alumina, nanoparticle alumina, highly pure naturally occurring carbon, alkaline, acid solids, allotropes of carbon, beryllium Be4 inductor, magnesium Mg12 inductor, carbon C6 nanoparticle conductor, copper Cu29 conductor and alternate carbon nanofoam C6 inductor ACNFI, gold, platinum, lead, acrylic and synthetic polymers, catalyst gaseous and electrolysis process materials for sintering and smelting pouring molten materials to apertures of variable hydraulic press plate, die cast extrusion molds, crucibles, and mold casings. Other distillation processing mechanically refined and nanoparticle preform slurry non ionic or electrolyte dispersion or molten highly pure metal, super alloy, highly pure naturally occurring carbon, allotropes of carbon, beryllium Be4 inductor, magnesium Mg12 inductor, carbon C6 nanoparticle conductor, copper Cu29 conductor and alternate carbon nanofoam C6 inductor ACNFI, nanoparticle alumina, alumina, silica alumina or molten diffusion forged crystalline silica optical with or without natural polyamide, natural rubber polyamide, allotropes of C6 carbon, alumina al13, synthetic polymers, natural polymers, or natural polymers rubber filtered and non filtered beads, gels, cables, lenses, glasses, up to or greater >1.25 inch left to right vertical and horizontal picture resolution integrated and polarized photogray, photocolor and photochemical light filtered light identification photo chemically active electron molecule film mirrors, visors, panels, and windshields, silica mineral, mineral sands, heavy minerals, glass, acrylic, synthetic polymer, acid solid, impedance matching ceramic red brick insulator, molybdenum, ceramic zirconia, ceramic silica, ceramic clay, Aragonite crystalline mineral  $\text{CaCO}_3$ , calcium carbonate  $\text{CaCO}_3$ , Potassium Selenite  $\text{K}_2\text{SeO}_3$ , Calcium sulfate  $\text{CaSO}_4$ , Gypsum hydrate  $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$ , silicon dioxide  $\text{SiO}_2$ , sodium oxide  $\text{Na}_2\text{O}$ , calcium oxide  $\text{CaO}$ , alkalines, minerals, including ionic suspension elements and ceramic silica mineral insulator for Specification 56 elements highly pure metal, and Specification 57 alloys. Distillation reservoir specification manufactured battery conservation of energy cool and cold low temperature operating range made Series of right angles 2 pi radians or one full turn the sum of the exterior angles form convex regular polygons corrugated and compartmented light makeweight fabrication moncombe shapes of triangle, square, pentagon, hexagon, heptagon, octagon, nonagon, polynumber and planess and right angle combinations light makeweight design electromagnetic conductive Group 17 the halogens, antimony Sb, Polysaccharide And ionic suspension electrolyte Phosphate Sodium carbon C 6 P 3 S 3 Na 3 particulate matter including Salts, Sulfosalts and Sulfides condensation metal, Hexafluorophosphate carbon C 6 PF 6 particulate matter condensation metal, Nitronium carbon C 6 NC 4 particulate matter condensation metal, Hydrogen chloride carbon C 6 HCl particulate matter condensation metal, Phosphorus chlorides carbon C 6  $\text{PCl}_3$ ,  $\text{POCl}_3$  and  $\text{PCl}_5$  particulate matter condensation metal, Phosphorus pentachloride carbon C 6  $\text{P}_4\text{O}_{10}$  particulate matter condensation metal, Nitronium chloride carbon C 6  $\text{PCl}_3 \cdot 2\text{NO}_2\text{Cl}$  particulate matter condensation metal, Chloride carbon C 6 Cl 4 particulate matter condensation metal, Hydrocarbon C 6 HC 4 particulate matter condensation metal, Methane carbon C 6 CH 4 particulate matter condensation metal, Ammonia carbon C 6 NH 3 particulate matter condensation metal, Sulfuric acid carbon C 6  $\text{H}_2\text{SO}_4$  particulate matter condensation metal and/or ceramic alkali and clay And Sodium potassium carbon C 6 Na K particulate matter condensation metal mechanically refined particles measure in microns Symbol micro lower-case letter mu metric SI equivalent alumina particles, alkaline particles, nickel particles, cadmium particles, lithium particles, magnesium particles, fused ionic material complex mechanically refined particles measure in microns Symbol micro lower-case letter mu metric SI equivalent acid complex particles, alkaline complex particles, antimonide complex particles, halide complex particles, alkalide complex particles, mechanically refined particles measure in microns Symbol micro lower-case letter mu metric SI equivalent Specification 56 conductive elements and Specification 57 conductive alloys, allotropes of carbon, beryllium Be4 inductor, magnesium Mg12 inductor, carbon C6 nanoparticle conductor, copper Cu29 conductor, alternate carbon nanofoam C6 inductor ACNFI and nanoparticle alumina measure in nanometers Nm. Distillation processing and/or for up to four molten pours 1.0 to 2.5 phase casted or extruded molten material or preform slurry non ionic or electrolyte. Molten pours and variable hydraulic press plate preform slurry non ionic or electrolyte mechanically refined and nanoparticle dispersion under vacuum control room scientific distillation ordinary atmospheric pressure less than ordinary atmospheric pressure catalyst gases other Specification 56 elements argon, carbon monoxide, carbon dioxide, or other gases mechanically refined or nanoparticle suspension catalyst greater or lesser than ordinary atmospheric pressure molecular diffusion, super cooling, and fractional distillation specification suspension may also accomplish allotropes of carbon hybridizations. Super alloy super cooling refrigeration vacuum pump and super alloy curved or linear expression comprising a scientific aperture, a divergence measured in angulation, and a scientific aperture diffusive gaseous particle vacuum pump negative pressurized stream accelerator super cooling refrigeration deceleration with or without nanoparticle synthesizing laser ablation and multi-waveform ablation X, Y, Z alignment with or without fluxing agents, molecular alumina al13, and fractional vacuum distillation gaseous and/or positive and negative ionic charges recovery and super alloy and/or ceramics and/or highly pure naturally occurring carbon and allotropes of carbon filler and adhesive insulator distillation reservoir variable

hydraulic press plate expanded and contracted greater or lesser than ordinary atmospheric pressure distillation recovery fractional vacuum distillation gaseous and/or positive distillation and variable hydraulic press plate expanded and contracted greater or lesser than ordinary atmospheric pressure distillation recovery allotropes of 6 C carbon, carbon, solid, liquid, and gases chemical non ionic groups of amphoteric polysaccharide linear or branched alkyl compounds or electrolytes and/or liquid ions and/or ionic melts and/or fused and/or acid and bases catalyst and/or catalyst slurry reservoir 6 C allotropes of carbon and liquid and/or liquid vapours and/or gaseous electrolyte catalyst acids and solid materials highly pure metal, super alloy, highly pure naturally occurring carbon, allotropes of carbon, beryllium Be4 inductor, magnesium Mg12 inductor, carbon C6 nanoparticle conductor, copper Cu29 conductor and alternate carbon nanofoam C6 inductor ACNFI, nanoparticle alumina, alumina, silica alumina or molten diffusion forged crystalline silica optical with or without natural polyamide, natural rubber polyamide, allotropes of C6 carbon, alumina al13, synthetic polymers, natural polymers, or natural polymers rubber filtered and non filtered beads, gels, cables, lenses, glasses, up to or greater>1.25 inch left to right vertical and horizontal picture resolution integrated and polarized photogray, photocolor and photochemical light filtered light identification photo chemically active electron molecule film mirrors, visors, panels, and windshields, silica mineral, mineral sands, heavy minerals, glass, acrylic, synthetic polymer, acid solid, impedance matching ceramic red brick insulator, molybdenum, ceramic zirconia, ceramic silica, ceramic clay, Aragonite crystalline mineral  $\text{CaCO}_3$ , calcium carbonate  $\text{CaCO}_3$ , Potassium Selenite  $\text{K}_2\text{SeO}_3$ , Calcium sulfate  $\text{CaSO}_4$ , Gypsum hydrate  $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$ , silicon dioxide  $\text{SiO}_2$ , sodium oxide  $\text{Na}_2\text{O}$ , calcium oxide  $\text{CaO}$ , alkalines, minerals, including ionic suspension elements and ceramic silica mineral insulator for Specification 56 elements highly pure metal, and Specification 57 alloys for building materials Number 4. preform slurry specification formula non ionic or electrolyte acid, base, or alkyl distillation reservoir specification vacuum processing with or without scientific electrolysis covalent bonding sequence drawing and spinning formula solutions mechanically refined and nanoparticle dispersion fine concrete, mortar, brick, and tiles, and high wear-heat resistant parts brushes, windings, coils, battery cells, electronic resistors, capacitors, brake pads, washers, spacers, bushings, annealing, drawn, spun, coils, windings, wire, woven textile mesh, shielding, and 1.0 to 2.5 phase casted or extruded die cast molding. An insulate, electronic part, brake calipers part, rotors part, brake pads, washers, spacers, shims, dowels, bushings part light weight chemical ionic acid usually an amino acid, non ionic bases usually nitrogen/hydrogen or non ionic groups of amphoteric polysaccharide linear or branched alkyl compounds usually methyl continuous sheets cut films insulate, specification formula non ionic or electrolyte acid, base, or alkyl distillation reservoir specification vacuum processing scientific electrolysis covalent bonding sequence drawing and spinning formula solutions mechanically refined and nanoparticle dispersion continuous spinning yarn and thread, spinning yarn and thread, preform optical grade silica and forged optical grade silica with or without natural polymer, natural polymer rubber, synthetic polymer, natural polyamide, natural polyamide rubber, allotropes of C6 carbon, and all specification materials. Variable hydraulic press, plate or distillation reservoir liquid dispersion and particulate matter PM specifications of nanoparticle and condensation-nuclei type size particles measure in microns Symbol micro lower-case letter mu metric SI equivalent natural polymer, natural polymer rubber, synthetic polymer, allotropes of C6 carbon, and all specification materials slurry non ionic heated or chilled interface **8**-Slurry non ionic tool steel line in heated or chilled chemical ionic acid usually an amino acid, non ionic bases usually nitrogen/hydrogen or non ionic groups of amphoteric polysaccharide linear or branched alkyl compounds usually methyl liquid dispersion liquid dispersion heated chemical non ionic groups of amphoteric polysaccharide linear or branched alkyl compounds methyl liquid dispersion natural polymer carbon, natural polymer or synthetic polymer carbon, allotropes of carbon, allotropes of carbon silica, allotropes of carbon silica alumina/nano alumina and allotropes of carbon alumina/nano alumina and all specification materials or liquid dispersion chilled polysaccharide linear or branched alkyl compounds and reinforcement of allotropes of carbon networks in suspension drying over usually fifteen minutes result network light weight natural polymer carbon, natural polymer or synthetic polymer carbon, allotropes of carbon, allotropes of carbon silica, allotropes of carbon silica alumina/nano alumina and allotropes of carbon alumina/nano alumina and all specification materials controllable, high purity, connectivity, strength, conductivity, and/or shape. Specification of molten diffusion particulate matter PM melts carbonaceous-polyamide, crystalline silica optical, crystalline silica synthetic polymer optical, crystalline silica cellulosic natural polymer, and crystalline silica cellulosic rubber natural polymer optical filtered and non filtered specifications condensation-nuclei type size particles measure in microns Symbol micro lower-case letter mu metric SI equivalent crystalline silica optical, crystalline silica synthetic polymer optical, crystalline silica cellulosic natural polymer, and crystalline silica cellulosic rubber natural polymer optical added molten diffusive particulate matter PM filtered condensation-nuclei type size particles measure in microns Symbol micro lower-case letter mu metric SI equivalent filtered versions of crystalline silica optical, crystalline silica synthetic polymer optical, crystalline silica cellulosic natural polymer, and crystalline silica cellulosic rubber natural polymer optical are filtered alumina, filtered nano alumina, filtered naturally occurring carbon, filtered allotropes of-alternate carbon nanotube inductor and infrared spectrum light analogous identification, filtered radioactive radiation protection precious metals, and filtered Specification 56 Elements spectrum. Formula enhanced molten diffusion mechanically shattered crystalline needlelike chards and refined particulate matter PM  $\text{SiO}_2$  gaseous suspension are drawn into heated 2200 degrees centigrade molten diffusion C-6 allotropes of carbon reservoir flash forming carbonaceous-silica Si+C6 allotropes of carbon is SiC silica allotropes of C6 carbon or  $\text{SiO}_2 + 2 \text{C6(s)} \rightarrow \text{SiC6(s)} + 2 \text{O(g)}$  thus allotropes of carbon Silicon-C6 is formed, formula enhanced molten diffusion mechanically shattered crystalline needlelike chards, refined or nanoparticle particulate matter PM  $\text{SiO}_2$  and al13 gaseous suspension are drawn into heated 2200 degrees centigrade molten diffusion C-6 allotropes of carbon reservoir flash forming carbonaceous-alumina silica Si+al13+C6 allotropes of carbon al13 alumina is SiAl13C silica allotropes of carbon al13 alumina or  $\text{SiO}_2 + \text{al13} + 2 \text{C6(s)} \rightarrow \text{SiC6al13(s)} + 2 \text{O(g)}$  thus allotropes of carbon alumina Silicon-C6al13 is formed. Vacuum or compression variable hydraulic press plate and pump specification gaseous negative or positive pressure in atmospheres mechanically refined and nanoparticle molecules, vacuum gaseous distillation reservoir mechanically refined and nanoparticle molecule transfer and mixing compounds, and vacuum gaseous mechanically refined and nanoparticle molecule preparation for control room casting, molding, sintering, and smelting. Additional distillation reservoir dioxide  $\text{CO}_2$  and carbon monoxide CO gaseous super alloy super cooling refrigeration molten diffusion particulate matter PM quenching by vacuum pump and super alloy curved or linear expression comprising a scientific aperture, a divergence measured in angulation, and a scientific aperture diffusive gaseous particle vacuum pump negative pressurized stream accelerator super cooling refrigeration deceleration and distillation reservoir supercooled quenching variable hydraulic press plate less than normal atmospheric with or without negatively pressurized distillation reservoir gaseous molecular diffusion and super alloy heated interface tool steel or supercooled temperature deceleration carbon dioxide  $\text{CO}_2$  and carbon monoxide CO fractional distillation hybridizations that may releasing oxides of  $\text{O}_2$  and  $\text{O}_1$ . Distillation reservoir with or without Multi waveform laser X, Y, Z field alignment carbon dioxide  $\text{CO}_2$  and carbon monoxide CO ablation and fractional distillation synthesizing. Distillation processing particulate matter PM with or without Carbon dioxide  $\text{CO}_2$  and

Carbon Monoxide CO are vacuum pump distillation reservoir negatively charged-allotropes of carbon electron molecule electrolysis processed and reinforced with extenders and fillers negatively charged-allotropes of alternate carbon nanotube inductor ACNTI particles. The distillation reservoir may contain of a gaseous mixture consisting of carbon dioxide CO<sub>2</sub>, carbon monoxide CO, oxides O<sub>2</sub>, oxides O<sub>1</sub>, and negatively charged-allotropes of alternate carbon nanotube inductor ACNTI particles. Specification of particulate matter PM carbonaceous-polyimide, crystalline silica optical, crystalline silica synthetic polymer optical, crystalline silica cellulosic natural polymer, and crystalline silica cellulosic rubber natural polymer optical filtered and non filtered specifications condensation-nuclei type size particles measure in microns Symbol micro lower-case letter mu metric SI equivalent, carbonaceous-polyamide, crystalline silica optical, crystalline silica synthetic polymer optical, crystalline silica cellulosic natural polymer, and crystalline silica cellulosic rubber natural polymer optical filtered and non filtered specifications negative charging chemical electron molecule electrolysis drawing and spinning, solution Liquid or gaseous quenching, vacuum processing evaporation and carbonaceous-polyamide, crystalline silica optical, crystalline silica synthetic polymer optical, crystalline silica cellulosic natural polymer, and crystalline silica cellulosic rubber natural polymer optical filtered and non filtered specifications high molecular-weight carbonaceous particulate matter PM in condensation-nuclei type size particles measure in microns Symbol micro lower-case letter mu metric SI equivalent fine beads are collected and vacuum packed sealed for secondary phase Function-specific optical properties manufacturing, and carbonaceous-polyamide beads vacuum packed sealed for fibrous filament yarn and thread Function-specific properties manufacturing. Universal pulp agro-fibrous cellulosic filaments and subsequent fatty acids and oils extractions cellulosic natural polymer using common distillation processing techniques. The primary agro-fibrous filaments sought come from agro-fibrous agriculture and waste materials hulls, husks, pits, straw, and peels. The end resultant filament is assorted lipid, lignin, liber, linnet, rosin and viscose. Characteristics and carbonaceous products of these woody-type plants are extracting cellulosic filaments for specification formula non ionic or electrolyte acid, base, or alkyl distillation reservoir specification vacuum processing scientific electrolysis covalent bonding sequence drawing and spinning formula solutions mechanically refined and nanoparticle dispersion continuous spinning yarn and thread while subsequent textile manufacturing. The process begins with collecting and pulverizing-shredding in specification mesh sizes massive tonnage of agro-fibrous agriculture and waste materials hulls, husks, pits, straw, and peels. The massive tonnage is batch processed exposure to steam begins cellulosic extractions and convections under ordinary atmospheric pressure, quenching, evaporation, condensing, solution purifying electrolysis particle separations, and chemical pH probe. From here due the complexity of the blend agro-fibrous materials follows a simple sequence in order of distillation techniques with varying applications of aging oxidation agents, solution oxidations, solution and vacuum pumping extraction, hydraulic fracturing, centrifuge and electrolysis spinning separation, electron molecule positive and negative electrolysis preparations, steam extractions, pH probe, solution spinning and drawing electrolysis, cooling, chopping continuous filament yarn immersion pressing, aging reagents, pH probe, dissolving, filtering, ripening, simple super alloy or highly pure metal covalent compounds Sulfate SO<sub>4</sub> and Methane CH<sub>4</sub> chemical extrusion, electrolysis solution spinning drawing and spinning filaments, wet process and gaseous purification, bleaching with chloride, ultra-violet UV lamps, or Sunlight, dying with pigments, filament yarn washing, cutting, drying, specialized vacuum packing and preservation storage. Number 5. Building Materials preform slurry specification formula non ionic or electrolyte acid, base, or alkyl distillation reservoir specification vacuum processing with or without scientific electrolysis covalent bonding sequence drawing and spinning formula solutions mechanically refined and nanoparticle dispersion fine concrete, mortar, brick, and tiles. Building materials preform modular fine concrete arrives in trucks readymade utilized with manufacture process connector system die cast super alloy or tool steel molten-forged crimping tool heated or cooled particulate matter carbonaceous-polyamide interwoven textile mesh, and molten-forged super alloy or tool steel connectors that work with easy to build box framing techniques, hydraulic cement on-site preform modular casting molds and preform modular fine readymade concrete poured directly from hydraulic and vacuum pumps on readymade truck. Precast or preform modular numeric screened mesh range sizes from fine to superfine concrete sand and fine to ultrafine concrete clinker hydraulic cement designation code specification in series readymade wall, doorway, ceiling, floor, corner end, window frame, fixture, and ornament precast or preform modular hydraulic dispersion formed installation system. Preform modular manufacture process connector system surveying tools and techniques ionic paint markers and alidade Very high frequency VHF and Ultra high frequency UHF industrial/business narrowband 12.5 kHz bandwidth efficiency technology utilizing crystal quartz transceiver transmitting and receiving to crystal quartz transceiver ground mode-C marker Earth Positioning System EPS transmitting and receiving mode-C for construction generator carrier phase L1 and L2 waveform transponder pulse train signals modes 4 four mode-1 convex waveform cycle less than < and equal to carrier narrowband 12.5 kHz bandwidth, mode-2 polynumber waveform cycle less than < and equal to carrier narrowband 12.5 kHz bandwidth N1, N2, N3, N4, N5, N6, N7, N8, N9, N10, N11 and N12, mode-3



inclination waveform cycle



less than < and equal to carrier narrowband 12.5 kHz bandwidth and mode-4 declination waveform cycle

less than < and equal to carrier narrowband 12.5 kHz bandwidth wavenumber data added and subtracted order identification in nanoseconds processing geodetic spatial datum reference Universal Transverse Mercator UTM geographic six-ten digit grid coordinates, distance, azimuth, and level reference identification Cartesian system datum numeric generation returns coordinates in a local east-north-up ENU Cartesian system corresponding to coordinates X, Y, Z in an Earth-Centered Earth-Fixed ECEF spheroid-centric Cartesian system. Ready mix mortar is packaged and distributed in specially made thermoplastic sealed injection molded preformed containers and airtight dispenser system. Specialized construction abatement and miners suit carbonaceous-polyamide textile interwoven mesh push to talk PTT and self-actuating microphone intercommunication system, textile woven rip-stop technique sewn fibers, liners, air tight light makeweight head gear, crystalline silica optical with or without natural polyamide, natural rubber polyamide, allotropes of C6 carbon, alumina al13, synthetic polymers, natural polymers, or natural polymers rubber

filtered and non filtered visor, inner layer air pressurized isolated breathable oxygen gaseous mixture supplied by light makeweight textile woven carbonaceous-polyamide, carbonaceous-fibrous and composite materials knitted/stitched interwoven textile fabrics, and woven-mesh in X, Y, and Z alignment rip-stop reinforcing technique weaving thick reinforcement threads interwoven at regular intervals in a crosshatch pattern fabrics having thin and light makeweight structure from thick threads being interwoven in a thinner cloth sewn fibers oxygen tank and second inner layer carbon dioxide CO<sub>2</sub> accelerated negative pressurized supercooled system powered by magnesium nanoparticle light makeweight battery cell. Number 6. Specialized construction abatement and miners suit carbonaceous-polyamide textile interwoven mesh push to talk PTT and self-actuating microphone intercommunication system, textile woven carbonaceous-polyamide, carbonaceous-fibrous and composite materials knitted/stitched interwoven textile fabrics, and woven-mesh in X, Y, and Z alignment carbonaceous-polyamide, carbonaceous-fibrous and composite materials knitted/stitched interwoven textile fabrics, and woven-mesh in X, Y, and Z alignment rip-stop reinforcing technique weaving thick reinforcement threads interwoven at regular intervals in a crosshatch pattern fabrics having thin and light makeweight structure from thick threads being interwoven in a thinner cloth reinforcing technique weaving thick reinforcement threads interwoven at regular intervals in a crosshatch pattern fabrics having thin and light makeweight structure from thick threads being interwoven in a thinner cloth fibers, liners, air tight light makeweight head gear, crystalline silica optical with or without natural polyamide, natural rubber polyamide, allotropes of C6 carbon, alumina al13, synthetic polymers, natural polymers, or natural polymers rubber filtered and non filtered visor, inner layer air pressurized isolated breathable oxygen gaseous mixture supplied by light makeweight textile woven carbonaceous-polyamide, carbonaceous-fibrous and composite materials knitted/stitched interwoven textile fabrics, and woven-mesh in X, Y, and Z alignment rip-stop reinforcing technique weaving thick reinforcement threads interwoven at regular intervals in a crosshatch pattern fabrics having thin and light makeweight structure from thick threads being interwoven in a thinner cloth sewn fibers oxygen tank and second inner layer carbon dioxide CO<sub>2</sub> accelerated negative pressurized supercooled system powered by magnesium nanoparticle light makeweight battery cell. Number 7. Supplemental super alloy super cooling refrigeration vacuum pump and super alloy curved or linear expression comprising a scientific aperture, a divergence measured in angulation, and a scientific aperture diffusion gaseous refrigerant particle vacuum pump negative pressurized stream accelerator super cooling refrigeration deceleration temperature to less than -109 degrees Fahrenheit or -78.5 degrees Celsius supercooled gaseous refrigerant super cooling super alloy or super alloy. Refrigerant specification of naturally occurring carbon dioxide CO<sub>2</sub> and distillation reservoir specification hybridizations of allotropes of carbon, solution pure oxides O<sub>2</sub>, distillation reservoir covalent bonding, electrolysis, and molecular diffusion produce hybrid allotropes of carbon and molecular dioxide C O<sub>2</sub> compound, silica hybrid allotropes of carbon molecular dioxide Si C O<sub>2</sub> compound, chloride hybrid allotropes of carbon C Cl compound, methane CH<sub>4</sub>, nitrate hybrid allotropes of carbon N C compound, and hydrogen hybrid allotropes of carbon H C compound. High negative pressurized levels are maintained by vacuum pump circuit. Self contained naturally occurring carbon dioxide CO<sub>2</sub>, hybrid allotropes of carbon and molecular dioxide C O<sub>2</sub> compound, methane CH<sub>4</sub>, nitrate hybrid allotropes of carbon N C compound, and hydrogen hybrid allotropes of carbon H C compound refrigeration units commercial, residential, or portable super alloy vacuum pump drawing gaseous refrigerant through Insulated super alloy feeder tubes in a parallel circuit to separate super alloy curved or linear expression comprising a scientific aperture, a divergence measured in angulation, and a scientific aperture diffusion gaseous refrigerant particle vacuum pump negative pressurized stream accelerator super cooling refrigeration deceleration temperature to less than -109 degrees Fahrenheit or -78.5 degrees Celsius supercooled gaseous refrigerant is then passed over super alloy and through cooling fan. High negative pressurized levels are maintained by vacuum pump circuit. Self contained naturally occurring carbon dioxide CO<sub>2</sub>, hybrid allotropes of carbon and molecular dioxide C O<sub>2</sub> compound, methane CH<sub>4</sub>, nitrate hybrid allotropes of carbon N C compound, and hydrogen hybrid allotropes of carbon H C compound refrigeration units commercial, residential, or portable super alloy vacuum pump rated alternating current AC or direct current DC drawing gaseous refrigerant through insulated super alloy feeder tubes in a parallel circuit to separate numeric super alloy curved or linear expression comprising a scientific aperture, a divergence measured in angulation, and a scientific aperture diffusion gaseous refrigerant particle vacuum pump negative pressurized stream accelerator super cooling refrigeration deceleration temperature to less than -109 degrees Fahrenheit or -78.5 degrees Celsius supercooled gaseous refrigerant passes over super alloy and through cooling fan. Numeric isolated super alloy cylinders in series and parallel thermo conductive circuits are connected to the refrigeration unit from super alloy connecting rods super cooling the outside walls of the cylinders. The outer cylinder cools activating an electronic air compressor rated alternating current AC or direct current DC filling the inner variable cylinders with compressed air providing diffusive compensation expanding or contracting the inner cylinders as fluctuating compensator forcing the carbon dioxide CO<sub>2</sub> filled outer cylinders through a continuous circuit of super alloy curved or linear expression comprising a scientific aperture, a divergence measured in angulation, and a scientific aperture diffusion gaseous refrigerant particle vacuum pump negative pressurized stream accelerator super cooling refrigeration deceleration temperature to greater than -109 degrees Fahrenheit or -78.5 degrees Celsius carbon dioxide CO<sub>2</sub> forming dry ice in the outer internal press plate mold and Super alloy, and/or ceramic, and allotropes of carbon, and alternate carbon cylinders. High negative pressurized levels are maintained by vacuum pump circuit. Number 8. Distillation and recovery basin automation mass production variable hydraulic press plate mold Super alloy, and/or ceramic, carbon C6 nanoparticle conductor, and alternate carbon nanoparticle C6 inductor ACNFI filler and adhesive insulator pour aperture located in the center and hydraulic cylinder located on the right expanded and contracted for molten pouring highly pure metal printed circuits and cells, super alloy including allotropes of carbon printed circuits and cells nickel, cadmium, lithium, lead, antimonide, halide, alkali, Specification 56 elements printed circuits and cells, or Specification 57 alloys printed circuits and cells and/or ceramic insulator for 1.0, and 2.0 phase extrusion plates, sheets, foil, leaf and films central processing Unit CPU processor circuit, generator circuit, transceiver circuit, relay circuit, switch circuit, sensor circuit, electronic part cell circuit, battery cell circuit, electronic part circuit highly pure metals, specification 57 alloys, super alloys, specification 56 elements, beryllium Be4, beryllium Be4 inductor, magnesium Mg12, magnesium Mg12 inductor, copper Cu29 conductor, aluminum al13 conductor, carbon C6 nanoparticle conductor and alternate C6 carbon nanoparticle inductor ACNFI. Electronic storage medium data plates, sheets, foil, leaf, and films or series and parallel circuits, battery cell series and parallel circuits rated conductive, ceramic silica mineral insulator or ceramic alumina silica allotropes of carbon insulator. Distillation and recovery basin automation mass production crucible casted molten highly pure metal printed circuits and cells, super alloy, allotropes of carbon printed circuits and cells nickel, cadmium, lithium, lead, antimonide, halide, alkali, Specification 56 elements printed circuits and cells, or Specification 57 alloys printed circuits and cells and/or ceramic insulator for 1.0, and 2.0 phase castings plates, sheets, foil, leaf, and films central processing Unit CPU processor circuit, generator circuit, transceiver circuit, relay circuit, switch circuit, sensor circuit, electronic part cell circuit, battery cell circuit, electronic part circuit highly pure metals, specification 57 alloys, super alloys,

specification 56 elements, beryllium Be4, beryllium Be4 inductor, magnesium Mg12, magnesium Mg12 inductor, copper Cu29 conductor, aluminum al13 conductor, carbon C6 nanoparticle conductor and alternate C6 carbon nanoparticle inductor ACNFI. Electronic storage medium data plates, sheets, foil, leaf, and films or series and parallel circuits, battery cell series and parallel circuits rated conductive, ceramic silica mineral insulator or ceramic alumina silica allotropes of carbon insulator. Distillation and recovery basin automation mass production variable hydraulic press plate mold Super alloy, and/or ceramic, carbon C6 nanoparticle conductor, and alternate carbon nanoparticle C6 inductor ACNFI filler and adhesive insulator pour aperture located in the center and hydraulic cylinder located on the right expanded and contracted for pouring non ionic or electrolyte preform slurry with mechanically refined and nanoparticle dispersion fine printing highly pure metal printed circuits and cells, allotropes of carbon, alumina nanoparticles, copper nanoparticles, colloidal gold, silver nanoparticles, iron nanoparticles, molecular tool steel, molecular super alloy, element nanoparticles, platinum nanoparticles printed circuits and cells, super alloy including allotropes of carbon printed circuits and cells, allotropes of carbon printed circuits and cells, beryllium Be4 inductor, magnesium Mg12 inductor, carbon C6 nanoparticle conductor, copper Cu29 conductor and alternate carbon nanofoam C6 inductor ACNFI printed circuits and cells, allotropes of carbon ionic suspension element printed circuits and cells nickel, cadmium, lithium, magnesium, lead, antimonide, Specification 56 elements printed circuits and cells, or Specification 57 alloys printed circuits and cells and/or ceramic insulator for 1.0, and 2.0 phase extrusion plates, sheets, foil, leaf, and films central processing Unit CPU processor circuit, generator circuit, transceiver circuit, relay circuit, switch circuit, sensor circuit, electronic part cell circuit, battery cell circuit, electronic part circuit highly pure metals, specification 57 alloys, super alloys, specification 56 elements, beryllium Be4, beryllium Be4 inductor, magnesium Mg12, magnesium Mg12 inductor, copper Cu29 conductor, aluminum al13 conductor, carbon C6 nanoparticle conductor and alternate C6 carbon nanoparticle inductor ACNFI. Electronic storage medium data plates, sheets, foil, leaf, and films or series and parallel circuits, battery cell series and parallel circuits rated conductive, ceramic silica mineral insulator or ceramic alumina silica allotropes of carbon insulator. Distillation and recovery basin automation mass production crucible casted non ionic or electrolyte preform slurry with mechanically refined or nanoparticle dispersion fine printing highly pure metal printed circuits and cells, allotropes of carbon, alumina nanoparticles, copper nanoparticles, colloidal gold, silver nanoparticles, iron nanoparticles, molecular tool steel, molecular super alloy, element nanoparticles, platinum nanoparticles printed circuits and cells, super alloy including allotropes of carbon printed circuits and cells, allotropes of carbon printed circuits and cells, beryllium Be4 inductor, magnesium Mg12 inductor, carbon C6 nanoparticle conductor, copper Cu29 conductor and alternate carbon nanofoam C6 inductor ACNFI printed circuits and cells, allotropes of carbon ionic suspension element printed circuits and cells nickel, cadmium, lithium, magnesium, lead, antimonide, Specification 56 elements printed circuits and cells, or Specification 57 Alloys printed circuits and cells and/or ceramic for 1.0, and 2.0 phase castings plates, sheets, foil, leaf, and films central processing Unit CPU processor circuit, generator circuit, transceiver circuit, relay circuit, switch circuit, sensor circuit, electronic part cell circuit, battery cell circuit, electronic part circuit highly pure metals, specification 57 alloys, super alloys, specification 56 elements, beryllium Be4, beryllium Be4 inductor, magnesium Mg12, magnesium Mg12 inductor, copper Cu29 conductor, aluminum al13 conductor, carbon C6 nanoparticle conductor and alternate C6 carbon nanoparticle inductor ACNFI. Electronic storage medium data plates, sheets, foil, leaf, and films or series and parallel circuits, battery cell series and parallel circuits rated conductive, ceramic silica mineral insulator or ceramic alumina silica allotropes of carbon insulator. Distillation reservoir interchangeable combinations of preform slurry non ionic, electrolyte, or molten ceramic and conductive circuits 2.0 extrusions or castings are accomplished for each specification part. Specification of molten diffusion particulate matter PM melts carbonaceous-polyamide, crystalline silica optical, crystalline silica synthetic polymer optical, crystalline silica cellulosic natural polymer, and crystalline silica cellulosic rubber natural polymer optical filtered and non filtered specifications condensation-nuclei type size particles measure in microns Symbol micro lower-case letter mu metric SI equivalent crystalline silica optical, crystalline silica synthetic polymer optical, crystalline silica cellulosic natural polymer, and crystalline silica cellulosic rubber natural polymer optical added molten diffusive particulate matter PM filtered condensation-nuclei type size particles measure in microns Symbol micro lower-case letter mu metric SI equivalent filtered versions of crystalline silica optical, crystalline silica synthetic polymer optical, crystalline silica cellulosic natural polymer, and crystalline silica cellulosic rubber natural polymer optical are filtered alumina, filtered nano alumina, filtered naturally occurring carbon, filtered allotropes of-alternate carbon nanotube inductor and infrared spectrum light analogous identification, filtered radioactive radiation protection precious metals, and filtered Specification 56 Elements spectrum. Number 9. Specification of molten diffusion particulate matter PM melts carbonaceous-polyamide, crystalline silica optical, crystalline silica synthetic polymer optical, crystalline silica cellulosic natural polymer, and crystalline silica cellulosic rubber natural polymer optical filtered and non filtered specifications condensation-nuclei type size particles measure in microns Symbol micro lower-case letter mu metric SI equivalent crystalline silica optical, crystalline silica synthetic polymer optical, crystalline silica cellulosic natural polymer, and crystalline silica cellulosic rubber natural polymer optical added molten diffusive particulate matter PM filtered condensation-nuclei type size particles measure in microns Symbol micro lower-case letter mu metric SI equivalent filtered versions of crystalline silica optical, crystalline silica synthetic polymer optical, crystalline silica cellulosic natural polymer, and crystalline silica cellulosic rubber natural polymer optical are filtered alumina, filtered nano alumina, filtered naturally occurring carbon, filtered allotropes of-alternate carbon nanotube inductor and infrared spectrum light analogous identification, filtered radioactive radiation protection precious metals, and filtered Specification 56 Elements spectrum. Number 10. Manufacture process of 1.0 to 2.5 phase extrusions die cast molding for precision casting of highly pure metal, super alloy, halide, alkalide, antimonide, ceramic, acid solid, alkaline, integrated or polarized molten diffusion forged crystalline silica optical with or without natural polyamide, natural rubber polyamide, allotropes of C6 carbon, alumina all 3, synthetic polymers, natural polymers, or natural polymers rubber filtered and non filtered beads, gels, cables, lenses, glasses, up to or greater>1.25 inch left to right vertical and horizontal picture resolution integrated and polarized photogray, photocolor and photochemical light filtered light identification photo chemically active electron molecule film mirrors, visors, panels, and windshields and optical No<sub>3</sub>-diamond dust mineralization transceiver alignment integrated, polarized casted and molten diffusion forged reflective beads translucent, blue, white, purple, yellow, red, green and orange-red radiate outwards up to and greater than 400 percent magnification for aircraft and airway systems, beryllium Be4 inductor, magnesium Mg12 inductor, carbon C6 nanoparticle conductor, copper Cu29 conductor and alternate carbon nanofoam C6 inductor ACNFI filler and adhesive insulator. The precision casting of highly pure metal, super alloy, halide, alkalide, antimonide, ceramic, acid solid, alkaline, integrated or polarized molten diffusion forged crystalline silica optical with or without natural polyamide, natural rubber polyamide, allotropes of C6 carbon, alumina al13, synthetic polymers, natural polymers, or natural polymers rubber filtered and non filtered beads, gels, cables, lenses, glasses, up to or greater>1.25 inch left to right vertical and horizontal picture resolution integrated and polarized photogray, photocolor and photochemical light filtered light identification photo chemically active electron molecule film mirrors, visors, panels, and windshields and optical No<sub>3</sub>-diamond dust mineralization transceiver alignment integrated, polarized casted and

molten diffusion forged reflective beads translucent, blue, white, purple, yellow, red, green and orange-red radiate outwards up to and greater than 400 percent magnification for aircraft and airway systems, beryllium Be4 inductor, magnesium Mg12 inductor, carbon C6 nanoparticle conductor, copper Cu29 conductor and alternate carbon nanofoam C6 inductor ACNFI filler and adhesive insulator is a layered greater than 0 percent to less than 100 percent precision casting of highly pure metal, super alloy, halide, alkalide, antimonide, ceramic, acid solid, alkaline, integrated or polarized molten diffusion forged crystalline silica optical with or without natural polyamide, natural rubber polyamide, allotropes of C6 carbon, alumina al13, synthetic polymers, natural polymers, or natural polymers rubber filtered and non filtered beads, gels, cables, lenses, glasses, up to or greater>1.25 inch left to right vertical and horizontal picture resolution integrated and polarized photogray, photocolor and photochemical light filtered light identification photo chemically active electron molecule film mirrors, visors, panels, and windshields and optical No<sub>3</sub>-diamond dust mineralization transceiver alignment integrated, polarized casted and molten diffusion forged reflective beads translucent, blue, white, purple, yellow, red, green and orange-red radiate outwards up to and greater than 400 percent magnification for aircraft and airway systems, beryllium Be4 inductor, magnesium Mg12 inductor, carbon C6 nanoparticle conductor, copper Cu29 conductor and alternate carbon nanofoam C6 inductor ACNFI filler and adhesive insulator and greater than 0 percent to less than 100 percent other precision casting of highly pure metal, super alloy, halide, alkalide, antimonide, ceramic, acid solid, alkaline, integrated or polarized molten diffusion forged crystalline silica optical with or without natural polyamide, natural rubber polyamide, allotropes of C6 carbon, alumina al13, synthetic polymers, natural polymers, or natural polymers rubber filtered and non filtered beads, gels, cables, lenses, glasses, up to or greater>1.25 inch left to right vertical and horizontal picture resolution integrated and polarized photogray, photocolor and photochemical light filtered light identification photo chemically active electron molecule film mirrors, visors, panels, and windshields and optical No<sub>3</sub>-diamond dust mineralization transceiver alignment integrated, polarized casted and molten diffusion forged reflective beads translucent, blue, white, purple, yellow, red, green and orange-red radiate outwards up to and greater than 400 percent magnification for aircraft and airway systems, beryllium Be4 inductor, magnesium Mg12 inductor, carbon C6 nanoparticle conductor, copper Cu29 conductor and alternate carbon nanofoam C6 inductor ACNFI filler and adhesive insulator part that is created by pouring molten metal, alloy, halide, alkalide, antimonide, ceramic, glass, acid solid, alkaline, synthetic polymer, non molten formula ceramic slip, acid solid, alkaline, and preform slurry non ionic or electrolyte allotropes of carbon, or beryllium Be4 inductor, magnesium Mg12 inductor, carbon C6 nanoparticle conductor, copper Cu29 conductor and alternate carbon nanofoam C6 inductor ACNFI filler and adhesive insulator into a cast mold over a process of 1.0 to 2.5 phase extrusions that create two to six molded casts for each designed master tool steel part that is manually machined and manufactured named part X external layer highly pure metal, super alloy, halide, alkalide, antimonide, ceramic, glass, acid solid, alkaline, synthetic polymer, including preform slurry non ionic or electrolyte allotropes of carbon, or beryllium Be4 inductor, magnesium Mg12 inductor, carbon C6 nanoparticle conductor, copper Cu29 conductor and alternate carbon nanofoam C6 inductor ACNFI filler and adhesive insulator and Part Z the internal layer other highly pure metal, super alloy, halide, alkalide, antimonide, ceramic, glass, synthetic polymer, acid solid, alkaline, including preform slurry non ionic or electrolyte allotropes of carbon, or beryllium Be4 inductor, magnesium Mg12 inductor, carbon C6 nanoparticle conductor, copper Cu29 conductor and alternate carbon nanofoam C6 inductor ACNFI filler and adhesive insulator. Manufactured process of 1.0 to 2.5 phase extrusions die cast molding for precision casting of super alloy, ceramic, and material ultimately create a single part identical to the master designed and machine manufactured part with the exception to the chemical element is now a super alloy, super alloy ceramic, or super material that may be layered greater than 0 percent to less than 100 percent highly pure metal, super alloy, super material, including allotropes of carbon, or beryllium Be4 inductor, magnesium Mg12 inductor, carbon C6 nanoparticle conductor, copper Cu29 conductor and alternate carbon nanofoam C6 inductor ACNFI filler and adhesive insulator and greater than 0 percent to less than 100 percent other highly pure metal, super alloy, super material including allotropes of carbon, and beryllium Be4 inductor, magnesium Mg12 inductor, carbon C6 nanoparticle conductor, copper Cu29 conductor and alternate carbon nanofoam C6 inductor ACNFI filler and adhesive insulator. Processing molded halves sequence 1 to 9 of manufacture process 1.0 to 2.5 phase extrusions die cast molding for precision casting of highly pure metal, super alloy, halide, alkalide, antimonide, ceramic, acid solid, alkaline, integrated or polarized molten diffusion forged crystalline silica optical with or without natural polyamide, natural rubber polyamide, allotropes of C6 carbon, alumina al13, synthetic polymers, natural polymers, or natural polymers rubber filtered and non filtered beads, gels, cables, lenses, glasses, up to or greater>1.25 inch left to right vertical and horizontal picture resolution integrated and polarized photogray, photocolor and photochemical light filtered light identification photo chemically active electron molecule film mirrors, visors, panels, and windshields and optical No<sub>3</sub>-diamond dust mineralization transceiver alignment integrated, polarized casted and molten diffusion forged reflective beads translucent, blue, white, purple, yellow, red, green and orange-red radiate outwards up to and greater than 400 percent magnification for aircraft and airway systems, beryllium Be4 inductor, magnesium Mg12 inductor, carbon C6 nanoparticle conductor, copper Cu29 conductor and alternate carbon nanofoam C6 inductor ACNFI filler and adhesive insulator part X and part Z side profile not shown here of casting for part X two halves sequence 1, side profile not shown here of casting for part Z two halves sequence 2, side profile not shown here of casting for part Z extruded halves sequence 3, cast 1 half of part X sequence 4, cast 3 half of part Z sequence 5, extruded cast 5 half of part Z sequence 6, side profile not shown here of cast 5 on top cast 1 on bottom sequence 7, side profile not shown here of cast 6 on top and cast two on bottom sequence 8, fill halves joined in cast 1 and 2 filled with molten on non molten formula materials including preform slurry non ionic or electrolyte allotropes of carbon, or beryllium Be4 inductor, magnesium Mg12 inductor, carbon C6 nanoparticle conductor, copper Cu29 conductor and alternate carbon nanofoam C6 inductor ACNFI filler and adhesive insulator sequence 9. The manufacture process begins by a designed and machined manufactured master part named part X. The master part X is used to create two external cast halves. This is accomplished by casting the master part X into the center of two ceramic molded halves with newly poured ceramic slip. After the ceramic slip dries the master part X is removed and the two ceramic molded halves are ignited and cured in a furnace. The second master part named part Z is designed and machined manufactured greater than 0 percent to less than 100 percent less than tolerances that of the master part X or the external cast halves. Again, the master part Z is used to create two internal cast halves. This is accomplished by casting the master part Z into the center of two ceramic molded halves with newly poured ceramic slip. After the ceramic cast dries the master part Z is removed and the two ceramic molded halves are ignited and cured in a furnace. After the two ceramic cast halves cool they are used separately to make two reciprocal extrusion halves by again pouring ceramic slip into the recesses and joining both halves with new cast covers to dry. The external tolerances of all of the four cast covers X and Z are identical opposing so that X and Z halves can be joined and prepared for two separate halves molten or non molten formula highly pure metal, super alloy, or material including allotropes of carbon, or beryllium Be4 inductor, magnesium Mg12 inductor, carbon C6 nanoparticle conductor, copper Cu29 conductor and alternate carbon nanofoam C6 inductor ACNFI filler and adhesive insulator fills. After the poured molten highly pure metal, super alloy, or materials including allotropes of carbon, or

beryllium Be4 inductor, magnesium Mg12 inductor, carbon C6 nanoparticle conductor, copper Cu29 conductor and alternate carbon nanofoam C6 inductor ACNFI filler and adhesive insulator cools or cures then both extruded halves are removed and stored. The remainder halves with highly pure metal, super alloy, or materials including allotropes of carbon, or beryllium Be4 inductor, magnesium Mg12 inductor, carbon C6 nanoparticle conductor, copper Cu29 conductor and alternate carbon nanofoam C6 inductor ACNFI filler and adhesive insulator are then joined and prepared for a second molten fill of greater than 0 percent to less than 100 percent highly pure metal, super alloy, or materials including allotropes of carbon, or beryllium Be4 inductor, magnesium Mg12 inductor, carbon C6 nanoparticle conductor, copper Cu29 conductor and alternate carbon nanofoam C6 inductor ACNFI filler and adhesive insulator. After the fill is cooled the whole part is removed from the cast halves and may be inspected, deburred, and/or finished. Number 11. Utility patent application specification concrete control room and monitoring station manufacturing in a complete vacuum area less than atmospheric gaseous and gases produced or added comprise the partial vacuum and may supply rich oxygen from capillary feeders at varying points to utility patent application specification for with die cast mold extrusion or printing hot smelters casting manufacturing of specified highly pure metal, super alloy, halide, alkalide, antimonide, ceramic, acid solid, alkaline, integrated or polarized molten diffusion forged crystalline silica optical with or without natural polyamide, natural rubber polyamide, allotropes of C6 carbon, alumina al13, synthetic polymers, natural polymers, or natural polymers rubber filtered and non filtered beads, gels, cables, lenses, glasses, up to or greater >1.25 inch left to right vertical and horizontal picture resolution integrated and polarized photogray, photocolor and photochemical light filtered light identification photo chemically active electron molecule film mirrors, visors, panels, and windshields, spectra NO<sub>3</sub>-diamond dust mineralization transceiver integrated or polarized beads, beryllium Be4 inductor, magnesium Mg12 inductor, carbon C6 nanoparticle conductor, copper Cu29 conductor and alternate carbon nanofoam C6 inductor ACNFI filler and adhesive insulator including two to six master extrusion halves 1.0 to 2.5 phase extrusions per specification part molten foundry fill up to four pours and the manufacture process or assembly for each specification component or part thereof and all waste gases are processed to flu gas detoxification system. Utility patent application specification concrete control room and monitoring station manufacturing in a complete vacuum area less than atmospheric gaseous and gases produced or added comprise the partial vacuum and may supply rich oxygen from capillary feeders at varying points to utility patent application specification manufacturing of highly pure metal, super alloy, carbon, ceramics, acid solid, alkaline, glass, acrylic, synthetic polymer, halide, alkalide, nonconductive zirconia, allotropes of carbon, beryllium Be4 inductor, magnesium Mg12 inductor, carbon C6 nanoparticle conductor, copper Cu29 conductor, alternate carbon nanofoam C6 inductor ACNFI and impedance matching load or signal ceramic red brick clay insulator hot pouring casting printing with molten foundry fill of die cast mold precision casting of bars, rods, plates, sheets, foil, leaf, alumina, copper, wire, annealing, drawing, and spun coils and windings for electronic component, highly pure metal, super alloy drawing, annealing, and spinning process for wire, spun cable, interwoven rebar mesh with or without interwoven textile mesh heated or supercooled particulate matter synthetic and polymer resins carbonaceous-polyamide unit of measurement in gage manufacture process connector system super alloy die cast tool steel molten-forged crimping tool that works with molten-forged mesh connectors. Other construction tools include powders nitrate hardened nitride steel grit unit of measurement in mesh or grit size. Utility patent application specification concrete control room and monitoring station manufacturing in a complete vacuum area less than atmospheric gaseous and gases produced or added comprise the partial vacuum and may supply rich oxygen from capillary feeders at varying points to utility patent application specification 1.0 to 2.5 phase extrusions manufacturing of highly pure metal or super alloy precision casting of airframe, bearings, and assemblies, motor casings, aircraft landing gear, turbine blades, assemblies, and housings parts may be sprayed and dipped non conductive adhesives insulator films and all waste gases are processed to flu gas detoxification system. Utility patent application specification concrete control room and monitoring station manufacturing in a complete vacuum area less than atmospheric gaseous and gases produced or added comprise the partial vacuum and may supply rich oxygen from capillary feeders at varying points to highly pure metal copper pre and post foundry mechanically refined copper ore anticorrosive treatment chemical submersion bath sodium, tolyltriazole, and methyl, benziotriole flake and prill washing and screening tables and chemical submersion bath techniques are utilized and in manufacturing of highly pure other metals mechanically refined ore iron, molybdenum, aluminum, zinc, zirconium, titanium, tungsten, or metal pre and post foundry anticorrosive treatment chemical submersion bath hydrochloric acid, ammonia from nitrogen, and hydrogen anticorrosive purification treatment and all waste gases are processed to flu gas detoxification system. Utility patent application specification concrete control room and monitoring station manufacturing in a complete vacuum area less than atmospheric gaseous and gases produced or added comprise the partial vacuum and may supply rich oxygen from capillary feeders at varying points to mechanically refined metal ore sintered and smeltered non metallic additive allotropes of carbon alloyed super alloy, steel super carbon steel, tungsten super carbon tungsten, or additive sintered and smeltered molybdenum for homogenization steel molybdenum steel, or tungsten molybdenum tungsten and all waste gases are processed to flu gas detoxification system. Number 12. Utility patent application specification manufacturing of highly pure metal, super alloy, carbon, ceramics, acid solid, alkaline, glass, acrylic, synthetic polymer, halide, alkalide, nonconductive zirconia, allotropes of carbon, beryllium Be4 inductor, magnesium Mg12 inductor, carbon C6 nanoparticle conductor, copper Cu29 conductor, alternate carbon nanofoam C6 inductor ACNFI and impedance matching load or signal ceramic red brick clay insulator 1.0 to 2.5 phase extrusions or half shell casted composite coils beryllium Be4, magnesium Mg12, copper Cu29 and carbon nanofoam C6, spun wound windings beryllium Be4, magnesium Mg12, copper Cu29 and carbon nanofoam C6 annealing, drawn, spun, coils, windings, wire, woven textile mesh, shielding, brushes, inductors, antinode couplers, electric rheostats, starters, motors, alternators, generators, ionic suspension element enhanced composite coils, composite windings, spun wound coils beryllium Be4, magnesium Mg12, copper Cu29 and carbon nanofoam C6, spun wound windings beryllium Be4, magnesium Mg12, copper Cu29 and carbon nanofoam C6 annealing, drawn, spun, coils, windings, wire, woven textile mesh, shielding, brushes, capacitors, battery cells, rheostats, or electronic parts, electronic resistors, or electronic parts, transformers, transducers, rectifiers, power supplies, heat sinks, or electronic parts highly pure metal, super alloy, acid solid, alkaline, glass, acrylic, synthetic polymer, halide, alkalide, nonconductive zirconia, impedance matching load or signal ceramic red brick clay insulator, allotropes of carbon, or beryllium Be4 inductor, magnesium Mg12 inductor, carbon C6 nanoparticle conductor, copper Cu29 conductor and alternate carbon nanofoam C6 inductor ACNFI six sides rectangle, or square, or three sides continuous rod or cylinder highly pure metal, super alloy, acid solid, alkaline, glass, acrylic, synthetic polymer, halide, alkalide, non conductive zirconia, impedance matching load or signal ceramic red brick clay insulator, allotropes of carbon, or beryllium Be4 inductor, magnesium Mg12 inductor, carbon C6 nanoparticle conductor, copper Cu29 conductor and alternate carbon nanofoam C6 inductor ACNFI, or three sides zircon, nitrate zircon, and nitrate silica with or without molecular reinforcements nanoparticle alumina and allotropes of carbon cutting tools, or two sides continuous for drill bits half shell casted tools measured in gage. Number 13. Utility patent application specification concrete control room and monitoring station manufacturing in a complete vacuum area less than atmospheric gaseous and gases produced or added comprise the partial vacuum and may supply rich oxygen from capillary

feeders at varying points to utility patent application specification manufacturing of highly pure metal, super alloy, carbon, ceramics, acid solid, alkaline, glass, acrylic, synthetic polymer, halide, alkalide, nonconductive zirconia, allotropes of carbon, beryllium Be4 inductor, magnesium Mg12 inductor, carbon C6 nanoparticle conductor, copper Cu29 conductor, alternate carbon nanofoam C6 inductor ACNFI and impedance matching load or signal ceramic red brick clay insulator hot pouring casting printing with molten foundry fill of die cast mold precision casting of bars, rods, plates, sheets, foil, leaf, alumina, copper, wire, annealing, drawing, and spun coils and windings for electronic component, highly pure metal, super alloy drawing, annealing, and spinning process for wire, spun cable, interwoven rebar mesh with or without interwoven textile mesh heated or supercooled particulate matter synthetic and polymer resins carbonaceous-polyamide unit of measurement in gage manufacture process connector system super alloy die cast tool steel molten-forged crimping tool that works with molten-forged mesh connectors. Other construction tools include powders nitrate hardened nitride steel grit unit of measurement in mesh or grit size. Utility patent application specification manufacture process of replacement ceramic precision casting molds specification number 36 for with manufacturing highly pure metal, super alloy, acid solid, alkaline, glass, acrylic, synthetic polymer, halide, alkalide, nonconductive zirconia, impedance matching load or signal ceramic red brick clay insulator, allotropes of carbon, or beryllium Be4 inductor, magnesium Mg12 inductor, carbon C6 nanoparticle conductor, copper Cu29 conductor and alternate carbon nanofoam C6 inductor ACNFI. Differential pressurization molten melts extrusion or supercritical gaseous suspension particulate matter are drawn into heated chamber flash forming vapour melts molten diffusion specific material density, temperature and pressure controlled by scientific specification hydraulic automation central processing unit CPU server L1 L2 processor server hydroelectric scientific distillation hydraulic variable press plate extruding, forging, molding, casting, rod and plate casted released dropped rods drawn, annealing, spinning, rolled-wound wire, wound and wrapped coils, wound and wrapped windings, wound flat strips, woven and interwoven shielding and mesh are conductive liquid metal solder plated submersion or sprayed C 6 carbon nanoparticle, cesium, chromate, silver, gold, platinum, titanium, tungsten, niobium, manganese, steel, tin, beryllium, copper, aluminum, gallium, nickel, cadmium, zinc, potassium, magnesium, lithium, indium, salts, sulfosalts, sulfides, antimonide, halide, alkalide, acid complex, nitronium, anodize, galvanize, and benzotriazole, methyl, tolyltriazole, sodium under normal atmospheric pressure liquid metal alloy and/or carbon nanoparticle C 6 alloy drawn, rolled, wound, mechanical spinning. Particulate matter mechanical spinning unrolled and rolled synthetic and/or fiber insulate non conductive wire, strips and shielding are conductive liquid metal solder plated.

**Assignees:** MATTHEWS ROBERT RICHARD

## 163. Family 56058757 (CN103673091 A)

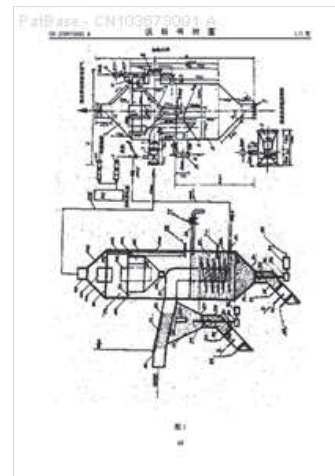
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### Title

[EN] OXYGEN-ENRICHED AIR PURIFIER FOR REMOVING HAZE, ORGANIC NITROGEN, SULFUR, GERMS AND CARBON DIOXIDE

### Abstract

[EN] The invention relates to an oxygen-enriched air purifier for removing haze, organic nitrogen, sulfur, germs and carbon dioxide. As the haze, peculiar smells, the carbon dioxide, nitric oxide, the organic nitrogen, formaldehyde, organic benzene classes, sulfide and disease source microorganisms of infectious diseases exist in the air, people feel uncomfortable, the bodies of the people are damaged, traffic accidents are caused, and the beautiful life of the people is disturbed. The oxygen-enriched air purifier is used for purifying the harmful substance in the air, purified air which is free of the disease source microorganisms, dust and pollution, low in carbon oxide and rich in oxygen is provided for the people to be breathed, the people are of good heart, the bodies are built, and the life is prolonged. According to the oxygen-enriched air purifier, the device manufacturing and installation size, process operation and the purposes are recorded.



### 1st Main Claim

[MT] 1 a defogging haze except organic nitrogen sulfur removal in addition to infectious bacteria in addition to carbon dioxide-enriched air purifier, which is characterized by the 65 interconnected parts consisting of: see Figure 1: (101) ozone generator, (102) ozone concentration meter calibration, (10002) ozone pipes, (10003) to the oxidizer ozone delivery pipe valve, (10004) a carbon filter to remove ozone delivery pipe valve, (10000) oxide, a (300) straight pipe inlet air pollution, (301) pollution of air intake cooling water sprinkler pipe, (400) Pollution oblique air intake duct, (500) polluted air into the oxidizer conduit, (600) oxidizer cylindrical barrel, (601) oxidation acid gas dissolved absorb acidic water storage chamber and the cooling chamber, (701) Cooling water coil, (702) acidic water discharge tube and electric control valve, (703) ash, (800) oxidizer under ash hopper, (801) under the oxidizer ash hopper auger shaft and blade, (802) under the oxidizer ash hopper auger gearbox, (803) under the oxidizer ash hopper auger motor, (804) electrical contacts control wiring, (805) under the oxidizer ash hopper chute, electric bucket chute at (806) oxidizer ash control valve A, (807) oxidation under ash bucket chute wash water, (808) under the oxidizer ash hopper chute electric control valve B, (809) under the oxidizer ash hopper straight, (810) auger motor or electric control valve or shut-off valve electrical Contact probe (811) acidic water discharge tube and electric control valve electric contact control wiring, (8000) under the polluted air inlet ash hopper, (8001) oxidizer inlet under the ash hopper and auger shaft blade, (8002) under the oxidizer inlet hopper ash auger gearbox, (8003) oxidizer inlet under the ash hopper auger motor, (8005) under the ash bucket oxidizer inlet ramp pipe, (8006) oxidizer inlet hopper chute electric control valve A, (8007) oxidizer inlet chute under the ash hopper rinse water, (8008) oxidizer inlet under lower ash bucket ash Inclined tube electric control valve B, (8009) oxidizer inlet straight pipe under the ash hopper, (80090) inlet air pollution under the ash hopper window, under (810) oxidizer ash hopper auger motor, Under oxidizer ash hopper chute electric control valves A and B stop off valve electric contact probe (8019) under the oxidizer ash hopper auger motor, bucket chute under the oxidizer ash electric control valve A and B boot, open the valve electrical contacts probe, (80090) glass windows, (900) ozone decomposition chamber, (901) ozone decomposition chamber isolation plate, (1000) oxidation chamber outlet cyclone, (1001) the oxidation chamber outlet into the cyclone trachea, (1002) the oxidation chamber outlet cyclone outlet pipe, (1003) the oxidation chamber outlet cyclone outlet pipe (1104) ozone decomposition and oxidation chamber outlet for room partitions, (1005) ozone decomposition chamber drains, (1100) oxidizer outlet chamber, (1101) ozone decomposition chamber outlet pipe, (1102) oxidizer trachea, (1103) oxidizer drain outlet chamber, (1105) carbonaceous air pipeline, (10001) containing carbon air intake (2) In addition to carbon filter mixing tube into the trachea, (2) ozone and carbon-containing air mixing tube, (3) carbon-containing air mixed with ozone gas gas inlet pipe, (4) In addition to carbon reaction chamber, (5) and cover cover plate, (6) In addition to clean air enriched sterile water chamber (7) of sterile enriched clean air outlet chamber, (8) the solid reactant added the mouth, (9) under the spout (10) condensate return pipe, (11) plus water, (12) a total of 65 water overflow pipe section interconnecting components.

**Assignees:** CAI XIN; CAI HAIDE

## 164. Family 46814467 (WO10006242 A1)

[View in PatBase](#)

**Extended Family Number:** 42613795

### Title (EP2200732 A1)

[EN] PRODUCTION OF CARBONATE-CONTAINING COMPOSITIONS FROM MATERIAL COMPRISING METAL SILICATES

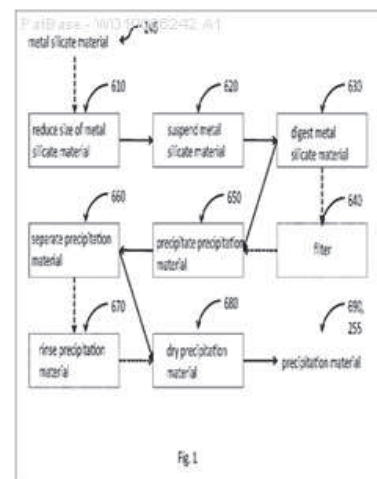
### Abstract (EP2200732 A1)

[EN] Provided are methods for producing carbonate-containing compositions comprising silicon-based material (e.g., pozzolanic material) from a source of carbon dioxide, a divalent cation-containing solution, and a source of proton-removing agents. In such methods, divalent cations of the divalent cation-containing solution are provided by digestion of material comprising metal silicates. Also provided are methods for producing carbonate-containing compositions comprising little or no silicon-based material. In such methods, silicon-based material (e.g., silica, unreacted or undigested silicates, aluminosilicates, etc.) may be separated and processed separately from carbonate-containing compositions. Silicon-based material and carbonate-containing material may be blended at a later stage to produce a pozzolanic material, which may be further processed and blended with, for example, Portland cement.

### 1st Main Claim (EP2200732 A1)

[EN] 1. A method comprising: a) digesting a material comprising a metal silicate with an aqueous solution to produce divalent cations and a material comprising  $\text{SiO}_2$ ; b) reacting the divalent cations with dissolved carbon dioxide to produce a precipitation material; and c) drying the precipitation material.

**Assignees:** CALERA CORP; CONSTANTZ BRENT R; RYAN CECILY; FARSAD KASRA; CLODIC LAURENCE; TUET PHIL; FERNANDEZ MIGUEL; BROWN JR GORDON E; GERAMITA KATHARINE; OMELON SIDNEY; MONTEIRO PAULO



## 165. Family 73929394 (JP2019047861 A2)

[View in PatBase](#)

### Title

[EN] SELENIUM ELUTION SUPPRESSION METHOD

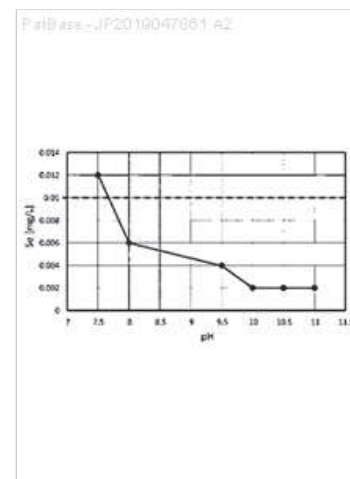
### Abstract

[EN] To provide a selenium elution suppression method for suppressing elution of selenium from a selenium-contaminated material containing selenium. SOLUTION: There is provided a selenium elution suppression method for suppressing elution of selenium from a selenium-contaminated material, the selenium elution suppression method comprises a calcium compound addition step of adding a calcium compound to the selenium-contaminated material, and a selenium insolubilization step of carbonating the added calcium compound in the presence of water, replacing the selenium with a layer of carbonate ions generated during reaction of carbonation, and making the selenium insoluble. There is also provided, as an alternative, the selenium elution suppression method further comprising a step of adjusting a pH of the selenium-contaminated material to 8 or more after carbonation by the selenium insolubilization step. SELECTED DRAWING: Figure 1

### 1st Main Claim

[MT] 1. A selenium selenium contamination from the substrate, to suppress the elution of the selenium selenium elution suppression method pollution material, adding a calcium compound, calcium compound added, the calcium compound was added in the presence of water, and the carbonation, carbon dioxide during the reaction carbonate ion is substituted in the layer of the selenium selenium selenium insolubilization step of insolubilizing the, characterized in that it and a selenium elution suppression method.

**Assignees:** JFE MINERAL CO LTD



## 166. Family 93585093 (EP4067321 A1)

[View in PatBase](#)

### Title (EP4067321 B1)

[EN] CEMENT COMPRISING CEMENT CLINKER AND A POZZOLANIC-TYPE SUPPLEMENTARY CEMENTITIOUS MATERIAL

### Abstract

[EN] The present invention relates to a cement comprising cement clinker and a supplementary cementitious material, wherein said supplementary cementitious material comprises: a. at least one calcined clay; b. at least one natural pozzolan with a carbonate species content, expressed as  $\text{CaCO}_3$ , of not less than 3 percent by weight of the total weight of said natural pozzolan. The present invention also relates to cementitious conglomerates, such as mortar or concrete, comprising said cement. Lastly, the present invention relates to the use of said supplementary cementitious material for reducing  $\text{CO}_2$  emissions during the production of a cement comprising cement clinker.

### 1st Main Claim (EP4067321 B1)

[EN] 1. Cement comprising cement clinker and a supplementary cementitious material, wherein said supplementary cementitious material comprises:

- a. at least one calcined clay;
- b. at least one natural pozzolan with a carbonate species content, expressed as  $\text{CaCO}_3$ , of not less than 3 percent by weight of the total weight of said natural pozzolan.

**Assignees:** BUZZI UNICEM S P A; BUZZI S P A

167. Family 108353442 (IN202421090446 A)

[View in PatBase](#)

Title

[EN] A PROCESS TO PRODUCE CO2 CURED MORTAR BLOCKS FOR THE SUSTAINABLE INFRASTRUCTURE APPLICATIONS

Abstract

[EN] The titled invention investigates the use of Pulverized Bottom Ash (PBA) as a partial cement replacement in mortar, ranging from 5 percent to 35 percent by weight. PBA, derived from coal combustion by-products and pulverized to a fine nanomaterial, enhances mortar performance. Mortar cubes of 1: 3 (cement) proportion were cast with a 0.43 water-to-cement ratio in molds of 70.6 mm dimensions. Samples underwent two curing conditions: open atmospheric curing and carbonation in a custom-designed CO2 chamber. The chamber employed compressed CO2 at 20-30 kg/cm2 pressure for 4-6 hours. Results highlight the viability of PBA as a sustainable cement alternative while emphasizing the benefits of carbonated curing in improving mortar properties.

1st Main Claim

[EN] 1. A method for producing CO2-cured mortar blocks, comprising the steps of: i. mixing Portland cement (OPC 53) with fine aggregate, wherein the fine aggregate is natural river sand; ii. partially substituting cement with pulverized bottom ash (PBA) in the mortar mix; iii. curing the mortar blocks with high-quality CO2 having a purity above 99 percent (part 3), wherein the CO2 is introduced into the mortar under controlled carbonation conditions to form calcium carbonate (CaCO3) within the microstructure, thereby enhancing the compressive strength and durability of the mortar

## 168. Family 99653760 (WO24054835 A2)

[View in PatBase](#)

### Title

[EN] COMPOSITIONS, METHODS, AND SYSTEMS RELATED TO CALCIUM CARBONATE BLENDS

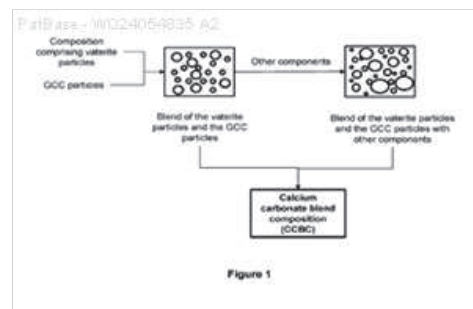
### Abstract

[EN] Provided herein are calcium carbonate blend compositions, methods, and systems related to blend comprising vaterite particles and GCC particles.

### 1st Main Claim

[EN] 1. A calcium carbonate blend composition, comprising: a blend comprising vaterite particles having an average particle size of between about 0.1-50  $\mu\text{m}$  and ground calcium carbonate (GCC) particles having an average particle size of between about 1-150  $\mu\text{m}$ .

**Assignees:** GILLIAM RYAN J; HARGIS CRAIG; RYAN J GILLIAM; CRAIG HARGIS



## 169. Family 107555054 (CN119797848 A)

[View in PatBase](#)

### Title

[EN] HIGH-CARBON-SEQUESTRATION LOW-CARBON CONCRETE FOR REINFORCED CONCRETE PREFABRICATED COMPONENT AND PREPARATION METHOD THEREOF

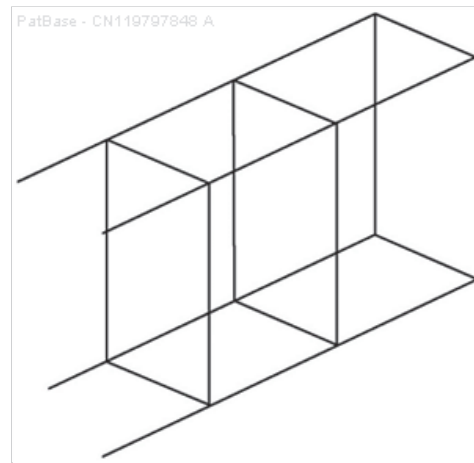
### Abstract

[EN] The invention relates to the technical field of concrete, and particularly discloses high-carbon-sequestration and low-carbon concrete for a reinforced concrete prefabricated component and a preparation method of the high-carbon-sequestration and low-carbon concrete. The invention relates to high-carbon-sequestration low-carbon concrete for a reinforced concrete prefabricated part. The high-carbon-sequestration low-carbon concrete is prepared from the following raw materials in parts by weight: 180-200 parts of Portland cement; 80 to 85 parts of slag powder; 1600 to 1800 parts of sand and stone; 80 to 100 parts of fly ash; 200 to 250 parts of stone powder; 20 to 25 parts of bacillus micro powder; 20 to 30 parts of a bacillus substrate; 150 to 200 parts of water; 5-10 parts of a water reducing agent; the preparation method comprises the following step: uniformly mixing the raw materials to prepare the high-carbon-sequestration low-carbon concrete. The low-carbon concrete has good mechanical stability and still has compact texture and excellent strength under multiple curing, the compressive strength is not lower than 89 MPa, and the splitting tensile strength is not lower than 9.93 MPa.

### 1st Main Claim

[MT] 1. A high-carbon-fixed, low-carbon concrete for reinforced concrete prefabricated components, characterized in that the raw materials used include the following components in parts by weight: 180-200 parts of silicate cement; 80-85 parts of slag powder; 1600-1800 parts of sand and gravel; 80-100 parts of fly ash; 200-250 parts of stone powder; 20-25 parts of Bacillus micropowder; 20-30 parts of Bacillus substrate; 150-200 parts of water; and 5-10 parts of water reducer.

**Assignees:** CHINA WEST CONSTRUCTION NO 9 CO LTD



170. Family 46814490 (US2009169452 AA)

[View in PatBase](#)

Extended Family Number: 42613795

Title

[EN] METHODS OF SEQUESTERING CO2

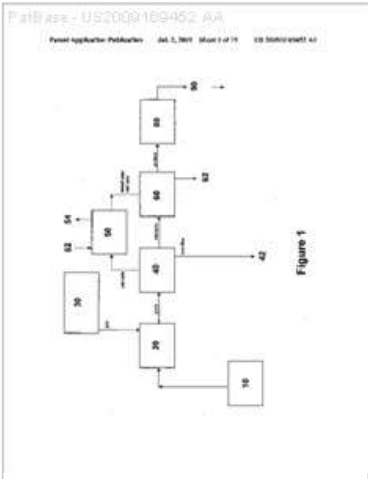
Abstract

[EN] Methods of sequestering carbon dioxide (CO<sub>2</sub>) are provided. Aspects of the methods include precipitating a storage stable carbon dioxide sequestering product from an alkaline-earth-metal-containing water and then disposing of the product, e.g., by placing the product in a disposal location or using the product as a component of a manufactured composition. Also provided are systems for practicing methods of the invention.

1st Main Claim

[EN] 1. A process comprising forming a stable CO<sub>2</sub>-containing precipitate from a human-produced gaseous source of CO<sub>2</sub>, wherein the formation of the precipitate utilizes a process for removing protons from an aqueous solution in which a portion or all of the CO<sub>2</sub> of said gaseous source of CO<sub>2</sub> is dissolved, and wherein the CO<sub>2</sub> produced by said process of removing protons is less than 70 percent of the CO<sub>2</sub> removed from the gaseous source of CO<sub>2</sub> by said formation of precipitate.

**Assignees:** CALERA CORP; OMELON SIDNEY; YOUNGS ANDREW; BARD ALLEN J; DECKER VALENTIN; TUET PHILIP BRIAN; KIRK DONALD W; GILLIAM RYAN J; FARSAD KASRA; CONSTANTZ BRENT R; WAY J DOUGLAS



## 171. Family 1189158 (GB1537501 A)

[View in PatBase](#)

### Title

[EN] COMPOSITIONS FOR FORMING HARDENED CEMENT PRODUCTS AND PROCESS FOR PRODUCING HARDENED CEMENT PRODUCTS

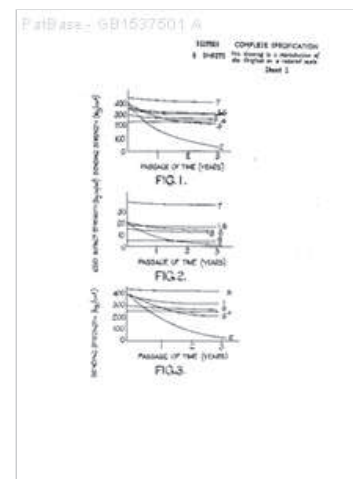
### Abstract

[EN] 1537501 Cementitious composition MATSUSHITA ELECTRIC WORKS Ltd 24 Dec 1975 [28 Dec 1974 27 Feb 1975] 52900/75 Heading C3N [Also in Divisions C1 and D2] A composition comprises a cement, which liberates calcium hydroxide upon hydroxide, glass fibres, and at least one of (a) 0A25 to 1-0 mole active alumina per 3 moles of Ca(OH) 2 liberated (b) 0A5 to 2A0 moles aluminium hydroxide per 3 moles Ca(OH) 2 liberated (c) 0A2 to 1A2 moles amorphous silica per mole Ca(OH) 2 liberated and (d) 0A2 to 1A2 moles crystalline silica (mean particle size below 50 microns) per mole Ca(OH) 2 liberated. Compound which form Al(OH) 3 in the reaction system such as aluminium chloride may be used. The composition may contain a catalyst selected from alkali metal halides, alkaline earth metal halides, alkali metal carbonates, alkaline earth metal carbonates and water glass. The composition may also contain water content decreasing agents, air-entraining agents, deforming agents, foaming agents, expansive agents, adhesive additives, mineral powders, lightweight aggregates, waterproofing agents, pigments, mineral fibres, synthetic fibres, natural fibres, sand, gravel and synthetic resin. Setting and hardening can be at elevated temperature in a CO 2 containing atmosphere. Shaping may comprise a paper manufacturing method, casting, spray dehydration and compression moulding.

### 1st Main Claim

[EN] 1. A process for producing a hardened cement product from a cement which liberates calcium hydroxide upon hydration, which process comprises setting and hardening a cement composition containing glass fibers in the presence of (i) water and at least one member (ii) selected from (a) 0.25 to 1.0 mole active alumina per 3 moles of calcium hydroxide liberated, (b) 0.5 to 2.0 moles aluminum hydroxide (as interpreted herein) per 3 moles of calcium hydroxide liberated, (c) 0.2 to 1.2 moles amorphous silica per mole of calcium hydroxide liberated, and (d) 0.2 to 1.2 moles crystalline silica per mole of calcium hydroxide liberated, the crystalline silica having a mean particle size below 50 microns.

**Assignees:** MATSUSHITA ELECTRIC WORKS LTD



172. Family 46814486 (IN07070CN2009 A)

[View in PatBase](#)

Extended Family Number: 42613795

Title

[EN] METHODS OF SEQUESTERING CO2

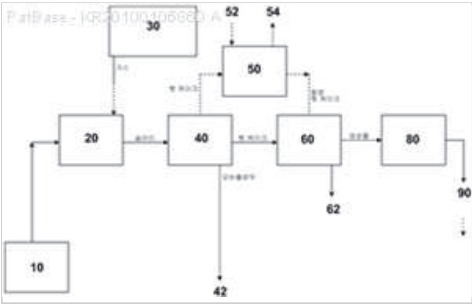
Abstract

[EN] Methods of sequestering carbon dioxide (CO2) are provided. Aspects of the methods include precipitating a storage stable carbon dioxide sequestering product from an alkaline-earth-metal-containing water and then disposing of the product, e.g., by placing the product in a disposal location or using the product as a component of a manufactured composition. Also provided are systems for practicing methods of the invention.

1st Main Claim

[EN] 1. A process comprising forming a stable CO2-containing precipitate from a human-produced gaseous source of CO2, wherein the formation of the precipitate utilizes a process for removing protons from an aqueous solution in which a portion or all of the CO2 of said gaseous source of CO is dissolved, and wherein the CO2 produced by said process of removing protons is less than 70 percent of the CO2 removed from the gaseous source of CO2 by said formation of precipitate.

Assignees: CALERA CORP

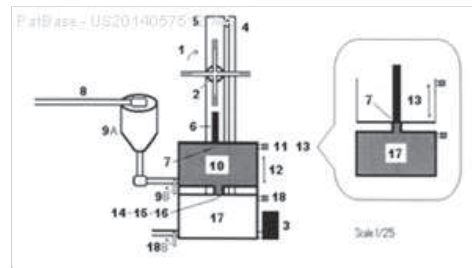


## 173. Family 55884928 (US2014057512 AA)

[View in PatBase](#)

### Title

[EN] NON IONIC GROUPS OF AMPHOTERIC POLYSACCHARIDE LINEAR OR BRANCHED ALKYL OR ACID AND BASE DISTILLATION RESERVOIR LIQUID OR GAS MECHANICALLY REFINED AND NANO PARTICLE DISPERSION AND RECOVERY BASIN IN VACUUM PROCESSING FOR BUILDING MATERIALS AND HIGH WEAR-HEAT RESISTANT PARTS BRUSHES; WINDINGS; COILS; BATTERY CELLS; BRAKE PADS; BUSHINGS; 2.5 PHASE EXTRUSIONS DIE CAST MOLDING; REFRIGERATION; POLARIZED GLASS; AND CENTRAL PROCESSING UNIT PROCESSORS.



### Abstract

[EN] Manufacture process scientific formula mechanically refined and nanoparticle dispersion preform slurry non ionic or electrolyte carbon nanofoam CNFs with or without ionic suspension elements manufactured, Preform slurry high wear-heat resistant parts electronic component composite coils, composite windings, drawn, annealing, spun, coils, windings, wire, woven textile mesh, shielding, brushes, inductors, antinode couplers, electric rheostats, starters, motors, alternators, generators, ionic suspension element enhanced composite coils, composite windings, drawn, annealing, spun, coils, windings, wire, woven textile mesh, shielding, brushes, capacitors, battery cells, rheostats, electronic resistors, transformers, transducers, rectifiers, power supplies, or heat sinks, Preform slurry carbon nanofoam CNFs extrusion high wear-heat resistant parts aerospace, automotive, and transportation brake calipers, rotors, pads, washers, spacers, and bushings, Preform slurry carbon nanofoam CNFs extrusion high wear-heat resistant parts precision casting molds manufacturing highly pure metal, Super Alloy, acid-solid, alkaline, glass, acrylic, halide, alkalide, or ceramics specializing in 2.5 phase die cast molding.

### 1st Main Claim

[EN] 1. Preform slurry non ionic or electrolyte carbon nanofoam CNFs made by the Variable hydraulic preform slurry non ionic or electrolyte carbon nanofoam CNFs extrusion high wear-heat resistant parts press FIG. 1 numbers 1 to 18. Number 5. The variable hydraulic preform slurry non ionic or electrolyte carbon nanofoam CNFs extrusion high wear-heat resistant parts Press with FIG. 1 numbers 1 to 18 specific components that conform to specified requirements to unique American Society for Testing and Materials International Standards Worldwide Identifiers. The variable hydraulic preform slurry non ionic or electrolyte carbon nanofoam CNFs extrusion high wear-heat resistant parts press, the center of this utility patent application specification Slurry formula in three scientific forms of 6 Solids, 7 Liquids and 8 Gases Noble gas argon or element in a gaseous state specified scientific formula liquid or gas mechanically refined and nanoparticle dispersion preform slurry non ionic or electrolyte carbon nanofoam CNFs extrusion solids, liquids, and/or gases, heated, chilled, or room temperature Chemical Non ionic Groups of Amphoteric Polysaccharide Linear or Branched Alkyl Compounds or electrolyte ionic melts, ionic fluids, and/or fused, and/or catalyst acid and bases, actual catalyst, and/or catalyst reservoir with or without ionic suspension element specification 48 elements and/or specification 49 alloys manufactured preform slurry non ionic or electrolyte carbon nanofoam CNFs extrusion high wear-heat resistant parts. Slurry carbon tool steel line in can be ionic process tool steel interface positive or negative electrode electronically charged for enhanced formulation. Specified amount of Slurry carbon is compressed to preform slurry non ionic or electrolyte carbon nanofoam CNFs extrusion specification pressure measured in millibars Mb. Slurry carbon reservoir regulated tool steel waste filter removes waste from the Slurry carbon tool steel reservoir while it is being filled with Slurry carbon from common recovery distillation heated interface tool steel and thermometer gauge, ordinary atmospheric pressure, vacuum pump barometric pressure measured in millibars Mb, and fractional distillation all waste gases are processed to flu gas detoxification system. Tool steel extrusion die cast design internal cavity regulator waste filter and tool steel vacuum release control and portal works in unison with the press plate drawing expanding and contracting Slurry carbon removing waste from the tool steel extrusion die cast design internal cavity while it is being filled with Slurry carbon from common recovery distillation heated interface tool steel and thermometer gauge, ordinary atmospheric pressure, vacuum pump barometric pressure measured in millibars Mb, and fractional distillation all waste gases are processed to flu gas detoxification system. Preform slurry non ionic or electrolyte making of four sections 1. Preform slurry non ionic or electrolyte carbon nanofoam CNFs extrusion high wear-heat resistant part 2. Preform slurry non ionic or electrolyte carbon nanofoam CNFs extrusion high wear-heat resistant parts electronic component composite coils, composite windings, drawn, annealing, spun, coils, windings, wire, woven textile mesh, shielding, brushes, inductors, antinode couplers, electric rheostats, starters, motors, alternators, generators, ionic suspension element enhanced composite coils, composite windings, drawn, annealing, spun, coils, windings, wire, woven textile mesh, shielding, brushes, capacitors, battery cells, rheostats, or electronic parts, electronic resistors, or electronic parts, transformers, transducers, rectifiers, power supplies, heat sinks, or electronic parts 3. Preform slurry non ionic or electrolyte carbon nanofoam CNFs extrusion high wear-heat resistant parts aerospace, automotive, and transportation brake calipers, rotors, pads, washers, spacers, and bushings 4. Preform slurry non ionic or electrolyte carbon nanofoam CNFs extrusion high wear-heat resistant parts precision casting molds for the manufacturing of highly pure metal, Super Alloy, ceramics, acid-solid, alkaline, glass, acrylic, halide, alkalide, nonconductive zirconia, carbon nanofoam CNFs, alternate carbon nanofoam CNFs inductor, or impedance matching load or signal ceramic red brick clay insulator 2.5 phase extrusions six master preform slurry non ionic or electrolyte carbon nanofoam CNFs extrusion high wear-heat resistant parts precision casting molds. Number 1. Distillation Reservoir and Recovery Basin Made From Super Alloy and/or Ceramic with Variable Hydraulic Press Plate 1.0 to 2.0 phase extrusions 1.0 polarized extrusion with positively and negatively molten charging distillation glass optical, lenses, and mirrors with or without alumina, Nano alumina, Carbon Nanofoam CNFs, Alternate Carbon Nanofoam CNFs Inductor, gold, or platinum and 2.0 extrusion acrylic. Other distillation processing Mechanically Refined non ionic or electrolyte preform slurry or Molten Highly Pure Metal; Super Alloy including Carbon; Carbon Nanofoam CNFs; Alternate Carbon Nano Foam CNFs Inductor; Nano alumina; Alumina; Silica mineral; Glass; Acrylic; Polymer Resin; Alumina Silica; Acid Solid; Impedance Matching Ceramic Red Brick Insulator; Molybdenum; Ceramic Zirconia; Ceramic Silica; Ceramic Clay; Calcium Carbonate; Alkaline; Minerals; including Ionic Suspension Elements and Ceramic Silica mineral Insulator for specification 48 elements Highly Pure Metal, and specification 49 alloys. Distillation reservoir Halogen Gas, Ammonia Gas From Nitrogen and Hydrogen, and Antimony Gas suspended elements mechanically refined and nanoparticle distillation Carbon Nanofoam CNFs, Alumina, Nano alumina, Nickel, Cadmium, Lithium,

Lead, Antimonide, Magnesium, Halide, Acid Solid, and Alkalide distillation processing and/or up to Four Pours 1.0 to 2.5 phase extrusions or Preform slurry non ionic or electrolyte. Both Processes Molten Pours and Variable hydraulic preform slurry non ionic or electrolyte Press in Vacuum Control Room Scientific Distillation Ordinary Atmospheric Pressure less than Ordinary Atmospheric Pressure Catalyst Gases Other specification 48 elements Argon, Carbon Monoxide, Carbon Dioxide, or Other Gas mechanically refined or nanoparticle suspension catalyst Greater or Lesser Than Ordinary Atmospheric Pressure. Super Alloy Super Cooling Refrigeration And Super Alloy Venturi Curvical or Linear Expression Comprising a Scientific Aperture, a Divergence Measured in Angulation, and a Scientific Aperture Diffusion Gaseous Particle Accelerator With Super Cooling Refrigeration Deceleration with or without nanoparticle synthesizing Laser Ablation and Multi Waveform Ablation X, Y, And Z Fields and Fractional Vacuum Distillation Gaseous and/or Positive and Negative Ionic Charges Recovery and Super Alloy, Ceramic Zirconium, Ceramic Molybdenum, Ceramic Impedance Matching Red Brick Clay Insulator and/or Ceramic Silica Distillation reservoir with Variable Hydraulic Press Plate Expanded and Contracted Greater or Lesser Than Ordinary Atmospheric Pressure Distillation Recovery Fractional Vacuum Distillation Gaseous and/or Positive Distillation and Variable Hydraulic Press Plate Expanded and Contracted Greater or Lesser Than Ordinary Atmospheric Pressure Distillation Recovery Allotropes of 6 C Carbon, Solid, Liquid, and Gases Chemical Non ionic Groups of Amphoteric Polysaccharide Linear or Branched Alkyl Compounds or Electrolytes and/or Liquid Ions and/or Ionic Melts and/or Fused and/or Acid and Bases Catalyst and/or Catalyst Slurry Reservoir 6 C Allotropes of Carbon and Liquid and/or Liquid Vapors and/or Gaseous Electrolyte Catalyst Acids and Solid Materials Carbon; Carbon Nanofoam CNFs; Alternate Carbon Nano Foam CNFs Inductor; Silica mineral; Silica Alumina; Acid Solid; Impedance Matching Ceramic Red Brick Insulator; Molybdenum; Ceramic Clay; Calcium Carbonate; Ceramic Zirconia; Silica mineral; and Minerals for Building Materials trade name Preform Modular alkalines, clays, and sands for fine concrete, mortar, bricks, tiles, and High Wear-Heat Resistant Parts Brushes; Windings; Coils; Battery Cells; Electronic Resistors; Capacitors; Brake Pads; Washers; Spacers; Bushings; Drawn; Annealing; Spun; Coils; Windings; Wire; Woven Textile Mesh; Shielding; And 2.5 phase extrusions Die Cast Molding. Number 2. Supplemental Super Alloy Super Cooling Refrigeration And Super Alloy Venturi Curvical or Linear Expression Comprising a Scientific Aperture, a Divergence Measured in Angulation, and a Scientific Aperture Diffusion Carbon Dioxide CO<sub>2</sub> Gaseous Particle Accelerator With Super Cooling Refrigeration Deceleration temperature to less than -109 degrees Fahrenheit or -78.5 degrees Celsius Carbon Dioxide CO<sub>2</sub> sublimated frozen gas Supercooling Super Alloy or Super Alloy Venturi. Number 3. Self contained Carbon Dioxide CO<sub>2</sub> Refrigeration unit commercial, residential, or portable Super Alloy vacuum with vacuum pump drawing Carbon Dioxide CO<sub>2</sub> gas through Insulated Super Alloy feeder tubes in a parallel circuit to separate Super Alloy Venturi Curvical or Linear Expression Comprising a Scientific Aperture, a Divergence Measured in Angulation, and a Scientific Aperture Diffusion Carbon Dioxide CO<sub>2</sub> Gaseous Particle Accelerator With Super Cooling Refrigeration Deceleration temperature to less than -109 degrees Fahrenheit or -78.5 degrees Celsius Carbon Dioxide CO<sub>2</sub> sublimated frozen gas is then passed over Super Alloy and through cooling fan. Number 4. Self contained Carbon Dioxide CO<sub>2</sub> Refrigeration unit commercial, residential, or portable Super Alloy vacuum with vacuum pump rated alternating current AC or direct current DC drawing Carbon Dioxide CO<sub>2</sub> gas through insulated Super Alloy feeder tubes in a parallel circuit to separate numeric Super Alloy Venturi Curvical or Linear Expression Comprising a Scientific Aperture, a Divergence Measured in Angulation, and a Scientific Aperture Diffusion Carbon Dioxide CO<sub>2</sub> Gaseous Particle Accelerator With Super Cooling Refrigeration Deceleration temperature to less than -109 degrees Fahrenheit or -78.5 degrees Celsius Carbon Dioxide CO<sub>2</sub> sublimated frozen gas passes over Super Alloy and through cooling fan. An isolated super alloy cylinder is connected to the Refrigeration unit from super alloy connecting rods super cooling the outside walls. The outer cylinder cools an electronic air compressor rated alternating current AC or direct current DC is activated filling an inner variable cylinder with compressed air providing diffusive compensation as it expands forcing the carbon dioxide CO<sub>2</sub> filled outer cylinder through a continuous circuit of Super Alloy Venturi Curvical or Linear Expression Comprising a Scientific Aperture, a Divergence Measured in Angulation, and a Scientific Aperture Diffusion Carbon Dioxide CO<sub>2</sub> Gaseous Particle Accelerator With Super Cooling Refrigeration Deceleration temperature to greater than -109 degrees Fahrenheit or -78.5 degrees Celsius Carbon Dioxide CO<sub>2</sub> forming dry ice in the outer internal cylinder. Number 5. Distillation and Recovery Basin Automation Mass Production Variable Hydraulic Press Plate Mold and Carbon Nanofoam CNFs Mold with Pour Aperture located in the center and hydraulic cylinder located on the right Expanded and Contracted for Molten Pouring Highly Pure Metal printed circuit, Super Alloy including Carbon Nanofoam CNFs printed circuit Nickel, Cadmium, Lithium, Lead, Antimonide, Halide, Alkalide, Specification 48 elements printed circuit, or Specification 49 Alloys printed circuit and/or Ceramic Insulator for 1.0, and 2.0 phase extrusion Plates, Sheets, Foil, and Leaf Central Processing Unit CPU processor, relay, or switch series or parallel circuit and Battery Cell series or parallel circuit rated conductive with Ceramic Silica mineral Insulator, or Ceramic Alumina Silica Carbon Nanofoam CNFs Insulator. Distillation and Recovery Basin Automation Mass Production Crucible Casted Molten Highly Pure Metal printed circuit, Super Carbon Alloy Carbon Nanofoam CNFs printed circuit Nickel, Cadmium, Lithium, Lead, Antimonide, Halide, Alkalide, Specification 48 elements printed circuit, or Specification 49 Alloys printed circuit and/or Ceramic Insulator for 1.0, and 2.0 phase castings Plates, Sheets, Foil, and Leaf Central Processing Unit CPU processor, relay, or switch series or parallel circuit and Battery Cell series or parallel circuit rated conductive with Ceramic Silica mineral Insulator, or Ceramic Alumina Silica Carbon Nanofoam CNFs Insulator. Distillation and Recovery Basin Automation Mass Production Variable Hydraulic Press Plate Mold and Carbon Nanofoam CNFs Mold with Pour Aperture located in the center and hydraulic cylinder located on the right Expanded and Contracted for Pouring non ionic or electrolyte preform slurry with mechanically refined and nanoparticle dispersion fine Printing Highly Pure Metal printed circuit, Super Alloy including Carbon Nanofoam CNFs printed circuit, Carbon Nanofoam CNFs printed circuit, Alternate Carbon Nanofoams CNFs printed circuit, Carbon Nanofoam CNFs Ionic Suspension Element printed circuit Nickel, Cadmium, Lithium, Lead, Antimonide, Magnesium, Specification 48 elements printed circuit, or Specification 49 Alloys printed circuit and/or Ceramic Insulator for 1.0, and 2.0 phase extrusion Plates, Sheets, Foil, and Leaf Central Processing Unit CPU processor, relay, or switch series or parallel circuit and Battery Cell series or parallel circuit rated conductive with Ceramic Silica mineral Insulator, or Ceramic Alumina Silica Carbon Nanofoam CNFs Insulator. Distillation and Recovery Basin Automation Mass Production Crucible Casted non ionic or electrolyte preform slurry with mechanically refined or nanoparticle dispersion fine Printing Highly Pure Metal printed circuit, Super Alloy including Carbon Nanofoam CNFs printed circuit, Carbon Nanofoam CNFs printed circuit, Alternate Carbon Nanofoams CNFs printed circuit, Carbon Nanofoam CNFs Ionic Suspension Element printed circuit Nickel, Cadmium, Lithium, Lead, Antimonide, Magnesium, Specification 48 elements printed circuit, or Specification 49 Alloys printed circuit and/or Ceramic for 1.0, and 2.0 phase castings Plates, Sheets, Foil, and Leaf Central Processing Unit CPU processor, relay, or switch series or parallel circuit and Battery Cell series or parallel circuit rated conductive with Ceramic Silica mineral Insulator, or Ceramic Alumina Silica Carbon Nanofoam CNFs. Distillation reservoir interchangeable combinations of preform slurry non ionic, electrolyte, or molten ceramic and conductive circuits 2.0 extrusions or castings are accomplished for each specification part. Number 6. Manufacture process of 2.5 phase extrusions Die Cast Molding for Precision Casting of Highly Pure Metal, Super Alloy including Carbon Nanofoam CNFs,

and/or Ceramic. The Highly Pure Metal, Super Alloy including Carbon Nanofoam CNFs, and/or Ceramic is a layered greater than 0 percent to less than 100 percent Highly Pure Metal or Super Alloy including Carbon Nanofoam CNFs and greater than 0 percent to less than 100 percent Other Metal, Super Alloy including Carbon Nanofoam CNFs or Ceramic part that is created by pouring molten metal or ceramic into a cast mold over a process of 2.5 phase extrusions that create six molded casts for each designed master tool steel part that is manually machined and manufactured named Part X external layer Highly Pure Metal or Super Alloy including Carbon Nanofoam CNFs and Part Z the internal layer other Highly Pure Metal, Super Alloy including Carbon Nanofoam CNFs or Ceramic Insulator. Manufactured process of 2.5 phase extrusions Die Cast Molding for Precision Casting of Super Alloy and Ceramic ultimately create a single part identical to the master designed and machine manufactured part with the exception to the chemical element is now a Super Alloy or Super Alloy Ceramic that is layered greater than 0 percent to less than 100 percent Highly Pure Metal or Super Alloy including Carbon Nanofoam CNFs and greater than 0 percent to less than 100 percent Other Highly Pure Metal, Super Alloy including Carbon Nanofoam CNFs and/or Ceramic. Processing molded halves sequence 1 to 9 of Manufacture process of 2.5 phase extrusions Die Cast Molding For Precision Casting of Highly Pure Metal, Super Alloy including Carbon Nanofoam CNFs, and/or Ceramic Part X and Part Z side profile not shown here of casting for Part X two halves sequence 1, side profile not shown here of casting for part Z two halves sequence 2, side profile not shown here of casting for part Z extruded halves sequence 3, cast 1 half of part X sequence 4, cast 3 half of part Z sequence 5, extruded cast 5 half of part Z sequence 6, side profile not shown here of cast 5 on top cast 1 on bottom sequence 7, side profile not shown here of cast 6 on top and cast two on bottom sequence 8, fill halves joined in cast 1 and 2 and filled with molten Highly Pure Metal or Super Alloy including Carbon Nanofoam CNFs sequence 9. The manufacture process begins by a designed and machined manufactured master part named part X. The master part X is used to create two external cast halves. This is accomplished by casting the master part X into the center of two ceramic molded halves with newly poured ceramic slip. After the ceramic slip dries the master part X is removed and the two ceramic molded halves are ignited and cured in a furnace. The second master part named part Z is designed and machined manufactured greater than 0 percent to less than 100 percent less than tolerances that of the master part X or the external cast halves. Again, the master part Z is used to create two internal cast halves. This is accomplished by casting the master part Z into the center of two ceramic molded halves with newly poured ceramic slip. After the ceramic cast dries the master part Z is removed and the two ceramic molded halves are ignited and cured in a furnace. After the two ceramic cast halves cool they are used separately to make two reciprocal extrusion halves by again pouring ceramic slip into the recesses and joining both halves with new cast covers to dry. The external tolerances of all of the four cast covers X and Z are identical opposing so that X and Z halves can be joined and prepared for two separate halves molten Highly Pure Metal or Super Alloy including Carbon Nanofoam CNFs fills. After the poured molten Highly Pure Metal or Super Alloy including Carbon Nanofoam CNFs cools then both extruded halves are removed and stored. The remainder halves with Highly Pure Metal or Super Alloy including Carbon Nanofoam CNFs are then joined and prepared for a second molten fill of greater than 0 percent to less than 100 percent Highly Pure Metal, Super Alloy including Carbon Nanofoam CNFs, and/or Ceramic. After the fill is cooled the whole part is removed from the cast halves and is inspected, deburred, and/or finished. Number 7. Replacement ceramic cast 2.5 phase design extrusion die cast molding for Super Alloy. The Super Alloy is a layered greater than 0 percent to less than 100 percent highly pure metal or Super Alloy and greater than 0 percent to less than 100 percent highly pure metal or Super Alloy part that is created by pouring molten metal into a cast mold over a process of 2.5 phase design extrusion that create four molded casts for each designed master steel part that is manually machined and manufactured named part X the external layer highly pure metal or Super Alloy and part Z the internal layer highly pure metal or Super Alloy. This replacement mold application is for the manufactured process of 2.5 phase design extrusion that creates a single part identical to the master designed and machined manufactured part. The new part chemical element becomes a Super Alloy that is layered greater than 0 percent to less than 100 percent highly pure metal, Super Alloy, ceramics, acid-solid, alkaline, glass, acrylic, halide, alkalide, nonconductive zirconia, carbon nanofoam CNFs, alternate carbon nanofoam CNFs inductor, or impedance matching load or signal ceramic red brick clay insulator and greater than 0 percent to less than 100 percent highly pure metal, Super Alloy, ceramics, acid-solid, alkaline, glass, acrylic, halide, alkalide, nonconductive zirconia, carbon nanofoam CNFs, alternate carbon nanofoam CNFs inductor, or impedance matching load or signal ceramic red brick clay insulator. The manufacture process begins by a designed and machined manufactured master part named part X. The master part X is used to create two external cast halves. This is accomplished by casting the master part X into the center of two ceramic molded halves with newly poured ceramic slip and then may be placed in a cool damp room and receive finish application with a wet sponge. After the ceramic cast dries the master part X is removed and the two ceramic molded halves are ignited and cured 3 hours in a kiln at 2000 degrees Fahrenheit or 12 hour interval day at 2000 degrees Fahrenheit. The second master part named part Z is designed and machined manufactured greater than 0 percent to less than 100 percent less than tolerances that of the master part X or the external cast halves. The master part Z is used to create two internal cast halves. This is accomplished by casting the master part Z into the center of two ceramic molded halves with newly poured ceramic slip and then may be placed in a cool damp room and receive finish application with a wet sponge. After the ceramic cast dries the master part Z is removed and the two ceramic molded halves are ignited and cured 3 hours in a kiln at 2000 degrees Fahrenheit or 12 hour interval day at 2000 degrees Fahrenheit. After the two ceramic cast halves cool they are used separately to make two reciprocal extrusion halves by pouring ceramic slip into the recesses and joining both halves with new cast covers to dry. The external tolerances of all of the four cast covers X and Z are identical opposing so that X and Z halves can be joined and prepared for two separate halves molten highly pure metal or Super Alloy fills. After the poured molten highly pure metal or Super Alloy cools both extruded halves are removed and stored. The remainder halves with highly pure metal or Super Alloy fills are then joined and prepared for a second molten fill of greater than 0 percent to less than 100 percent highly pure metal or Super Alloy. After the highly pure metal or Super Alloy is cooled the whole part is removed from the cast halves and is inspected, deburred, and finished.

**Assignees:** MATTHEWS ROBERT RICHARD

## 174. Family 95379374 (US2024286917 AA)

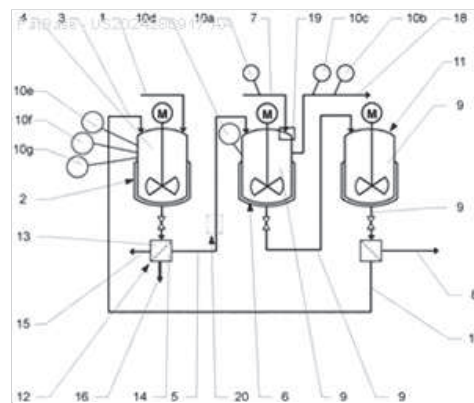
[View in PatBase](#)

### Title (EP4363388 A1)

[EN] METHOD FOR PRODUCING CALCIUM CARBONATE SOLIDS FROM ALKALINE MINERALS

### Abstract (EP4363388 A1)

[EN] The present invention relates to a method for producing calcium carbonate solids (8) from alkaline minerals (1) comprising the following method steps: Supplying alkaline minerals (1) and an extraction agent (3) into a reactor tank (2). Stirring the alkaline minerals (1) and the extraction agent (3) in the reactor tank (2) such that a first suspension (4) is formed. Draining of the first suspension (4) from the reactor tank (2) and separating a liquid phase (5) comprising calcium from the first suspension (4) and transferring the liquid phase (5) into a carbonation tank (6). Supplying a gas (7) comprising CO<sub>2</sub> into the carbonation tank (6), wherein the consumption of CO<sub>2</sub> results in the precipitation of calcium carbonate solids (8) thereby generating a second suspension (9) and nucleating and growing of the calcium carbonate solids (8). Furthermore, a measure of the consumed CO<sub>2</sub> is determined by at least one sensor (10);



### 1st Main Claim (EP4363388 A1)

[EN] 1. Method for producing calcium carbonate solids (8) from alkaline minerals (1), said method comprising the following method steps: a. Supplying the alkaline minerals (1) into a reactor tank (2); b. Supplying an extraction agent (3), in particular an aqueous salt solution, into the reactor tank (2); c. Stirring the alkaline minerals (1) and the extraction agent (3) in the reactor tank (2) such that a first suspension (4) is formed; d. Draining of the first suspension (4) from the reactor tank (2) and separating a liquid phase (5) comprising calcium from the first suspension (4); e. Transferring the liquid phase (5) into a carbonation tank (6); f. Supplying a gas (7) comprising CO<sub>2</sub> into the carbonation tank (6), wherein the consumption of CO<sub>2</sub> results in the precipitation of calcium carbonate solids (8) thereby generating a second suspension (9); g. Determining a measure of the consumed CO<sub>2</sub> in the carbonation tank (6) by at least one sensor (10); h. Nucleating and growing of the calcium carbonate solids (8).

**Assignees:** ETH ZÜRICH; EIDGENÖSSISCHE TECHNISCHE HOCHSCHULE ZÜRICH; ETH ZÜRICH

## 175. Family 105615524 (US2024417326 AA)

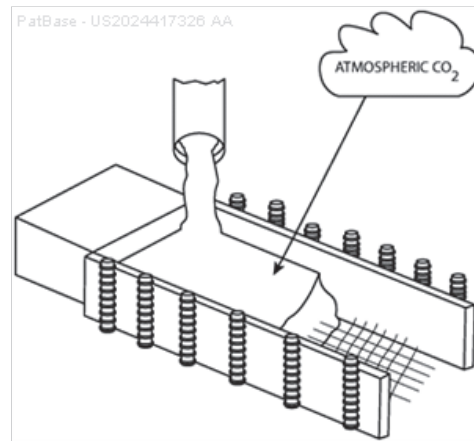
[View in PatBase](#)

### Title

[EN] CARBON-ABSORBING ALGAE CONCRETE AND METHOD OF PRODUCTION

### Abstract

[EN] A carbon-sequestering geopolymer concrete composition and method of manufacture is disclosed. The composition comprises a geopolymeric binder phase of aluminosilicate materials and an alkaline activator, coarse and fine aggregates, dried marine algae powder, and optional supplementary cementitious materials. This enables significantly reduced carbon dioxide emissions during production compared to standard concrete mixes. Additionally, the integrated algae powder facilitates direct capture and mineralization of atmospheric carbon dioxide as the concrete cures. Aspects of embodiments of the invention include the concrete composition; a sidewalk embodiment comprising said concrete; associated sidewalk construction methods; and alternate sidewalk embodiment claims. Compared to conventional concretes, the technology disclosed herein provides over 70 percent lower CO<sub>2</sub> emissions coupled with enhanced carbon mineralization that progresses over the material lifetime. This enables various infrastructure applications to reach carbon-absorbing or carbon-negative performance credentials. The composition also exhibits excellent mechanical strength, freeze-thaw resilience, and extended durability properties.



### 1st Main Claim

[EN] **1.** A carbon-negative concrete composition comprising:

7-13 percent Class F fly ash;

5-10 percent ground granulated blast furnace slag (GGBFS);

1-4 percent metakaolin;

35-45 percent recycled coarse aggregates;

35-45 percent natural fine aggregates;

1-4 percent sodium hydroxide solution;

1-4 percent sodium silicate solution;

0.3-3 percent of algae biomass,

0.3-3 percent of at least one or more of the group consisting of calcium carbonate and magnesium carbonate;

0.2-2.5 percent of at least one or more of the group consisting of olivine, basalt rock dust, biochar, and alginate beads;

3-20 percent water;

wherein the composition is configured to reduce CO<sub>2</sub> inputs by approximately 80-130 tons and capture an additional 150-250 tons of CO<sub>2</sub> per 1,000 tons of concrete produced.

**Assignees:** LAFAVE MICHAEL

176. Family 46713831 (TW201016600 A)

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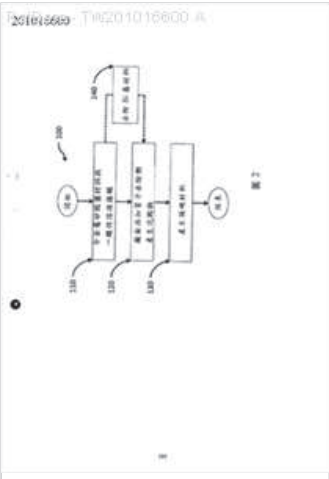
Extended Family Number: 42613795

Title

[EN] PRODUCTION OF CARBONATE-CONTAINING COMPOSITIONS FROM MATERIAL COMPRISING METAL SILICATES

Abstract

[EN] Provided are methods for producing carbonate-containing compositions comprising silicon-based material (e.g. pozzolanic material) from a source of carbon dioxide, a divalent cation-containing solution and a source of proton-removing agents. In such methods, divalent cations of the divalent cation-containing solution are provided by digestion of material comprising metal silicates. Also provided are methods for producing carbonate-containing compositions comprising little or no silicon-based material. In such methods, silicon-based material (e.g. silica, unreacted or undigested, silicates, aluminosilicates, etc) may be separated and processed separately from carbonate-containing compositions. Silicon-based material and carbonate-containing material may be blended at a later stage to produce a pozzolanic material, which may be further processed and blended with, for example, Portland cement.



1st Main Claim

[MT] 1. a way, which includes: a) digestion in an aqueous solution of metal silicate materials to produce the divalent cations and containing of SiO<sub>2</sub> Materials; b) so that such divalent cations dissolved carbon dioxide reaction to produce a precipitate; and c) drying the precipitate.

Assignees: CALERA CORP

177. Family 88615355 (WO21244728 A1)

[View in PatBase](#)

Title (EP4157795 B1)

[EN] A TWO STAGES EXTRACTION METHOD FOR SYNTHESIZING PRECIPITATED CALCIUM CARBONATE

Abstract

[EN] Present invention relates to a method and a process for synthesizing high purity calcium carbonate precipitate from waste or by-products bearing calcium compounds. The method comprises of two calcium extraction stages; whereby in stage 1) water or an ammonium based aqueous solution is utilised to dissolve calcium ions from the free and reactive calcium phases, followed by removal of solids from the calcium rich aqueous solution, prior to introduction of carbon dioxide gas into the said solution to precipitate calcium carbonate. The solid residue is then subjected to a second calcium extraction stage; whereby in stage 2) carbonic acid, produced by increased carbon dioxide partial pressure in a water containing reactor, is used as the extraction solvent; followed by the removal of solids from the calcium rich aqueous solution, after which the precipitation of calcium carbonate is induced by decreasing the carbon dioxide partial pressure.

1st Main Claim (EP4157795 B1)

[EN] 1. A method for synthesizing precipitated calcium carbonate **characterized in that** the method comprises following steps:

- Step 1) adding the solid, calcium bearing material, into a continuously stirred extraction solution (R1), said solid calcium bearing material being an oil shale ash from energy or oil and gas generation or iron and steelmaking slags or coal ash or waste cement;
- Step 2) separating the solid residual material from the calcium rich solution;
- Step 3) subjecting the calcium rich solution from step 2 to carbonation (CR1) for precipitating calcium carbonate, wherein carbonation is induced by introducing carbon dioxide gas directly into the calcium containing aqueous solution (CR1);
- Step 4) separating the calcium carbonate precipitate from solution, recovering the extraction solution and directing it to said extraction solution (R1), for use in step 1;
- Step 5) subjecting residual material from step 2 to a-second calcium extraction-(R2), where carbonic acid  $H_2CO_3$  is used as the calcium extraction agent, wherein the said carbonic acid is produced by increasing carbon dioxide partial pressure within the extraction reactor for dissolving carbon dioxide in water;
- Step 6) separating residual material from the aqueous calcium rich solution while still under pressure;
- Step 7) subjecting the aqueous calcium rich solution to precipitation (CR2) by releasing the carbon dioxide pressure to precipitate calcium carbonate;
- Step 8) separating the calcium carbonate precipitate from the solution; re-circulating the recovered solution back to said second calcium extraction (R2) in step 5.

Assignees: R S OSA SERVICE OUE



178. Family 58943912 (KR20150035653 A)

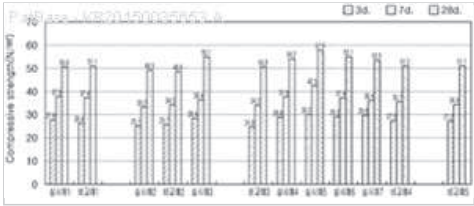
[View in PatBase](#)

Title

[EN] ADDITIVE FOR CONCRETE COMPRISING BOTTOM ASH AND THE METHOD FOR PREPARING THEREOF

Abstract

[EN] The present invention relates to a concrete admixture using bottom ash; and to a manufacturing method of the admixture. According to an embodiment of the present invention, provided is a concrete admixture using bottom ash, which comprises a pulverized form of bottom ash generated by rapidly cooling a coal material in a synthetic natural gas (SNG) manufacturing process. According to another embodiment of the present invention, provided is a manufacturing method of a concrete admixture using bottom ash, which comprises the steps of collecting bottom ash generated in an SNG manufacturing process; and pulverizing the collected bottom ash. The present invention pulverizes bottom ash generated in an SNG manufacturing process and uses the bottom ash for a concrete admixture, thereby allowing economic efficiency to be enhanced by recycling the bottom ash that is a by-product. In addition, the amount of cement used is reduced in a concrete manufacturing process by using the admixture. Accordingly, the present invention can prevent environmental pollution caused by carbon dioxide generated in a conventional cement manufacturing process and an alkaline component dissolved from cement.



1st Main Claim

[MT] 1. Synthesis natural gas (SNG) Admixture for Concrete Using the bottom ash comprising a powder of the manufacture that is bottom ash generated by the rapid cooling of the coal raw material in the process (bottom ash).

**Assignees:** POHANG IRON AND STEEL CO; RESEARCH INST OF INDUSTRIAL SCIENCE AND TECHNOLOGY

**179. Family 71037420 (EP3384973 A1)**

[View in PatBase](#)

### Title

# [EN] PROCESS OF RECOVERING CARBON DIOXIDE FOR ENRICHING THE GAS STREAMS USED FOR PRODUCING SODIUM CARBONATE AND SODIUM HYDROGEN CARBONATE BY SOLVAY PROCESS

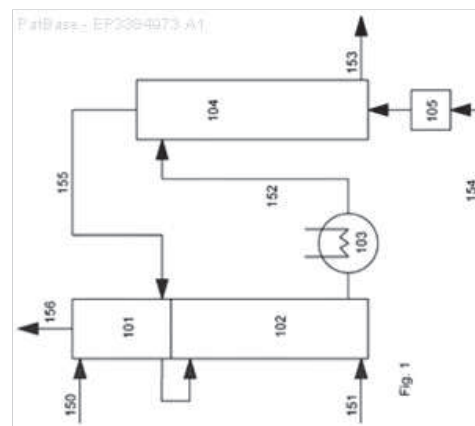
## Abstract

[EN] The invention is related to improvements in the integrated process for producing sodium carbonate and sodium hydrogen carbonate by the ammonia-soda process. In particular, the invention concerns the method and system used for removing carbon dioxide from process gases by chemical absorption and using the recovered carbon dioxide in production of soda by the ammonia-soda process.

### 1st Main Claim

[EN] 1. A process for recovering carbon dioxide for enriching the gas streams used for producing sodium carbonate and sodium hydrogen carbonate by the ammonia-soda process, comprising:

- contacting, in the CO<sub>2</sub> absorption column, the streams of process gases and/or outlet gases occurring in the process for producing sodium carbonate and sodium hydrogen carbonate by the ammonia-soda process, comprising:
  - - a part or whole kiln gas stream originating from lime burning in shaft lime kilns with air blow, and/or
  - - a part or whole outlet gas stream from the plant for carbonation of soda ash, and/or
  - - a part or whole outlet gas stream from the plant for carbonation of baking soda,
  - - and optionally one or more of streams of flue gases or other gases containing carbon dioxide, resulting from combustion of solid, liquid, or gaseous fuels in order to produce heat or electrical energy to meet the production requirements by the ammonia-soda process,
  - - and optionally one or more of streams of flue gases or other gases containing carbon dioxide, originating from an external supplier
- with a stream of aqueous absorbent solution,
- to form aqueous absorbent solution enriched in carbon dioxide,
- heating aqueous absorbent solution enriched in carbon dioxide in evaporator,
- desorption of gaseous carbon dioxide with regeneration of aqueous absorbent solution in a desorption column,
- cooling regenerated aqueous absorbent solution and returning it to said CO<sub>2</sub> absorption column, and
- removing from the desorption column and cooling the stream having a high carbon dioxide content for using in the process for producing sodium carbonate and sodium hydrogen carbonate by the ammonia-soda process.



**Assignees:** INST CHEMICZNEJ PRZEROBKI WĘGLA; CIECH R AND D SP Z O O; CIECH R AND D SPÓŁKA Z OGRANICZONĄ ODPOWIEDZIALNOŚCIĄ

## 180. Family 13321661 (US5690729 A)

[View in PatBase](#)

### Title

[EN] CEMENT MIXTURES WITH ALKALI-INTOLERANT MATTER AND METHOD

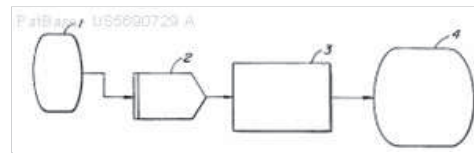
### Abstract

[EN] A method of reinforcing cement/concrete mixtures with alkali-intolerant reinforcements and/or aggregate, such as uncoated, common glass filament, plastic filament, fabric and roving made therefrom by reducing the pH of the mixture while in its plastic state, and/or after it has set and cured, to about 7. With a neutral pH, the alkali-intolerant reinforcements need not be coated to protect them from degradation. In the absence of alkalinity, the reinforcement and/or aggregate material bonds with the cement mixture to form a relatively stronger mixture, which can be shaped as desired, made part of permanently poured structures, cement boards and many other small and large products. By selecting appropriate and, if desired, different materials for the reinforcements and/or aggregate, the strength, flexibility, etc. characteristics of the product can be readily changed to adapt the product to the intended use. The pH is reduced by migrating such materials as CO<sub>2</sub> and/or CO and O<sub>3</sub> into the cement after it has cured and, if desirable, also during curing. The CO<sub>2</sub> and/or CO and O<sub>3</sub> for the chemical reactions to reduce the pH are most suitably obtained from flue gases of independent combustion processes which would otherwise be discharged as atmospheric pollutants.

### 1st Main Claim

[EN] 1. A method of protecting alkali-intolerant material in a cured cement product comprising the steps of mixing dry cement, ground calcite, and an alkali-sensitive material, adding water to form a paste, molding the paste into a product, curing the product, exposing the cured product to carbon dioxide, and reducing the pH of the mixture to about 7 by generating calcium carbonate in calcite form.

**Assignees:** MATERIALS TECHNOLOGY LTD



181. Family 46814479 (CA2670049 AA)

[View in PatBase](#)

Extended Family Number: 42613795

Title

[EN] ROCKS AND AGGREGATE, AND METHODS OF MAKING AND USING THE SAME

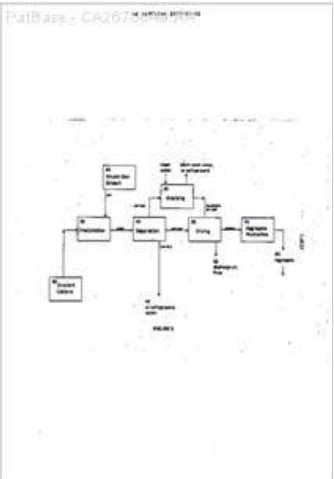
Abstract

[EN] Compositions comprising synthetic rock, e.g., aggregate, and methods of producing and using them are provided. The rock, e.g., aggregate, contains CO2 and/or other components of an industrial waste stream. The CO2 may be in the form of divalent cation carbonates, e.g., magnesium and calcium carbonates. Aspects of the invention include contacting a CO2 containing gaseous stream with a water to dissolve CO2, and placing the water under precipitation conditions sufficient to produce a carbonate containing precipitate product, e.g., a divalent cation carbonate.

1st Main Claim

[EN] 1. A synthetic aggregate comprising a CO2-sequestering component comprising one or more carbonate compounds, wherein the CO2-sequestering component has a  $\delta^{13}\text{C}$  value less than -10 U, further wherein the carbonate content of the aggregate is at least 50 percent w/w, and wherein the aggregate has a hardness of at least 3 on the Mohs hardness scale.

Assignees: CALERA CORP



182. Family 52787076 (KR20130004533 A)

[View in PatBase](#)

Title

[EN] MANUFACTURE METHOD OF INORGANIC FOAM USING GEOPOLYMER SILICA SOL.GEL METHOD

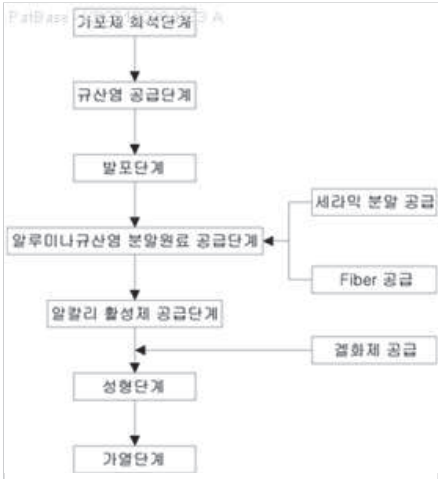
Abstract

[EN] PURPOSE: A manufacturing method of a nonflammable inorganic foamed material using inorganic binder in geopolymer and a silica sol-gel process is provided to enhance thermal insulation, soundproofing property, durability, and water resistance. CONSTITUTION: A manufacturing method of an inorganic foamed material using geopolymer and a silica sol-gel process comprises following steps: diluting a foaming agent in an aqueous solution; providing silicate for providing a silica sol-gel method; generating micro-bubbles through a foaming device; providing aluminum and silicate which are starting materials to produce geopolymer; providing alkali metal and earth metal in order to function as a binder, an alkali activator, a plasticizer, and a dispersing agent during geopolymer manufacturing process; molding for insulation and soundproofing; and final heating. [Reference numerals] (AA) Foaming agent diluting step; (BB) Silicate providing step; (CC) Foaming step; (DD) Aluminum and silicate providing step as starting materials; (EE) Providing ceramic powder; (FF) Providing fiber; (GG) Alkali activator providing step; (HH) Providing gelant; (II) Molding step; (JJ) Heating step

1st Main Claim

[MT] 1. Silica sol-gel process using geo-polymers and inorganic foamed molded product manufacturing method of the non-combustible foam, to provide a source of diluted foaming agent is a foaming agent was diluted solution; silica sol-gel method; Silicate supply step for providing the micro-bubble generating equipment through the foam is foamed in combination of Si-o-al; a three-dimensional network macromolecules of geo polymer starting material in order to produce a silicate and aluminum silicate to supply the raw material powder of alumina; supplying the creation of geo-polymers, alkali-active agent, a dispersant, a binder and a plasticizer to provide the role alkali metal and earth metal; Alkali supply step for supplying a predetermined size for heat insulation and sound insulation; forming step for forming into a shape of a foamed molded product of the geopolymer and dehydration and fine foam of the heating step for providing characterized in that comprises a method of manufacturing an inorganic foamed molded product.

Assignees: JU CHEL WAN; I DONG HUI



183. Family 106512847 (KR102759624 B1)

[View in PatBase](#)

Title

[EN] A METHOD OF MANUFACTURING GROUTING MATERIALS USING WASTE SHELLS AS THE MAIN RAW MATERIAL AND A GROUTING CONSTRUCTION METHOD FOR ECO-FRIENDLY WATER-BLOCKING AND REINFORCEMENT USING THE SAME

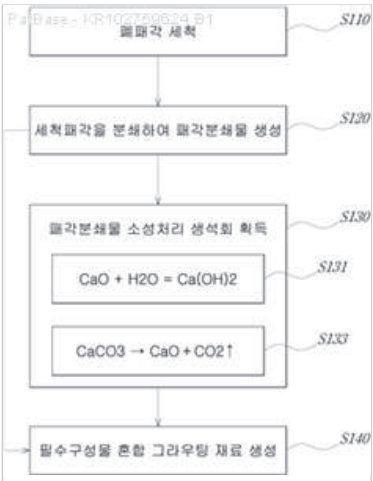
Abstract

[MT] The present invention relates to a grouting construction and materials therefor, comprising: a washing step of removing foreign substances including connecting lines and organic substances from waste shells that are discarded or collected after their contents are consumed and discarded, and washing them; a drying and crushing step of sequentially feeding and passing the washed shells from the washing step through a dryer and a crusher to dry and crush them to produce crushed shells; a calcining step of calcining the crushed shells from the dry and crushing step to produce calcium oxide; The present invention relates to a method for producing an eco-friendly grout material comprising the largest amount of calcined shell powder, and a method for constructing an eco-friendly waterproofing grout using the same, the method comprising: a mixing step of producing a grout material using material A, which is a mixture of water glass or silica sol and water in a set ratio; and material B, which is a mixture of cement, slag, fly ash, sodium bicarbonate, and bentonite, and water in a set ratio, including calcium oxide produced by calcining the crushed shell powder; and a first calcination step (S131) of reacting a calcium hydroxide turbidity mixed with the crushed shell powder and water with carbon dioxide (CO<sub>2</sub>) at a temperature of 2 to 5 degrees centigrade and a pressure of 30 to 40 kg/cm<sup>2</sup>, adding ammonia water to adjust the pH to 7.0 to 9.2, and then heating the mixture to 60 to 99 degrees centigrade for 5 to 30 minutes to evaporate water (H<sub>2</sub>O) and precipitate calcium carbonate.

1st Main Claim

[MT] 1. A washing step S110 of removing and washing the foreign matter including the connecting line and organic matter in the waste Pair angle collected with the contents consumed or closed at the Pair angle; a drying step S120 of subjecting the wash step S110 to drying and pulverizing the wash Pair angle by sequentially inputting the wash step S110 to the dryer and pulverizing the dried product And a mixing step (S140) of producing a grout material mixed with water glass or silica SOL and water at a set ratio, and a B material mixed with cement, slag, fly ash, sodium hydrogen carbonate and bentonite with water at a set ratio, and in the calcination step (S130) includes a temperature of 2-cm mixed water of 5-cm turbid of the ground water<sup>2</sup> Carbon dioxide under pressure (C0<sub>2</sub>2), 7.0 and water (H 9.2<sub>2</sub>O) evaporating the resulting mixture to precipitate calcium carbonate.

Assignees: LEE SAN HA; LEE DEONG KYUN; LEE SOL HA



184. Family 68939243 (WO18052220 A1)

[View in PatBase](#)

Title

[EN] METHOD AND FACILITY FOR PREPARING SODIUM BICARBONATE AND CALCIUM CARBONATE

Abstract

[EN] According to one embodiment of the present invention, provided is a method and a facility for preparing sodium bicarbonate and calcium carbonate, comprising the steps of: producing sodium bicarbonate (NaHCO<sub>3</sub>) through a reaction of sodium hydroxide and carbon dioxide by supplying a carbon dioxide-containing gas to a sodium hydroxide (NaOH) solution; producing calcium carbonate (CaCO<sub>3</sub>) through a reaction of a carbonate ion (CO<sub>3</sub><sup>2-</sup>) and a calcium ion by supplying a calcium ion-containing solution to the filtrate remaining after recovering the calcium carbonate to a solution in which the sodium hydroxide is dissolved, wherein a sodium salt having a solubility higher than that of the sodium bicarbonate is added to the sodium hydroxide solution. According to the present invention, there are effects enabling calcium carbonate and sodium bicarbonate, which are high-value-added materials, to be produced together from industrial by-products, which are to be disposed, and preventing the problem of a dissolution rate decrease of calcium ions when implementing a continuous process.

1st Main Claim

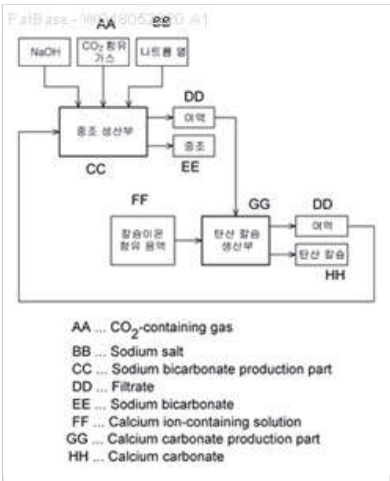
[MT] Sodium Hydroxide (NAOH) solution by supplying carbon dioxide to the carbon dioxide-containing gas is supplied, the sodium hydroxide (naoh) solution was prepared and, by the reaction of carbon dioxide and bicarbonate;

the scale to produce and recovering the remaining filtrate by supplying the aqueous solution of carbonate ions containing calcium ions (CO<sub>3</sub><sup>2-</sup>)and calcium carbonate (CACO<sub>3</sub>) in the reaction of calcium ions; and producing

the calcium carbonate and recovering the remaining filtrate dissolved in the aqueous solution of sodium hydroxide (naoh), which re-supplied to the

carbon dioxide is supplied to the aqueous solution of the sodium salt is a high solubility than the tank further comprises a method of demodulation and calcium carbonate.

**Assignees:** RESEARCH INST OF INDUSTRIAL SCIENCE AND TECH; ACADEMIC COOPERATION FOUNDATION KEIMYUNG UNIV IND; RESEARCH INST OF INDUSTRIAL SCIENCE AND TECHNOLOGY; RES INST IND SCIENCE AND TECH; UNIV KEIMYUNG IACF



185. Family 55020527 (JP2013208571 A2)

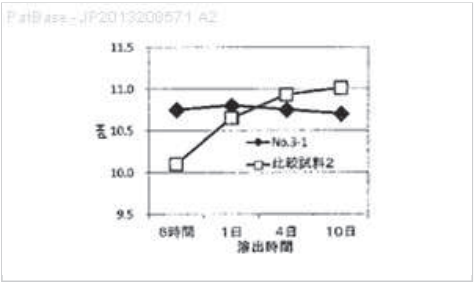
[View in PatBase](#)

Title

[EN] METHOD FOR TREATING CIVIL ENGINEERING AND CONSTRUCTION MATERIAL

Abstract

[EN] PROBLEM TO BE SOLVED: To provide a method for industrially advantageously treating a civil engineering and construction material capable of preventing occurrence of a high-pH eluate over a long period without needing a large-scale reaction water tank, wastewater-treating facility or the like.SOLUTION: There is provided a treatment method for a civil engineering and construction material capable of inhibiting elution of calcium compounds from the material including aqueous calcium compounds to prevent elevation of the pH of the eluted water. The method is characterized by adding a substance containing  $MgCO_3$  to the civil engineering and construction material and mixing them.



1st Main Claim

[MT] 1. Calcium compound is eluted from civil building materials containing calcium compound soluble, A method for processing a civil engineering material that inhibits the pH of the leachate from rising, and  $MgCO_3$  Treatment of civil engineering material, characterized in that in addition to the civil engineering and construction materials  $MgCO_3$ -containing product containing, and mix.

**Assignees:** NIPPON STEEL AND SUMITOMO METAL CORP; NIPPON STEEL AND SUMITOMO METAL

## 186. Family 103973833 (WO25110411 A1)

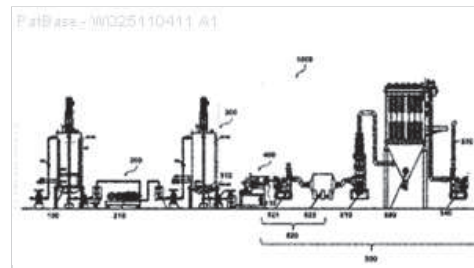
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### Title

[EN] APPARATUS AND METHOD FOR CONTINUOUSLY PRODUCING VATERITE CRYSTALLINE CALCIUM CARBONATE USING GREENHOUSE GAS

### Abstract

[EN] The present invention relates to an apparatus and a method for continuously producing vaterite crystalline calcium carbonate using a greenhouse gas and, more specifically, to a method for continuously producing vaterite crystalline calcium carbonate using a greenhouse gas, whereby it is possible to continuously produce high-quality vaterite crystalline calcium carbonate while utilizing carbon dioxide, which is a greenhouse gas, by using a carbonation reaction of seawater and alkaline industrial by-products.



### 1st Main Claim

[MT] A calcium extraction unit that produces a calcium extraction solution in which magnesium is precipitated in a solid state by adding seawater to alkaline industrial by-products;

A first separation unit for separating a magnesium precipitate by centrifuging the calcium elution solution produced in the above calcium elution unit;

A reaction unit which receives a calcium leached solution from which a magnesium precipitate is separated from the first separation unit, and supplies carbon dioxide-containing gas in the form of microbubbles having an average diameter of 1 mm to 2.5 mm to the calcium leached solution from which the magnesium precipitate is separated, thereby obtaining a reactant in which calcium carbonate is precipitated;

A second separation unit for removing the reactant obtained from the above reaction unit to obtain a calcium carbonate cake; and

A continuous production device for vaterite crystal-phase calcium carbonate, characterized by including a drying unit for producing vaterite crystal-phase calcium carbonate by simultaneously drying and crushing the calcium carbonate cake through particle collision by rotation while spraying hot air of 100 degrees centigrade to 550 degrees centigrade on the calcium carbonate cake obtained in the second separation unit.

**Assignees:** BAEK KWANG MINERAL PRODUCTS CO LTD; NATIONAL KOREA MARITIME AND OCEAN UNIVERSITY AND DB FOUNDATION; TAEKYUNG BK CO LTD

## 187. Family 15033635 (WO9011258 A1)

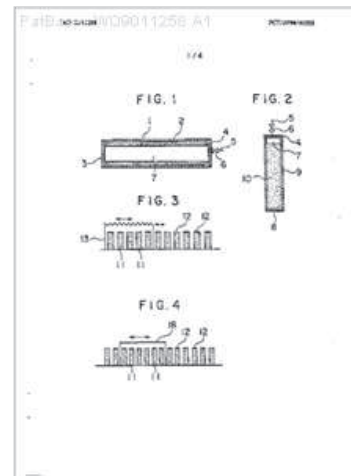
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### Title (EP0464203 A1)

[EN] HYDRAULIC SUBSTANCE, METHOD OF PRODUCING AND CURING THE SAME, CURING CHAMBER, AND PAINT

### Abstract (EP0464203 A1)

[EN] A method of producing and curing a hydraulic substance and a curing chamber and a paint used in this method in order to prevent cracking of a hardened article and making the same difficult water-absorbent and highly strong by controlling the formation of an efflorescent component in the step of hardening the hydraulic substance. The method of production comprises using an aqueous solution of lime instead of water to retard the evaporation of water to thereby form dense  $\text{CaCO}_3$ , thus giving a hardened article having a reduced water-absorbency and an increased strength. The method of curing is characterized by conducting the curing while suppressing the evaporation of water or making up for water lost in the step of hardening. Examples of the method include one which comprises conducting curing through, e.g., air drying and supplying water to the surface of the hydraulic substance as soon as it will not be disintegrated by water or the like, and one which comprises injecting at least one member selected from among a fluid which reacts with an efflorescent component, an aqueous solution of lime and a synthetic resin emulsion containing a reactant into the hardened hydraulic substance. The curing chamber includes one provided with a ceiling heater to prevent dewing and one provided with a steam generator, a temperature sensor, a temperature setting device, a temperature control unit, and so forth. The paint comprises a cement slurry and/or a synthetic resin emulsion and a reactant or a colorant and serves to prevent the occurrence of efflorescence.



### 1st Main Claim (EP0464203 A1)

[EN] 1. Method for producing hydraulic material characterized in that pre-hardened hydraulic material is produced by using aqueous solution of calcium hydroxide or aqueous solution of lime, such as, efflorescence ingredient, instead of water, and at need, reaction agent reactable with efflorescence ingredient is further added to such pre-hardened hydraulic material, and subsequently the hydraulic material is molded and subject to curing.

[MT] A method 徴 for producing a hydraulic material, in particular, in place of water, is to use an aqueous calcium hydroxide solution or a lime-based aqueous solution such as a efflorescence component solution mainly composed of the aqueous calcium hydroxide solution, or further add a reaction agent that reacts with efflorescence components to form an unhardened hydraulic material, and mold, cure, and cure. A cured hydraulic material made without adding or without adding a reactive agent, or a cured hydraulic material according to claim 1, wherein one or more of a reaction solution that reacts with the efflorescence component, a lime-based aqueous solution, and a synthetic resin-based jarine with the reactive agent are added to the cured hydraulic material under atmospheric or pressurized atmosphere of air or carbon dioxide, Liquid is not accumulated on the surface and the efflorescence component in the air is not transferred to the surface by one or a plurality of times, whereby carbon dioxide gas in the air, carbon dioxide gas substituted by the evaporation of water, carbon dioxide in the air, a reaction agent, or a reaction liquid wound in the hydraulic material during kneading, Or further forming a resin coating layer on the surface to suppress secondary efflorescence, make water absorption difficult and/or make water-permeable, or increase strength 徴. A method for curing a hydraulic substance.

**Assignees:** MITSUO KOJI; MITSUO MITSUKO; MITSUO HIROSHI

## 188. Family 104759283 (CN118745083 A)

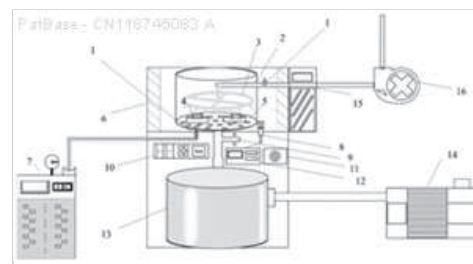
[View in PatBase](#)

### Title

[EN] CARBONIZATION PRODUCT PRODUCTION DEVICE AND PREPARATION METHOD FOR RECOVERING CO<sub>2</sub> AND SMELTING WASTE RESIDUES

### Abstract

[EN] The invention discloses a production device and a preparation method of a carbonized product for recovering CO<sub>2</sub> and smelting waste slag, which integrates carbon dioxide recovery, metallurgical waste slag dissolution and dispersion, carbonization, product regulation and control, product monitoring, suction filtration and drying, modifies the metallurgical waste slag by a wet carbonization process, and disperses CO<sub>2</sub> to maintain the overall reaction uniformity of wet carbonization. Adjusting and controlling the crystal form of a carbonized product and monitoring the pH value of the product, then filtering and drying, screening to a proper particle size, and then co-doping with cement to prepare the green gelling material. The method is simple in process and high in operability, the carbonization degree of the metallurgical waste residues is effectively improved, the cost is greatly reduced, and the prepared metallurgical waste residue cementing material is high in strength, good in carbon sequestration performance, low in production cost, low in carbon and environmentally friendly.



### 1st Main Claim

[MT] 1. A recovered CO<sub>2</sub> And a carbonization product production plant for smelting waste slag, characterized in that it comprises a tank, a dissolving vessel, a sieve, a suction bottle, an electronic pump, a steam generator, Temperature-controlled display, sonicator, ultrasonic transducer, rotor, speed controller, pH monitor, CO<sub>2</sub> Disperser, CO<sub>2</sub> An integrated filtration and heat exchange device; the dissolving vessel is provided with a screen at its bottom and two one-way exhaust valves under the screen; the dissolving vessel bottom is connected to a suction filter bottle by a funnel seal, a funnel valve is provided on the funnel, and the suction filter bottle is connected to an electronic pump outside the chamber; the steam generator is connected to the chamber, Emphasizing the throttle temperature by controlling the pressure; a temperature-controlled display is provided below the dissolution vessel; the ultrasound generator and the ultrasound transducer are mounted beside the dissolution vessel by wire connection; the rotor is located inside the dissolution vessel, The speed controller is located below the dissolving vessel; the pH monitor is used to monitor the pH change of the solution in the dissolving vessel; the CO<sub>2</sub> Integrated filtration and heat exchange units include CO<sub>2</sub> Filters and heat exchange fans, CO<sub>2</sub> The filter unit is passed through a CO with a one-way outlet valve<sub>2</sub> Pipe to CO<sub>2</sub> Disperser, CO<sub>2</sub> The disperser is located in the dissolving vessel, the heat exchange fan can regulate the reaction ambient temperature according to the internal carbonization reaction exotherm and the external heat.

**Assignees:** XI AN UNIV OF ARCHITECTURE AND TECHNOLOGY; UNIV XIAN ARCHITECTUR AND TECH

## 189. Family 5002251 (GB1569511 A)

[View in PatBase](#)

### Title

[EN] CEMENT COMPOSITION

### Abstract

[EN] [Source: Claim 1] 1. A portland cement mix comprising: a ground portland cement with or without added gypsum, aggregate, and sufficient water to effect hydraulic setting of the cement, and having added thereto carbon dioxide in an amount sufficient to control setting of the mix and stabilise the hydrated cement.

### 1st Main Claim

[EN] 1. A portland cement mix comprising: a ground portland cement with or without added gypsum, aggregate, and sufficient water to effect hydraulic setting of the cement, and having added thereto carbon dioxide in an amount sufficient to control setting of the mix and stabilise the hydrated cement.

**Assignees:** WESTVACO CORP

190. Family 69574439 (US2019177220 AA)

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Title (EP3532445 A1)

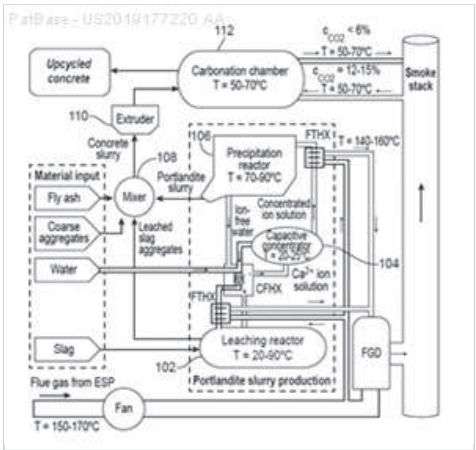
[EN] EFFICIENT INTEGRATION OF MANUFACTURING OF UPCYCLED CONCRETE PRODUCT INTO POWER PLANTS

Abstract (EP3532445 A1)

[EN] A manufacturing process of a concrete product includes: (1) extracting calcium from solids as portlandite; (2) forming a cementitious slurry including the portlandite; (3) shaping the cementitious slurry into a structural component; and (4) exposing the structural component to carbon dioxide sourced from a flue gas stream, thereby forming the concrete product.

1st Main Claim (EP3532445 A1)

[EN] 1. A manufacturing process of a concrete product, comprising: extracting calcium from solids as portlandite; forming a cementitious slurry including the portlandite; shaping the cementitious slurry into a structural component; and exposing the structural component to carbon dioxide sourced from a flue gas stream, thereby forming the concrete product.



**Assignees:** UNIV CALIFORNIA; UNIV ARIZONA STATE; THE UNIV OF CALIFORNIA; ARIZONA BOARD OF REGENTS ON BEHALF OF ARIZONA STATE UNIV; UNIV ARIZONA

191. Family 71050416 (WO19093726 A1)

[View in PatBase](#)

Title

[EN] CALCIUM CARBONATE-COATED HIGH-FUNCTIONAL MICROPARTICLE MANUFACTURING METHOD USING WASTE CONCRETE SLUDGE

Abstract

[EN] The present invention relates to a method for treating, in an environment-friendly manner, sludge and waste water generated in a process of grinding waste concrete to reproduce the same as aggregate, and reusing the treated sludge and waste water. The method can separate only microparticles from sludge comprising a cement ingredient and a sand ingredient and coat the surfaces of the microparticles with calcium carbonate by using a mineral carbonization technology, thereby manufacturing the miroparticles as a high-functional admixture to be used for cement, mortar, or the like.

1st Main Claim

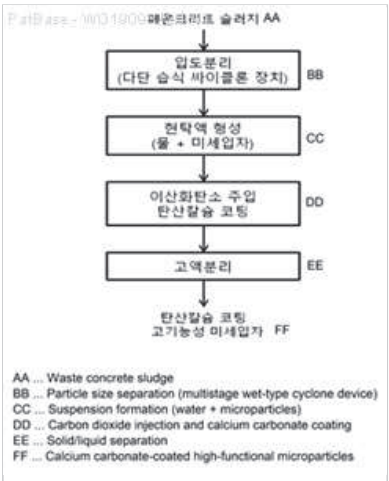
[MT] The waste concrete aggregate reproduction as occurring in the process of creating water contains a waste concrete pulverized coal and a particle size separation to the sludge through the solid-liquid separation and the sludge within the sludge to reference or less particle size of the microparticles; the separation step of separating the

microparticles is separated from the sludge suspension by mixing together with water to form a suspension;

the suspension, by injecting carbon dioxide in the water, and it is related to calcium ions are reacted with carbon dioxide to form a calcium carbonate in the suspension to be precipitated on the surface of the microparticles; and

the suspension in a coating step to mutually separating the liquid and solid; solid-liquid separation step is characterized in that it includes a sludge waste concrete manufacturing method using microparticles coated calcium carbonate.

**Assignees:** KOREA INST GEOSCIENCE AND MINERAL RESOURCES KIGAM; KOREA INST OF GEOSCIENCE AND MINERAL RESOURCES; KOREA INST GEOSCIENCE AND MINERAL RESOURCES



192. Family 60462194 (KR20150109087 A)

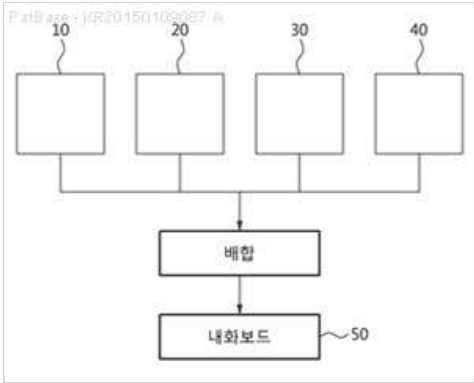
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**Title**  
[EN] FIRE-PROOF BOARD

**Abstract**  
[EN] The present invention relates to a fire-proof board and, more specifically, to a fire-proof board with an improved fire-proof function, which can be applied to a fire-proof design, a tunnel, and an underground space. The fire-proof board comprises: a first aggregate using shells which contains lime; a second aggregate containing silicon; and a binder combining the first aggregate and the second aggregate. The fire-proof board further includes an admixture which mixes the first aggregate and the second aggregate wherein the admixture is a water reducing agent using polycarboxylate. Therefore, the present invention consists of an organic-inorganic composite body which supplements disadvantages and accentuate advantages by using organic and inorganic compounds from industrial wastes. In addition, the present invention supplies ingredients at a low price by applying the industrial wastes, thereby reducing unit costs of the products.

**1st Main Claim**  
[MT] 1. First aggregate using a shell containing chlorine components; Second aggregate, which contains a silicon component; And binder for binding the aggregate of the first and second aggregate; Fireproof board, including.

**Assignees:** NAT UNIV KONGJU IND ACAD COOP; KONGJU NATIONAL UNIV IND UNIV COOPERATION FOUNDATION



193. Family 12794668 (US5593650 A)

[View in PatBase](#)

Title (EP0668845 B1)

[EN] PROCESS FOR PRODUCING A HIGH-DENSITY CAESIUM AND RUBIDIUM SALT SOLUTION

Abstract (EP0668845 B1)

[EN] PCT No. PCT/EP93/03143 Sec. 371 Date Jul. 17, 1995 Sec. 102(e) Date Jul. 17, 1995 PCT Filed Nov. 10, 1993 PCT Pub. No. WO94/11303 PCT Pub. Date May 26, 1994The method of making a high density saline cesium and rubidium solution includes comminuting uncalcined pollucite and/or calcined lepidolite to a grain size of less than 0.1 mm; combining the comminuted material in the presence of water with Ca(OH)<sub>2</sub> at a mol ratio of SiO<sub>2</sub> to CaO of not less than 1:2; hydro-thermally decomposing at a temperature of 200 DEG to 280 DEG C., a pressure of 20 to 40 bar and with a suspension density of 4 to 15 percent by weight for from 1 to 3 hours to form a suspension containing insoluble solids; filtering the insoluble solids and washing to form a filtrate and concentrating the filtrate; blowing carbon dioxide into the concentrated filtrate to precipitate calcium carbonate and lithium carbonate and filtering the concentrated filtrate to separate the precipitated carbonates from a remaining solution; and then adding an acid or acid anhydride to the remaining solution until the pH of the remaining solution reaches about 6 and concentrating by evaporation to form the high density saline cesium and rubidium solution.

1st Main Claim (EP0668845 B1)

[EN] 1. A method for producing a high-density caesium and rubidium salt solution by hydrothermal decomposition of minerals containing caesium and rubidium with Ca(OH)<sub>2</sub>, which is used in a molar ratio, calculated as SiO<sub>2</sub>: CaO, of greater than or equal to 1:2, the decomposition being effected at a decomposition temperature of 200 to 280 degrees centigrade and a pressure of 20 to 40 bar over a period of 1 to 3 hours, with uncalcined pollucite and/or calcined lepidolite ground down to a grain size of < 0.1 mm being used in the decomposition and the suspension density of the decomposition mixture being in the range of 4 to 15 percent by weight, then the insoluble solids are filtered off and washed, calcium and lithium ions are removed from the filtrate of the decomposition process by gassing with carbon dioxide and filtering off the precipitated carbonates, the remaining solution is reduced and salts of caesium and rubidium are formed by the addition of an acid or an acid anhydride up to a pH value of approximately 6, the filtrate separated off after decomposition being used several times in the hydrothermal decomposition.

**Assignees:** METALLGESELLSCHAFT AG; CHEMETALL GMBH; PRINZ HORST; WEGNER MARION; HOFMANN HARTMUT; KOEBELE KLAUS

PatBase - JP3578007 B2 表 1  
Ca(OH)<sub>2</sub>によるポリユーサイトの温浸  
SiO<sub>2</sub>:CaOのモル比1:2、8%懸濁液200℃、反応時間3時間  
粒径<0.04mm

原料(kg)		回収物				原料ポリユーサイト	
ポリユーサイト		濃度	Cs		Rb		に基づく収率(%)
Cs	Rb	kg	%	kg	%	kg	Cs Rb
4.192	0.173	629	0.66	4.146	0.028	0.173	98.9 100

## 194. Family 84522006 (US2023036356 AA)

[View in PatBase](#)

### Title (EP3808713 A1)

[EN] INTEGRATED PROCESS FOR MANUFACTURING HYDRAULICALLY HARDENING BUILDING MATERIAL

### Abstract (EP3808713 A1)

[EN] Method for manufacturing hydraulically hardening building materials, comprising:- providing concrete demolition waste with a maximum particle size of up to 150 mm as a starting material,- mixing the starting material with water to form a feedstock slurry,- introducing carbon dioxide or a precursor thereof into the feedstock slurry to form carbonated concrete fines in an amount from 1 to 100 wt.- percent of the hardened binder contained in the starting material and to detach the concrete fines from the aggregate contained in the starting material to form a product slurry, and- mixing the product slurry with a cement forming the building material, and use of the obtainable building material for manufacturing building structures as well as method for manufacturing a supplementary cementitious material slurry comprising the steps:- providing concrete demolition waste with a maximum particle size of up to 150 mm as starting material,- mixing the starting material with water to form a feedstock slurry,- introducing carbon dioxide or a precursor thereof into the feedstock slurry transforming from 1 to 100 wt.- percent of the hardened binder contained in the starting material to carbonated concrete fines with a reactivity index of at least 1.1 times to form the supplementary cementitious material slurry.

### 1st Main Claim (EP3808713 A1)

[EN] 1. Method for manufacturing hydraulically hardening building materials, comprising:

- - providing concrete demolition waste with a maximum particle size of up to 150 mm as a starting material,
- - mixing the starting material with water to form a feedstock slurry,
- - introducing carbon dioxide or a precursor thereof into the feedstock slurry to form carbonated concrete fines from the hardened binder paste contained in the starting material in an amount from 1 to 100 wt.- percent of the hardened binder and to detach the concrete fines from the aggregate contained in the starting material to form a product slurry, and
- - mixing the product slurry with a cement to form the building material.

**Assignees:** HEIDELBERGCEMENT AG; HCONNECT 2 GMBH

## 195. Family 97996231 (CN116375373 A)

[View in PatBase](#)

### Title

[EN] METHOD FOR IMPROVING PERFORMANCE OF LOW-SULFUR CLINKER BY UTILIZING DESULFURIZATION WASTE ASH

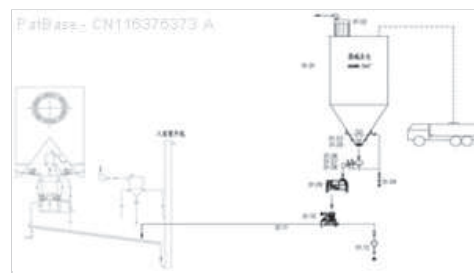
### Abstract

[EN] The invention provides a method for improving the performance of low-sulfur clinker by using desulfurized waste ash, and belongs to the technical field of building materials, the desulfurized waste ash is mixed with raw materials entering a kiln, the mixture enters a preheater for raw material drying, dehydration and homogenization reaction, then the mixture enters a decomposing furnace for decomposition, and finally the mixture enters a rotary cement kiln to generate clinker. Resourceful treatment is carried out on the desulfurization waste ash which is difficult to dispose in regions, resource utilization of waste is achieved, good social and economic benefits can be brought, the desulfurization waste ash is directly fed into a kiln inlet chute of a cement production line and enters a preheater for high-temperature oxidation curing, the technological process is simple, operation is flexible, and cost is low. The device can be used after existing waste equipment of a cement plant is transformed, personnel and equipment investment is low, and the device has good application and popularization value.

### 1st Main Claim

[MT] 1. A method of improving the performance of low sulfur clinker using sulfur waste ash, characterized by: The sulfur waste ash is mixed with the raw material into the kiln, into the preheater for raw material drying, dewatering and homogenization reaction, then into the decomposition furnace for decomposition, and finally into the cement rotary kiln raw matte.

**Assignees:** CHINA RESOURCES CEMENT TECH RESEARCH AND DEVELOPMENT GUANGXI CO LTD



## 196. Family 94336691 (CN115321890 A)

[View in PatBase](#)

### Title

[EN] SOLID WASTE-BASED BINDER FOR SEALING AND STORING CARBON DIOXIDE, PREPARATION METHOD AND CARBON DIOXIDE SEALING AND STORING METHOD THEREOF

### Abstract

[EN] The invention relates to a solid waste-based binder for sealing and storing carbon dioxide, a preparation method of the solid waste-based binder, and a method for sealing and storing carbon dioxide by using the solid waste-based binder. A solid waste material; a functional additive; the preparation method comprises the following steps: heating and extruding the functional additive and part of the solid waste material through a twin-screw extruder, processing to below 400 or 600 meshes through a mechanical pulverizer, and uniformly stirring and mixing with the inorganic cementing material and the like through a multifunctional stirrer to obtain binder powder; the first sealing process comprises the following steps: uniformly mixing binder powder, sand and water through a multifunctional stirrer, preparing a sample (240mm \* 115mm \* 53mm), and curing the flue gas to seal the carbon dioxide in the flue gas; and the second method comprises the following steps: uniformly mixing and stirring the binder, the aggregate and the water in a sealable stirring tank, introducing the flue gas, continuously stirring for 30-60 minutes, and then directly using the mixture for backfilling of a mine pit, a mine hole, an oil well and a mine so as to seal and store the carbon dioxide in the flue gas.

### 1st Main Claim

[MT] 1. A solid-waste based binder for sequestering carbon dioxide, characterized in that said binder comprises, by mass, the following components: 5.0 to 35 parts of inorganic cement material; 55 to 90 parts of waste material; and 0.3 to 10 parts of functional aid;

Said inorganic cementitious material is one or more of aluminate cement, silicate cement, sulfur aluminate cement, and oil well cement;

Said solid waste material employs one or several of converter steel slag, blast furnace slag powder, fly ash, electrostone slag, magnesium slag, molybdenum tail slag, red mud, coal gasification slag, phosphorus gypsum, det sulfur gypsum, coal mine spoil;

Said functional aid employs one or more of staple fibers, specific gravity modifiers, carbonization enhancers, premature strength agents, challenge agents, retarders.

**Assignees:** LINHE CLIMATE TECH BEIJING CO LTD

197. Family 33303170 (JP2006188368 A2)

[View in PatBase](#)

Title

[EN] METHOD OF MANUFACTURING CARBONATED SOLIDIFIED SUBSTANCE

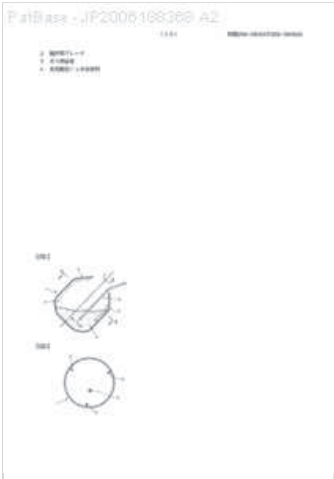
Abstract

[EN] PROBLEM TO BE SOLVED: To stably manufacture a carbonated solidified substance having adequate quality even from a raw material large in the proportion of fine powders. SOLUTION: The carbonated and solidified substance granulated product is obtained by granulating a un-carbonated Ca-containing raw material containing water in the presence of carbon dioxide gas to solidify the raw material under granulation by carbonation reaction. The carbonated solidified substance small in remaining free CaO is obtained by carbonating and solidifying the granulated material through the carbonation reaction under granulation to cause the carbonation to the inside even using a raw material having high free CaO content and the large proportion of fine powders.

1st Main Claim

[MT] 1. granulated carbon dioxide in the presence of Ca-containing materials, including carbonated water yet, by reaction with carbon dioxide to solidify the material in grain 該造 obtain a solidified carbonate granules manufacturing method of solidified carbon dioxide can be characterized.

Assignees: JFE STEEL KK; JFE HOLDINGS INC



## 198. Family 108005696 (WO25101950 A1)

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### Title

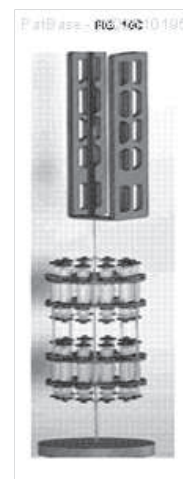
[EN] PRODUCTS OF MANUFACTURE FOR EXPORTING ATMOSPHERIC CARBON DIOXIDE INTO LONG-TERM WATER STORAGE RESERVOIRS

### Abstract

[EN] In alternative embodiments, provided are products of manufacture and methods for exporting or sequestering atmospheric carbon dioxide (CO<sub>2</sub>), methane, inorganic and organic nutrients, pollutants, metals, plastics, and the like into an aqueous storage reservoir, optionally a long-term aqueous storage reservoir. In alternative embodiments, provided are products of manufacture designed as a Floater-Coupled-to-Sinker (so called "FloCS") that can export CO<sub>2</sub>, methane, inorganic and organic nutrients, pollutants, metals and/or plastics into or adherent to or attached to a water or aqueous storage reservoir, optionally long-term water or aqueous storage reservoirs.

### 1st Main Claim

[EN] 1. A product of manufacture for exporting or sequestering atmospheric carbon dioxide (CO<sub>2</sub>), methane, an inorganic or an organic nutrient, a pollutant, a metal, a plastic, or a combination thereof, from an aquatic or an ocean environment to an aqueous storage reservoir, wherein the carbon dioxide (CO<sub>2</sub>), methane, the inorganic or the organic nutrient, pollutant, metal, plastic, or combination thereof is degraded, modified or digested by an organism and exported or sequestered into or adherent to or attached to an aqueous storage reservoir, optionally a long-term aqueous storage reservoir, the product of manufacture comprising: (a) an aqueous storage reservoir operatively connected to, or attached to, a floater component; (b) a floater component attached to or operatively attached to the aqueous storage reservoir, wherein the floater comprises at least one organism, optionally at least one plant, macroalgae or algae, and the floater is capable of or fabricated for: (i) sequestering, degrading or digesting atmospheric carbon dioxide (CO<sub>2</sub>), methane, an inorganic or an organic nutrient, a pollutant, a metal, a plastic, or a combination thereof, and (ii) exporting the sequestered, degraded or digested atmospheric carbon dioxide (CO<sub>2</sub>), methane, the inorganic or organic nutrient, the pollutant, the metal, the plastic or the combination thereof to the aqueous storage reservoir, wherein the floater component comprises or has contained therein an organism, and the atmospheric carbon dioxide (CO<sub>2</sub>), methane, the inorganic or organic nutrient, the pollutant, the metal, the plastic or the combination thereof is degraded, modified or digested by the organism, wherein the floater component is sufficiently buoyant to keep or maintain the aqueous storage reservoir in the photic or euphotic, or epipelagic or sunlit, zone of an aquatic or ocean environment, or at least keep or maintain the aqueous storage reservoir above the mesopelagic zone of the aquatic or ocean environment, wherein optionally the aqueous storage reservoir, optionally a long-term aqueous storage reservoir, is adapted or fabricated to be in an aquatic or ocean environment, wherein optionally the aquatic or ocean environment is a lake (optionally a deep lake with low oxygen bottom waters); a peat-land; a swamp; a man-made dump; a man-made reservoir; a flooded quarry; or a volcanic crater or a caldera; and (c) a sinker component attached or adherent to the aqueous storage reservoir and/or the floater component, wherein the sinker comprises or has contained therein any organism or man-made material that is denser than water, and when in an aqueous environment is able to grow or expand such that over time it becomes sufficiently negatively buoyant to the degree that the product of manufacture sinks, and optionally the sinker component comprises a polymer material that undergoes an increase in density when immersed in seawater, and this increase in density can be achieved by the polymer selectively absorbing divalent cations, optionally calcium (Ca<sup>2+</sup>) and magnesium (Mg<sup>2+</sup>) ions, and optionally the polymer matrix comprises: polyacrylate or polyacrylic acid, poly(methacrylic acid) (PMAA), divinylbenzene (DVB), PMAA-DVB, styrene-divinylbenzene (S-DVB), styrene, polydopamine, polyvinyl alcohol, chitosan, activated carbon, a polyelectrolyte complex and/or a mixture thereof, and optionally the polymer composition is modified with one or more functional groups (and optionally the functional groups selectively bind to one or more divalent cations, optionally calcium (Ca<sup>2+</sup>) and/or magnesium (Mg<sup>2+</sup>) ions) to promote targeted ion absorption, and optionally this selective absorption induces localized crosslinking or structural contraction within the polymer resulting in a higher-density material without significant expansion in volume, and optionally the one or more functional groups comprise barium hydroxide, strontium hydroxide, calcium hydroxide or a combination thereof.



**Assignees:** SAN DIEGO STATE UNIV SDSU FOUNDATION DBA SAN DIEGO STATE UNIV RESEARCH FOUNDATION

## 199. Family 104787655 (CN118754520 A)

[View in PatBase](#)

### Title

[EN] IN-SITU FOAMING LOW-CARBON CONCRETE AND PREPARATION METHOD THEREOF

### Abstract

[EN] The invention discloses in-situ foaming low-carbon concrete and a preparation method thereof. The in-situ foaming low-carbon concrete is prepared from the following raw materials in parts by mass: 500 to 2000 parts of low-carbon cement, 300 to 1500 parts of lightweight aggregate, 100 to 200 parts of zeolite, 10 to 40 parts of carbon curing agent, 1 to 10 parts of air entraining agent, 1 to 10 parts of foam stabilizer, 10 to 80 parts of sodium bicarbonate, 10 to 80 parts of effervescent tablets and 400 to 1500 parts of water. According to the preparation method provided by the invention, waste resources of a premixed concrete mixing plant can be fully utilized, carbon dioxide can be furthest absorbed or cured by each component of the concrete, the carbon sequestration capability of the concrete is improved, and meanwhile, the thermal insulation property and the mechanical property of the foam concrete are met.

### 1st Main Claim

[MT] 1. An in-situ foamed low-carbon concrete, characterized by comprising the following mass parts of raw materials: Low-carbon cement 500 to 2000 parts, light aggregate 300 to 1500 parts, zeolite 100 to 200 parts, carbon curing agent 10 to 40 parts, air-entraining agent 1 to 10 parts, foam stabilizing agent 1 to 10 parts, Sodium bicarbonate 10 to 80 parts, effervescent tablets 10 to 80 parts, water 400 to 1500 parts;

A process for preparing said in situ foamed low carbon concrete comprising the steps of:

- (1) the zeolite is placed in the flue gas channel of the cement production kiln to adsorb carbon dioxide for 7 to 10 days, and crushed to obtain the treated zeolite, controlling the particle average particle size of less than 45 microns;
- (2) the low-carbon cement is placed in a pulverizer for 1 to 3 hours to break, then the sodium bicarbonate, the effervescent tablet, pulverized for 1 to 2 hours to obtain low-carbon cementitious material powder;
- (3) blending the low carbon gelling material powder, the light aggregate, the carbon curing agent and the treated zeolite uniformly to obtain a premix;
- (4) slowly adding said water, said foam stabilizing agent, said air-enriching agent, and stirring to homogeneously obtain concrete to said premix;
- (5) the concrete is poured into the mold, waiting for concrete to set, the in situ foamed low carbon concrete can be prepared.

**Assignees:** CSCEC COMMERCIAL CONCRETE CO; CHINA WEST CONSTR GROUP CO LTD; CSCEC COMMERCIAL CONCRETE CO LTD

## 200. Family 58627713 (KR20150022189 A)

[View in PatBase](#)

### Title

[EN] CONCRETE BINDER AND PROCESS THEREOF

### Abstract

[EN] The present invention relates to a concrete binder which can be used by substituting cement, and to a desired manufacturing method thereof. According to the present invention, the concrete binder comprises: one or more particulate materials selected among a hydraulic material, a latent hydraulic material, and a pozzolan material; and calcium magnesium ( $\text{CaO} \cdot \text{MgO}$ ) generated by a decarboxylation reaction of  $\text{CaCO}_3 \cdot \text{MgCO}_3$ . Also, alkali sulfate can be included in the same. The method for manufacturing the concrete binder sinters  $\text{CaCO}_3 \cdot \text{MgCO}_3$  at 700-1400 degrees centigrade, pyrolyzes carbon dioxide, and manufactures calcium magnesium ( $\text{CaO} \cdot \text{MgO}$ ). And then, the concrete binder can be manufactured that all materials are prepared in powder conditions and mixed, or a part or all materials are mixed and ground.

### 1st Main Claim

[MT] 1. Hydraulic material, latent hydraulic materials, one or more of the pozzolanic material selected powder;  $\text{CaCO}_3 \cdot \text{MgCO}_3$  Lime produced by the decarboxylation of the koto ( $\text{CaO} \cdot \text{MgO}$ ); Concrete binder, characterized in that configuration, including:

**Assignees:** KANG YOUNG LIM

201. Family 72572399 (KR20180137206 A)

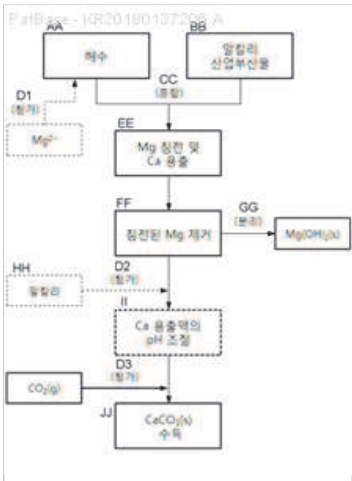
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**Title**  
[EN] A METHOD FOR PRODUCING HIGH PURITY CALCIUM CARBONATE USING INDIRECT CARBONATION OF ALKALINE INDUSTRIAL BY-PRODUCTS AND SEAWATER

**Abstract**  
[EN] The present invention relates to a method of storing carbon dioxide and a method of producing high-purity calcium carbonate by using indirect carbonation of alkaline industrial by-products and seawater. In particular, disclosed is a method of producing high-purity calcium carbonate by using alkaline industrial by-products and seawater, the method comprising the following steps: (1) adding 1.0-10.0 g of alkaline industrial by-products to 100 ml of seawater to precipitate magnesium present in the seawater and elute calcium (Ca) present in the alkaline industrial by-products; (2) removing the precipitated magnesium from the calcium effluent; and (3) injecting carbon dioxide into the effluent from which the precipitated magnesium has been removed, to yield calcium carbonate. The method of producing high-purity calcium carbonate according to the present invention may elute calcium from alkaline industrial by-products by using seawater as a solvent; by using magnesium contained in the seawater, may elute calcium contained in the alkaline industrial by-products with high efficiency; by using the alkaline industrial by-products, may precipitate magnesium inside seawater, which hinders the formation of high-purity calcium carbonate, and thus may increase the purity of calcium carbonate; and by utilizing seawater in place of a costly solvent, may serve to increase carbon dioxide storage and the cost-effectiveness of calcium carbonate production.

**1st Main Claim**  
[MT] 1. (1) alkali industrial by-products, 4.4~1.8 g per 100ml, ratio of magnesium (Mg) present in the water are precipitated, and at the same time as industrial by-products present in the alkali is eluted calcium (Ca); (2) such that the precipitated from the calcium eluent; and (3) removing the magnesium magnesium is removed the precipitated by injecting the carbon dioxide in the eluent to obtain; calcium carbonate (CaCO<sub>3</sub>) containing the alkaline calcium carbonate of industrial by-products and water manufacturing method using the same.

**Assignees:** KOREA MARITIME UNIV IND ACAD; KOREA MARITIME UNIV IND ACADEMIC COOPERATION FOUNDATION; KOREA MARITIME AND OCEAN UNIV IND ACADEMIC COOPERATION CENTER



202. Family 89371242 (US11572307 BA)

[View in PatBase](#)

Title

[EN] PROCESS FOR MODIFYING STEEL SLAG THROUGH ACIDIFICATION AND CARBONIZATION COUPLING

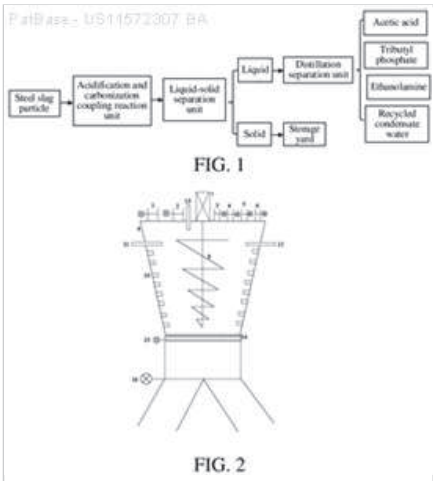
Abstract

[EN] The present invention belongs to the technical field of metallurgical solid waste resource utilization, and particularly relates to acidification and carbonization coupling modified steel slag as well as a preparation process and an application thereof. The process specifically includes the following steps of adopting acetic acid, tributyl phosphate, ethanolamine and a NaOH and Ca(OH)<sub>2</sub> emulsion as reaction reinforcing agents, and modifying the steel slag together with CO<sub>2</sub>-rich lime kiln flue gas. The process for modifying the steel slag through acidification and carbonization coupling provided in the present invention has the advantages of simple reaction conditions and no need of high-pressure CO<sub>2</sub>, additionally, the carbonation reaction rate can be greatly increased, and f-CaO and f-MgO in the steel slag can be effectively eliminated.

1st Main Claim

[EN] 1. A process for modifying steel slag through acidification and carbonization coupling, wherein acetic acid, tributyl phosphate, ethanolamine and a NaOH and Ca(OH)<sub>2</sub> emulsion are used as reaction reinforcing agents, and the steel slag is modified together with CO<sub>2</sub>-rich lime kiln flue gas; the process for modifying the steel slag through acidification and carbonization coupling specifically comprises the steps of sequentially adding water and acetic acid solid to the steel slag, mixing and reacting for 20-60 min, then introducing the lime kiln flue gas containing CO<sub>2</sub> gas, and meanwhile, and adding the tributyl phosphate, the NaOH and Ca(OH)<sub>2</sub> emulsion and the ethanolamine for acidification and carbonization coupling reaction; when the water and the acetic acid solid are sequentially added to the steel slag, the water amount is controlled according to the liquid-solid ratio of 20:1 to 5:1, and the concentration of the acetic acid is controlled to be 5 percent to 20 percent; the final total amount of the tributyl phosphate is the same as the molar mass of the added acetic acid; the amount of the NaOH and Ca(OH)<sub>2</sub> emulsion is required to adjust the pH value of liquid between 8 and 11; and the amount of the ethanolamine is 5 percent to 20 percent.

**Assignees:** UNIV SHANDONG; QINGDAO DANENG ENVIRONMENTAL PROT EQUIPMENT INC CO; QINGDAO HAITAI ENERGY SCIENCE AND TECH RESEARCH INST; SHANDONG UNIV; QINGDAO DANENG ENVIRONMENTAL PROT EQUIPMENT CO LTD



203. Family 90172489 (WO22144012 A1)

[View in PatBase](#)

**Title**  
[EN] ANORTHITE MICRO-NANO PORE HEAT INSULATION REFRACTORY MATERIAL AND PREPARATION METHOD THEREFOR

**Abstract**  
[EN] An anorthite micro-nano pore thermal insulation refractory material and a preparation method therefor. The anorthite micro-nano pore thermal insulation refractory material is mainly made of basic raw materials, additives and water. The anorthite micro-nano pore thermal insulation refractory is white, yellowish or yellow in appearance, the main crystal phase of the product thereof is anorthite, and the mass content of CaO in its chemical composition is 4-22 wt percent, the pore size distribution is between 0.006-250 micro m, and the average pore size is 0.1-19 micro m. The micro-nano sized air pore structure ensures a better thermal insulation performance of the product at a low bulk density and a high strength. The preparation method is environmentally friendly and has no pollution, and the structure and performance of the product are easy to accurately control.

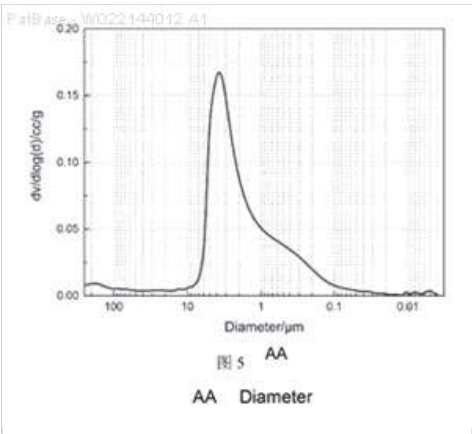
**1st Main Claim**  
[MT] A feldspar micronanopore insulation refractory material, characterized in that said feldspar micronanopore insulation refractory material is made of a base material, an addition charge and water; the mass content of CaO in the chemical composition of the article is 4~ 22%; and

The base raw material consists of the following percentages by weight of raw materials: 6~ 50% calcium raw material, 0~ 36% alumina raw material, 0~ 79% alumino-siliceous raw material, and 0~ 42% silica raw material;

Said addition comprises at least a foaming agent, with or without additives; said foaming agent is composed of a blowing agent, an inorganic curing agent, an organic curing agent and a cell conditioning agent, the blowing agent, an inorganic curing agent, an organic curing agent and a cell conditioning agent being added in a mass of 0.01 to 10%, respectively, based on the mass of the base material; 0.1 to 20%, 0.1 to 2% and 0.01 to 1%; when an additive is used, said additive is selected from one or more combinations of one or more than two of dispersants, suspending agents, mineralizing agents and infrared opacifiers, and neither mineralizing agents and infrared opacifiers is added in mass greater than 10% based on the mass of base material;

The mass of the water is 30~ 300% of the mass of the base stock.

**Assignees:** ZHENGZHOU LIGHT IND UNIV; UNIV ZHENGZHOU LIGHT IND



204. Family 91705722 (CN114538846 A)

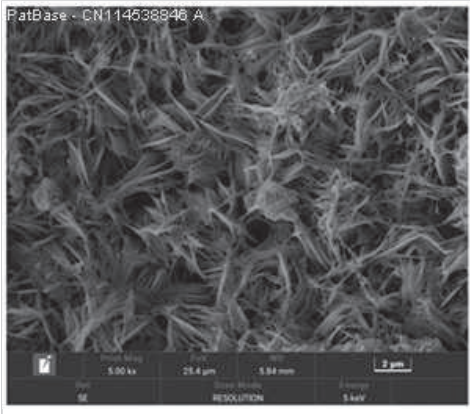
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**Title**  
[EN] GLASS CEMENT MORTAR WITH LOW ALKALI SILICON REACTION, CONCRETE AND PREPARATION METHOD

**Abstract**  
[EN] The invention discloses low-alkali silicon reaction glass cement mortar, concrete and a preparation method. Comprising glass fine aggregate subjected to surface pretreatment; the surface pretreatment comprises the step of soaking glass particles by using a saturated Ca (OH) 2 solution. According to the method, the replacement rate of the glass fine aggregate can be increased to 100 percent, chemical reagents are simple, and large-scale production is facilitated.

**1st Main Claim**  
[MT] 1. A low-alkali-silicon reacted glass cement mortar, characterized by comprising fine glass aggregates subjected to surface pretreatment; said surface pretreatment being soaking glass particles using a saturated Ca (Oh) 2 solution.

**Assignees:** HUNAN UNIV; UNIV HUNAN



205. Family 74994853 (CN109967489 A)

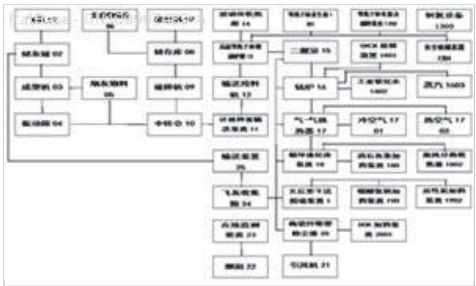
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Title

[EN] PROCESS AND SYSTEM FOR MELTING TREATMENT OF FLY ASH AND RESIDUE OF HAZARDOUS WASTE THROUGH HIGH-TEMPERATURE PLASMA

Abstract

[EN] The invention discloses a technical process and a treatment system for the melting treatment of the fly ash and residue of hazardous waste through high-temperature plasma. The treatment process comprises the following components: (a) a pre-treatment system for molding fly ash and crushing and screening of the hazardous waste residue and the waste glass; (b) a measuring, weighing, conveying and feeding system; (c) a high-temperature plasma melting treatment system; (d) a microwave plasma secondary combustion chamber; (e) a boiler and a gas-gas heat exchanger cooling and dust removal system; (f) a circulating fluidized bed and a desulfurization and deacidification and dioxin adsorbing device through a semi-drying method; (g) a desulfurization and deacidification and dioxin adsorbing device through a venturi drying method; (h) a ceramic fiber filter pipe dust remover and a dust removal, desulfurization and denitration and dioxin eliminating device; and (i) a smoke exhausting system. The process actually achieves a more thorough treatment effect for volume reduction, innocuity, and resource, the secondary environmental pollution problem can be avoided, the daily processing capacity is high, the economic operating cost is lower, and the working environment is safer and more environment-friendly.



1st Main Claim

[MT] 1. A high temperature plasma hazardous waste fly ash, residue harmless treatment process, characterized in that it comprises the following steps:

(a) a hazardous waste feed pretreatment system

outside the unit transported to the fly ash into the ash storage tank (01) (02) scratch up, followed by special delivery device into the molding machine (03) roll into a ball-type or extruded into bulk materials, and then by conveyor into the shaker (04) screening separation, meet the specifications of the molded material transported to the transfer chamber (10) to be processed; Does not meet the requirements of fine ash material (05) to return to step on the road (03) inside the molding machine to be processed;

Outside the unit to transport hazardous waste residue (06) into the dedicated storage repository (08) scratch up, followed by a conveyor into the crusher (09) crushing process, and then transported by conveyor to the residue transfer chamber (10) to be processed;

The outsourcing waste glass (07) feeding waste glass repository (08) scratch up, followed by a conveyor into the crusher (09) crushing process, and then transported by conveyor to the waste glass transfer chamber (10) to be processed;

(B) weighing conveyor feeding system

according to the actual working conditions of process parameter setting, the above three kinds of different materials, and other trace elements were in dedicated transit warehouses (10) weighing dispensing device (11) to complete the job mixing metering weighing ratio, then by special conveyor feeder (12) to a high temperature plasma melting furnace (13) for uniform delivery of feed;

(C) a high temperature plasma melting treatment system

by conveyor feeder (12) is put to a high temperature plasma melting furnace (13) within the above-mentioned three kinds of mixed materials, to instantly all organics decompose into aqueous solutions of non-condensable gases and vaporized molecules; Inorganic matter and heavy metals in the molten shallow crucibles into a semi-fluid, expensive high-density metals and general metal deposited on hierarchical special crucible container periodically discharge recovery, low density non-metallic semi-fluid overflow tank top by the above-described crucible oozing of the high temperature plasma furnace (13) at the bottom of the melt overflow pipe outflow; The semi-fluid into the vitreous collection box (14), and then cooled to form the vitreous Sinotrans to secure storage area, the dust-containing high temperature flue gas and non-condensable gas, vaporized water vapor molecules and other substances into the secondary combustion chamber (15) to be processed;

The high-temperature plasma melting furnace (13) supporting the auxiliary and control systems are: plasma generator, the plasma power and monitoring devices (1301) (1302), nitrogen equipment safety explosion-proof device (1303) and (1304), etc., with the high temperature plasma melting furnace (15) provided at the top N groups (1301) of the plasma generator into the furnace crucible of molten shallow reaction zone and melting semi-fluid channels of two units provide heat;

The high-temperature plasma melting furnace (13) provided with a safety explosion-proof device (1304), and conveyor feeder (12), and the plasma generator (1301), a second fuel chamber (15) and the high temperature flue gas duct and the flue gas path sixth vitreous slag duct in communication with the high temperature plasma melting furnace (13) and plasma power supply and monitoring device (1302), (1303) (1301) the four nitrogen production equipment, the plasma generator is connected;

(D) microwave plasma incineration secondary combustion chamber at

high temperature plasma melting furnace (13) of the device above the hot exhaust gas into the second combustion chamber (15), generated by the microwave plasma (also available DC inverter) provides higher than 1500 degrees high temperature plasma as a

burning heat, forcing dioxins and other pollutants heating the molecular chain breaking reached harmless disposal purposes, said second combustion chamber (15) generated by the coarse particles in the lower part of the ash discharge port into the ash collection box (24); Some other fine particles of fly ash with high temperature flue gas (16) into the boiler furnace to be treated;

The second combustion chamber (15) and high-temperature plasma melting furnace (13), and the plasma generator (1301), safety explosion-proof device (1304), (16) and the ash collection box (24) of the boiler flue gas path sixth user with China Unicom, the second combustion chamber (15) and a plasma generator (1301), safety explosion-proof device (1304), the plasma power and monitoring device (1302), (1303) five persons nitrogen equipment is connected;

(E) boilers and gas - gas heat exchanger cooling dust removal system

(1) of the boiler unit: by the secondary combustion chamber (15) is transported out of the outlet end of the high temperature flue gas into the waste heat boiler (16) furnace, heated to 180 degrees centigrade (1602) industrial demineralized water steam (1603) as a post-channel processes, such as bathing, heating, drying, the waste heat boiler (16) is discharged out of the dust into the ash collection box (24) to be processed, said means (1601) for selective non-catalytic reduction SNCR denitration process without catalyst, under the action of the furnace temperature is 850 ~ 1000 degrees centigrade regional jet (spray 8% aqueous ammonia, vaporized urea) reducing agent, the high temperature flue gas nitrogen oxides to harmless nitrogen and water, reducing agent and NOX in the flue gas only high temperature reactions, generally does not react with oxygen. Snrc commonly used in the boiler furnace, the NOX emissions down to about 30 to 60% / nm<sup>3</sup>, denitration efficiency, low investment costs;

(2) gas - gas heat exchanger units: The waste heat boiler (16) high temperature flue gas emissions from 800 degrees centigrade into the gas - gas heat exchanger (17), the ambient temperature of 20 degrees centigrade cold air heat exchange to 200 to 400 degrees centigrade (1701) (1702), as the hot air drying, heating, and the gas - gas heat exchanger (17) is discharged out of the dust into the ash collection box (24) to be processed, said gas-gas heat exchanger (17) is less than 350 degrees centigrade, and output high temperature flue gas into the circulating fluidized bed apparatus (18) to be processed;

(F) circulating fluidized bed semi-dry desulfurization deacidification, adsorption dioxins device

by the above-mentioned gas - gas heat exchanger (17) output is less than 350 degrees centigrade, the high temperature flue gas from the circulating fluidized bed (18) into the bottom of the boiling fluidized furnace area, in quartz sand heat carrier catalytic disturbances, and feeding the coming half dry stone mortar complete acid-base chemical reaction, the acid desulfurization effect, semi-dry lime slurry in accordance with the set amount of 1: 1.4 ~ 1.6 proportion invested to ensure the circulating fluidized bed furnace (18) above the basic agent to meet their needs; the amount of acid-base chemical reaction. At the same time, to a certain extent, must also enhance a variety of alkaline oxides, density and degree of dust fly ash concentration vortex to inhibit the formation of P<sub>cdd</sub>/f<sub>s</sub> emissions; At the same time put in semi-dry pulp limestone (calcium oxide) and high temperature flue gas acidic substances react chemically to produce calcium compound (CaCO<sub>3</sub>, CaSO<sub>3</sub>, CaSO<sub>4</sub>, Ca (ClO), etc.) in the rapid vaporization of water molecules H<sub>2</sub>O will escape from the bursting, resulting in calcium compound in vivo leaving a large number of ultra-fine water molecules (H<sub>2</sub>O) can also be understood as the cave molecular sieve; Its specific surface area much larger than the surface area of the activated carbon adsorption of gaseous dioxin, heavy metals arsenic (As), selenium (Se), mercury (Hg) and other harmful substances in hiding place, ideal adsorption rate of 60 to 70%,

quartz sand as a fluidized bed catalytic medium and put in full contact with the lime slurry, there must be a part of the lime dust particles high temperature flue gas flow away, so the addition of the circulating fluidized bed (18) of flue gas outlet end of the cyclone collector (1802); The escape of excess lime powder after collection, again put into the fluidized bed furnace, continue to repeat the above-mentioned acid-base chemical reaction step, thereby referred to as circulating fluidized bed desulfurization, adsorption dioxins, the slaked lime dosing device (1801) is based on the circulating fluidized bed (18), automatically detects the resulting acid alkaline concentration data feedback to intelligent control center, the data actuator in accordance with the instruction to adjust the furnace automatic feeding the slaked lime conveyor feeding quantity, to ensure that the furnace alkaline concentration indicators meet the design requirements of the technical parameters of the fluidized bed (18) discharged from the dust from entering the ash collection box (24) to be processed;

(G) a venturi dry desulfurization deacidification, adsorption dioxins device

of the circulating fluidized bed (18) of the outlet end of the flue gas emissions of high temperature flue gas into the venturi dry desulfurization unit (19), continue to flue gas residues in the acidic substances, with sodium bicarbonate powder was acid-base chemical reaction; The purpose of is to ensure that into a ceramic fiber filter dust collector (20) within the high temperature flue gas can not be acidic substances, given its presence superscalar catalyst / catalyst produce HCL, SO<sub>2</sub> poisoning,

the venturi dry desulfurization deacidification mode, using the venturi throat tube position with high flow rate injection window to ensure that the dosing device (1901) of sodium bicarbonate sodium bicarbonate powder and flue gas acidic substances in the venturi dry desulfurization unit (19) in the cylinder body, has sufficient residence time and maximum vorticity degree spoiler thoroughly mixed, under the action of the acid-base chemical reaction while achieving high efficiency desulfurization deacidification purposes, while the procedure of the slaked lime powder continue to escape from the venturi dry desulfurization acid-base chemical reaction occurs in the device; At the same time where the specific surface area calcium compound molecular cave continues adsorption dioxins, heavy metals arsenic (As), selenium (Se), mercury (Hg) and other harmful substances,

the dosing device provided with the above-mentioned sodium bicarbonate (1901) opposite the injection window, also set an activated carbon dosing device (1902) injection window; Special design structure of dry desulfurization deacidification device (19) to meet the needs of activated carbon and residence time large eddy current technical conditions, to achieve efficient adsorption of dioxins, heavy metals arsenic (As), selenium (Se), mercury (Hg) and other harmful substances in effect,

the venturi dry desulfurization deacidification device (19) outlet end of the high temperature flue gas temperature flue gas output

into the ceramic fiber filter dust collector (20) to be processed, wherein the venturi dry desulfurization deacidification device (19) of particles of dust collecting barn emissions of dust from entering the ash collection box (24),

(h) to be processed ceramic fiber filter tube precipitator dust removal, desulfurization and denitration, eliminate dioxin device;

The above venturi dry desulfurization deacidification device (19) outlet end of the high temperature flue gas temperature flue gas dust into the output of the ceramic fiber filter dust collector (20), dust removal, desulfurization and acid, eliminating nitrogen oxides and dioxins and other harmful gases disposal work,

the ceramic fiber filter tube material consists of aluminum silicate fiber and inorganic adhesive composition, good chemical stability, in 250 ~ 375 degrees temperature environment, dust filtration efficiency less than 5mg/nm<sup>3</sup> economic operation, each of the root filter tube forming a cylindrical outer cylinder jacket formula of lime cake to an independent reaction bed, and can be caused by high temperature flue gas spoiler disordered trajectory; Thus hundreds or even thousands of root monomer ceramic fiber filter tubes into a ceramic fiber filter dust collector (20), effective space is a very good desulfurization deacidification reaction chamber, through the injection of sodium bicarbonate (NAHCO<sub>3</sub>) alkali agent baking soda powder and high temperature flue gas sufficient acid-base chemical reaction, hydrogen chloride removal rate of up to 97%; Sulfur oxide removal rate of up to 95%;

The use of selective catalytic reduction (SCR), 8% aqueous ammonia reductant into the ceramic fiber filter dust collector (20) of flue gas reaction chamber; At 230 to 400 degrees centigrade, ambient temperature flue gas to vanadium and titanium-based catalyst (catalyst) acting as the carrier medium to accelerate chemical reactions, so that the nitrogen oxide catalytic selective reduction to harmless N<sub>2</sub> and H<sub>2</sub>O; The denitration efficiency greater than 85%.

In the vanadium-titanium tungsten catalyst, under the action of forces dioxins and 3 percent oxygen chemical reaction to be decomposed into CO<sub>2</sub>, H<sub>2</sub>O, HCL and other non-toxic substances discharged, >91.7% dioxin removal efficiency;

The ceramic fiber filter tube dust collection bin (20) at the bottom of drained dust from entering the ash collection box (24) to be treated, the ceramic fiber filter dust collector (20) outlet end of the exhaust gas into the induced draft fan (21) output to be processed;

(l)

The above-mentioned ceramic fiber tube dust smoke evacuation system (20) associated with the output in compliance with local waste environmental emissions standards of 150 to 170 degrees centigrade clean exhaust gas delivered to the chimney by the induced draft fan (21) (22) into the atmosphere. Flue gas line monitoring device (23) detecting emissions in the flue gas dust, sulfur dioxide, hydrogen chloride, carbon monoxide, nitrogen oxides, oxygen, carbon dioxide and the like.

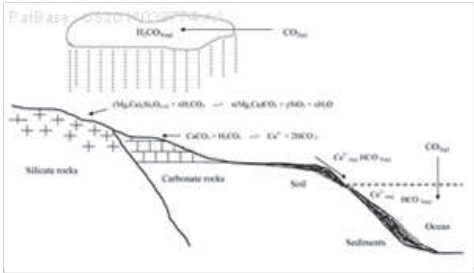
**Assignees:** LU JUN

206. Family 48320551 (US2011038774 AA)

[View in PatBase](#)

**Title**  
[EN] METHOD FOR SEQUESTERING CARBON DIOXIDE

**Abstract**  
[EN] A method for sequestering carbon dioxide (CO<sub>2</sub>) that includes generating ammonia from an ammonium salt to make a basic ammoniated aqueous solution and using the solution to remove at least a portion of CO<sub>2</sub> from a CO<sub>2</sub>-bearing gas and precipitate the removed CO<sub>2</sub> as bicarbonate. The aqueous solution is recycled. Various valuable byproducts, including sodium bicarbonate, sodium carbonate, ammonium bicarbonate, and hydrochloric acid, are produced. Ammonia is generated by reacting an ammonium salt with either acidic or basic materials. Non-limiting examples of suitable ammonium salt include ammonium chloride, ammonium sulfate, ammonium bisulfate, and ammonia nitrate, those of the acidic material include ammonium bisulfate and sulfuric acid, and those of the basic material include calcium oxide, limestone, dolomite, cement kiln dust, calcium-rich fly ash, steel and iron slag, and silicate rocks or mining wastes that are rich in serpentine, olivine or wollastonite.



**1st Main Claim**  
[EN] 1. A method for sequestering at least a portion of CO<sub>2</sub> from a volume or stream of CO<sub>2</sub>-bearing gas, comprising: (a) reacting an ammonium salt with either acidic or basic materials, whereby generating ammonia; (b) dissolving said ammonia in a recycled aqueous solution, whereby producing a basic ammoniated solution; (c) reacting said volume or stream of CO<sub>2</sub>-bearing gas with said basic ammoniated solution, whereby removing at least a portion of CO<sub>2</sub> from said CO<sub>2</sub>-bearing gas, precipitating said CO<sub>2</sub> as bicarbonate, and resulting in a CO<sub>2</sub>-depleted gas and said recycled aqueous solution; and (d) removing said precipitated bicarbonate from said recycled aqueous solution.

**Assignees:** ZHONG SHAOJUN; SHAOJUN ZHONG

## 207. Family 90756445 (US2024018046 AA)

[View in PatBase](#)

### Title (EP4222128 A1)

[EN] EARLY STRENGTH SLAG-BASED CEMENTITIOUS BINDER

### Abstract (EP4222128 A1)

[EN] The present invention provides exemplary method and additive for making cementitious binders that comprise primarily ground granulated blast furnace slag (GGBFS) having excellent strength at 24 hours, with preferably little or minimal amounts of Ordinary Portland Cement (OPC). As OPC manufacture involves carbon dioxide release into the atmosphere, the use of a GGBFS-based binder composition will help to enhance sustainability practices in the construction industry and minimizing strength losses implied by deletion of OPC. Strength in the GGBFS binder composition is enhanced by an alkaline-earth activator in combination with a strength enhancing component comprising dispersant and secondary activator.

### 1st Main Claim (EP4222128 A1)

[EN] 1. A method for making a cementitious composition, comprising: mixing together with water the following components: (A) a cementitious binder composition comprising ground granulated blast furnace slag (GGBFS) in an amount of 71 percent -100 percent based on total dry weight of the cementitious binder component; (B) at least one alkaline-earth activator chosen from  $\text{Ca(OH)}_2$ , CaO, MgO, or a mixture thereof; and (C) an early strength enhancer component comprising (i) at least one slag dispersant chosen from a polycarboxylate ether (PC) type polymer dispersant, a nonPC dispersant chosen from a sulfonate type dispersant or a phosphonate type dispersant; and (ii) at least one activator chosen from calcium nitrate, calcium nitrite, calcium chloride, sodium chloride, triethanolamine, methyldiethanolamine, sodium thiocyanate, or mixture thereof.

**Assignees:** GCP APPLIED TECH INC

PatBase - ID202307860 A

208. Family 103078135 (KR102675583 B1)

[View in PatBase](#)

Title

[EN] GEO-POLYMER COMPOSITE HAVING BIOCHA AND FURNACE SLAG AND MORTAR COMPOSITE HAVING SUCH GEO-POLYMER COMPOSITE

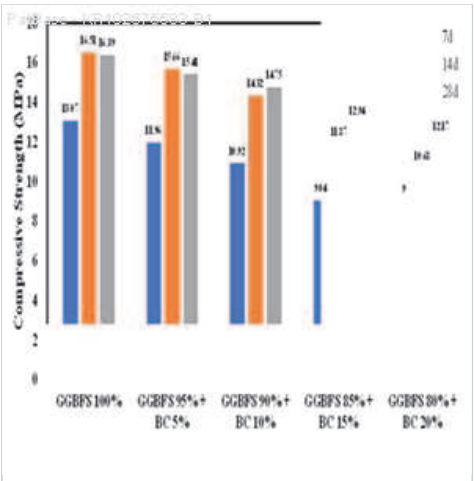
Abstract

[MT] The present invention is directed to a " sedative-polymer composition comprising " biochar and blast " as well as a " geomagnetic-free binder , and a " sedative-fine powder , and a composition comprising blended water and  $ca(Oh)_2$  , thereby reducing the amount of carbon dioxide emissions resulting from cement production and contributing to the achievement of national ematsutheir Odance gas reduction targets .

1st Main Claim

[MT] 1. Binding material, compounded water and additives; the binding material is mixed with blast furnace slag fines, characterized in that the biochar fine powder powderizes a biochar obtained by pyrolysis of biomass generated in a wood-pellet power plant; the blast furnace slag fine powder is included at 90% by weight, and the biochar as non-pulverized water (WOH) in a total of 100% by weight ratio  $ca_2$ Of the total weight of the binder is contained in 5 parts by weight relative to 100 parts by weight of the binder ; and the degree of pulverization of the bio-vehicle fine powder is  $12,000\text{ cm}^2\text{G/g}$  and the degree of powder of blast furnace slag fines is  $4,000\text{ cm}^2\text{G/g}$ .

**Assignees:** KOREA INST OF CIVIL ENGINEERING AND BUILDING TECH; KOREA INST CIVIL ENG AND BUILDING TECH; KOREA INST OF CIVIL ENGINEERING AND BUILDING TECHNOLOGY KICT



209. Family 103916708 (WO24163636 A1)

[View in PatBase](#)

Title

[EN] MITIGATING CHLORIDE ION OXIDATION DURING SALINE WATER ELECTROLYSIS FOR HYDROGEN PRODUCTION AND CARBON DIOXIDE MINERALIZATION

Abstract

[EN] The present disclosure relates to methods of sequestering CO<sub>2</sub> comprising a first cathodic chamber, performing a first alkaline process, a first anodic chamber, performing a first acidic process, and dechlorinating a solution by contacting the solution with a dechlorinating agent. Also provided herein are systems comprising a first cathodic chamber and a first anodic chamber.

1st Main Claim

[EN] 1. A method of sequestering CO<sub>2</sub> comprising: (a) in a first cathodic chamber, performing an alkaline process comprising: (i) alkalinizing a first solution by contacting the first solution with a cathode disposed inside the cathodic chamber, thereby forming an alkaline solution and H<sub>2</sub>, wherein the first solution comprises water and divalent alkaline earth ions;(ii) contacting the alkaline solution with a CO<sub>2</sub> source, thereby forming a carbonated solution comprising a mixture of ionic compounds, wherein the ionic compounds comprise CCE<sup>2+</sup>; (b) in a first anodic chamber, performing an acidic process comprising: (i) acidifying a second solution comprising chloride ions by contacting the second solution with an anode disposed inside the anodic chamber, thereby forming an acidic solution; and (ii) deacidifying the acidic solution by contacting the acidic solution with a deacidifying agent, thereby forming a deacidified solution; and(c) dechlorinating the acidic solution or deacidified solution by contacting the acidic solution or the deacidified solution with a dechlorinating agent; wherein: the cathodic chamber and the anodic chamber are in ionic communication; and the acidic process and the alkaline process are performed simultaneously or sequentially.

**Assignees:** UNIV CALIFORNIA; THE UNIV OF CALIFORNIA



210. Family 46814491 (US2009301352 AA)

[View in PatBase](#)

Extended Family Number: 42613795

Title

[EN] PRODUCTION OF CARBONATE-CONTAINING COMPOSITIONS FROM MATERIAL COMPRISING METAL SILICATES

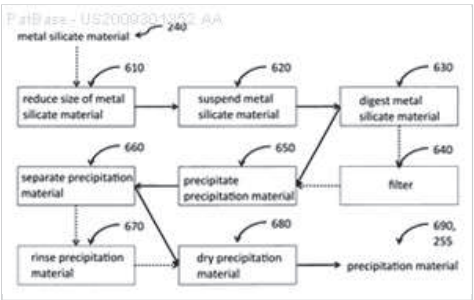
Abstract

[EN] Provided are methods for producing carbonate-containing compositions comprising silicon-based material (e.g., pozzolanic material) from a source of carbon dioxide, a divalent cation-containing solution, and a source of proton-removing agents. In such methods, divalent cations of the divalent cation-containing solution are provided by digestion of material comprising metal silicates. Also provided are methods for producing carbonate-containing compositions comprising little or no silicon-based material. In such methods, silicon-based material (e.g., silica, unreacted or undigested silicates, aluminosilicates, etc.) may be separated and processed separately from carbonate-containing compositions. Silicon-based material and carbonate-containing material may be blended at a later stage to produce a pozzolanic material, which may be further processed and blended with, for example, Portland cement.

1st Main Claim

[EN] 1. A method comprising: a) digesting a material comprising a metal silicate with an aqueous solution to produce divalent cations and a material comprising SiO<sub>2</sub>; b) reacting the divalent cations with dissolved carbon dioxide to produce a precipitation material; and c) drying the precipitation material.

**Assignees:** TUET PHILIP; CONSTANTZ BRENT R; FARSAD KASRA; RYAN CECILY; CLODIC LAURENCE; FERNANDEZ MIGUEL; BROWN JR GORDON E; GERAMITA KATHARINE; OMELON SIDNEY; MONTEIRO PAULO; CALERA CORP



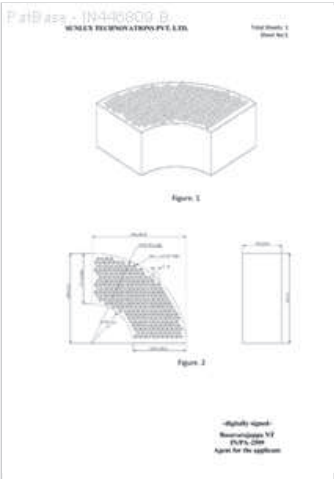
211. Family 95914860 (IN202241070973 A)

[View in PatBase](#)

**Title**  
[EN] CARBON DIOXIDE ABSORBENT BED

**Abstract**  
[EN] The invention discloses the composition and method of manufacturing and use of carbon dioxide absorption bed or CA bed. The composition comprises a potassium bicarbonate (KHCO<sub>3</sub>), that acts as active CO<sub>2</sub> gas-absorbent component, a support matrix SLA-92, provides structure and porosity for better absorption of CO<sub>2</sub>, a sepiolite binder provides a good mechanical integrity and strength and a distilled water as solvent to prepare slurry for the molding process. The method comprises the preparation of dry and wet mixture composition, molding of CA bed and post molding one time activation. Further use of the CA bed comprises steps of the CO<sub>2</sub> absorption and regeneration process for repetitive application.

**1st Main Claim**  
[EN] 1. Composition of a carbon dioxide absorbent bed (CA Bed) comprises: an active component, that acts as active CO<sub>2</sub> absorbent; a support matrix provides structure and porosity for absorption of CO<sub>2</sub>; a binder provides a good mechanical integrity and strength with catalytic advantage (due to presence of alumina) to improve the overall strength of the absorbent bed; a solvent to prepare slurry for a molding process of desired shape and size



212. Family 93808907 (US2023036470 AA)

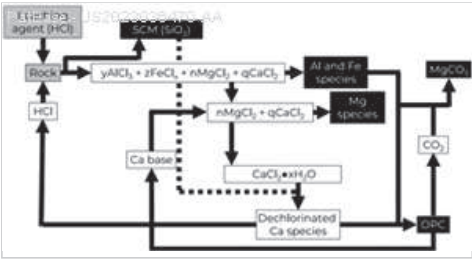
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**Title (EP4323320 A1)**  
[EN] CEMENTITIOUS PRODUCTION FROM NON-LIMESTONE MATERIAL

**Abstract (EP4323320 A1)**  
[EN] Methods and composition are provided for deriving cement and/or supplementary cementitious materials, such as pozzolans, from one or more non-limestone materials, such as one or more non-limestone rocks and/or minerals. The non-limestone materials, e.g., non-limestone rocks and/or minerals, are processed in a manner that a desired product, e.g., cement and/or supplementary cementitious material, is produced.

**1st Main Claim (EP4323320 A1)**  
[EN] 1. A method for producing clinker comprising: (a) contacting a non- limestone material comprising calcium with hydrochloric acid to produce a calcium-depleted solid fraction and a calcium-rich liquid fraction comprising calcium chloride; (b) treating the calcium-rich liquid fraction to produce a solid comprising calcium chloride; (c) dechlorinating the solid comprising calcium chloride to produce a dechlorinated solid comprising calcium compounds; and (d) treating the dechlorinated solid comprising calcium to produce clinker.

**Assignees:** BRIMSTONE ENERGY INC; SULPHUR ENERGY INC



213. Family 66522725 (US2019048437 AA)

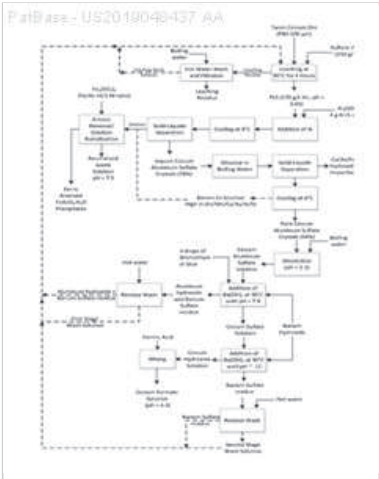
[View in PatBase](#)

**Title**  
[EN] RECOVERY OF CESIUM FROM EPITHERMAL MINERAL DEPOSITS

**Abstract**  
[EN] Hydrometallurgical processes are provided for the recovery of metal values, including cesium, from epithermal mineral deposits, including pharmacosiderite-containing ores. Aspects of the process involve the preferential formation of a cesium alum, and preparation of cesium hydroxide from the cesium alum.

**1st Main Claim**  
[EN] 1. A process for extracting cesium from an ore, or a concentrate of the ore, wherein the ore is derived from an epithermal mineral deposit comprising Cs, Rb and K, the process comprising: leaching the ore with an acid in a heated leaching solution, to produce a cesium-containing leachate; separating the liquid cesium-containing leachate from a solid leach residue by solid-liquid separation; treating the liquid leachate solution with an aluminum salt and cooling the solution, to provide conditions in a mother liquor that favour the formation of a cesium alum precipitate over the formation of other solid alkali metal alums in the mother liquor; separating the cesium alum from the mother liquor, leaving a cesium-alum-barren solution; and, directing the cesium alum to a purification and cesium recovery process.

**Assignees:** CASCADERO COPPER CORP



## 214. Family 65530343 (CN106587788 A)

[View in PatBase](#)

### Title

[EN] LOW-CEMENT-CONTENT SELF-COMPACTING CONCRETE AND PREPARATION METHOD THEREOF

### Abstract

[EN] The invention provides low-cement-content self-compacting concrete. The low-cement-content self-compacting concrete is composed of the following ingredients: 100-220kg/m<sup>3</sup> of cement, 50-200kg/m<sup>3</sup> of mineral admixture, 500-650kg/m<sup>3</sup> of fine aggregate, 720-900kg/m<sup>3</sup> of coarse aggregate, 15-40kg/m<sup>3</sup> of concrete additive and 60-240kg/m<sup>3</sup> of water. A preparation method of the self-compacting concrete comprises the following steps: (1) putting the fine aggregate, coarse aggregate, cement, a water reducing agent and water into a mixing machine according to the formula ratio, and obtaining cement mortar; (2) putting the mineral admixture into the cement mortar, and mixing; and (3) then putting the rest concrete additive and the rest of water, mixing, and uniformly stirring, so that the self-compacting concrete is obtained. The low-cement-content self-compacting concrete provided by the invention can greatly reduce the cement content, reduce shrinkage by reducing the water cement ratio and improve the stability and strength of concrete, and carbon dioxide emission is reduced as the cement content is reduced, thereby being beneficial to energy conservation, emission reduction, consumption reduction and sustainable development of the environment.

### 1st Main Claim

[MT] 1. A low cement content of self-compacting concrete, characterized in that it consists of the following components: 220Kg/m<sup>3</sup> ~ 100 cement, mineral admixture of 50 to 200 kg/m<sup>3</sup>, fine aggregate, coarse aggregate 720 ~ 500 ~ 650kg/m<sup>3</sup> 900kg/m<sup>3</sup>, concrete admixtures kg / m<sup>3</sup> ~ 15, water 60 to 240 kg/m<sup>3</sup>.

**Assignees:** CHANGSHA KAMILE SU CHEMICAL CO LTD

## 215. Family 88506326 (CN113735479 A)

[View in PatBase](#)

### Title

[EN] PREPARATION METHOD OF CALCIUM CARBONATE COATED MODIFIED WASTE RUBBER POWDER

### Abstract

[EN] The invention discloses a preparation method of calcium carbonate coated modified waste rubber powder, and belongs to the technical field of high polymer material modification. The method comprises the following steps: (1) performing surface clear water treatment of waste rubber powder; (2) treating the surface of the waste rubber powder with an acidic solution; (3) treating the surface of the waste rubber powder with a coupling agent; (4) coating the surface of the waste rubber powder with calcium carbonate; and (5) crushing the modified waste rubber powder aggregate. Through a multi-stage treatment process, the interface compatibility and the interface bonding strength of the obtained modified waste rubber powder and cement paste are remarkably improved; in addition, a composite structure with the organic waste rubber powder as a core and inorganic calcium carbonate as a shell is formed, so that the mechanical property and durability of the waste rubber powder are obviously improved.

### 1st Main Claim

[MT] 1. A preparation method of calcium carbonate overmodified spent rubber powder, characterized in that said preparation method comprises the following steps: (1) spent rubber powder surface fresh water treatment; (2) spent rubber powder surface acidic solution treatment; (3) spent rubber powder surface coupling agent treatment; (4) spent rubber powder surface calcium carbonate coating treatment; and (5) modified spent rubber powder agglomerate crushing treatment.

**Assignees:** SHANXI TRANSP SCIENCE AND TECHNOLOGY R AND D CO LTD; SHANXI PROVINCE TRANSP NEW TECHNOLOGY DEVELOPMENT CO LTD; SHANXI JIAOKE BRIDGE ACCESS CO LTD

## 216. Family 102720375 (KR20240069138 A)

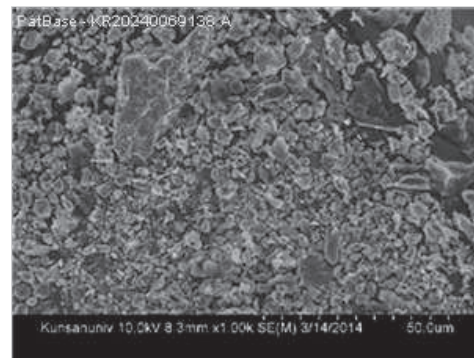
[View in PatBase](#)

### Title

[EN] METHOD FOR PRETREATMENT OF ASH CONTAINING AMOUNT OF FREE CAO USING CARBON DIOXIDE AND COMPOSITION INCLUDING THE PRETREATED ASH AS BINDER

### Abstract

[MT] The invention relates to a method for the pretreatment of ash containing a large amount of free lime and to a composition containing said pretreated ash as a binder . The present invention provides a pretreatment method of preparing an ash containing a large amount of free lime to spread over the entire area of the container , preparing a test body in which the free lime is converted to calcium hydroxide by reacting with water , and carbonating the test body in a carbon dioxide aquatic chamber , It is possible to reduce the concentration of carbon dioxide in the air through trapping / adsorbing property of free lime from the ash containing the large glass lime and also to reduce the concentration of carbon dioxide in the air through trapping / adsorbing property of free lime CO<sub>2</sub> when the pre-treated ash is blended as a binder , and further , it is possible to increase the recycling value of the ash containing the large glass lime which is difficult to be utilized as a conventional construction material .



### 1st Main Claim

[MT] 1. A pretreatment method for ash containing large glass lime carried out by 1. Preparing an ash containing large glass lime to the entire area of the container, 2) introducing water to the container to prepare a test body, and 3) allowing the test body to carbonation in a carbon dioxide curing chamber to capture carbon dioxide in the test body.

**Assignees:** GACHON UNIV OF IND ACADEMIC COOPERATION FOUNDATION; UNIV GACHON IND ACAD COOP FOUND

## 217. Family 66860613 (US2017253530 AA)

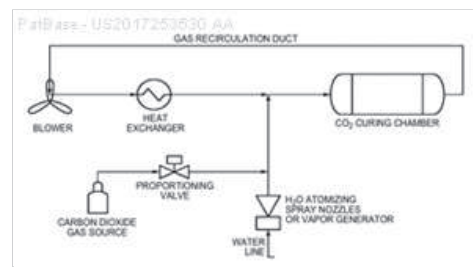
[View in PatBase](#)

### Title (EP3423421 B1)

[EN] WHITE CARBONATABLE CALCIUM SILICATE BASED CEMENTS AND METHOD OF PREPARATION

### Abstract

[EN] The invention provides a new class of carbonatable calcium silicate-based, white clinkers and the ground cement produced from these clinkers, as well as methods of their production and use thereof. The disclosed white clinkers and the ground cement exhibit a high brightness and are suitable for use in products with high aesthetic considerations.



### 1st Main Claim (EP3423421 B1)

[EN] 1. A white carbonatable calcium silicate cement composition, comprising:

- one or more discrete crystalline calcium silicate phases selected from CS (wollastonite or pseudowollastonite), C<sub>3</sub>S<sub>2</sub> (rankinite), C<sub>2</sub>S (belite, larnite, bredigite), and
- an amorphous calcium silicate phase,
- wherein the one or more discrete crystalline calcium silicate phases form about 30 percent or more by mass of the total phases, and wherein
- elemental Ca and elemental Si are present in the composition at a molar ratio from about 0.8 to about 1.2;
- metal oxides of Al, Fe and Mg are present at about 30 percent or less by mass;
- the total color-imparting oxides of one or more of metals selected from Fe, Ti, Mn and Cr are present in an amount of less than about 1.5 percent by mass of the total cement composition;
- wherein the cement composition is **characterized by** a reflectance value (L\*), as measured from the Hunter L\*a\*B color scale, of greater than about 85 percent; and
- wherein each of the crystalline and amorphous phases is suitable for carbonation with CO<sub>2</sub>.

**Assignees:** SOLIDIA TECHNOLOGIES INC; SOLIDIA TECH INC

218. Family 43625040 (US2009202410 AA)

[View in PatBase](#)

Title (EP2274070 A2)

[EN] CAPTURE AND SEQUESTRATION OF CARBON DIOXIDE IN FLUE GASES

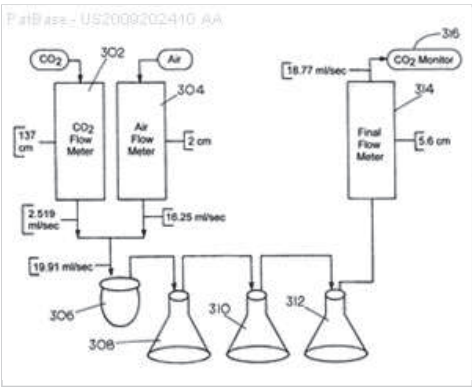
Abstract (EP2274070 A2)

[EN] There is provided a process for the capture and sequestration of carbon dioxide that would otherwise enter the atmosphere and contribute to global warming and other problems. CO<sub>2</sub> capture is accomplished by reacting carbon dioxide in flue gas with an alkali metal carbonate, or a metal oxide, particularly containing an alkaline earth metal or iron, to form a carbonate salt. A preferred carbonate for CO<sub>2</sub> capture is a dilute aqueous solution of additive-free (Na<sub>2</sub>CO<sub>3</sub>). Other carbonates include (K<sub>2</sub>CO<sub>3</sub>) or other metal ion that can produce both a carbonate and a bicarbonate salt. Examples of suitable metal oxides include several alkaline earths including CaO and MgO. The captured CO<sub>2</sub> is preferably sequestered using any available mineral or industrial waste that contains calcium magnesium or iron in non- carbonate forms, or iron in the Fe+2 oxidation state.

1st Main Claim (EP2274070 A2)

[EN] 1. A method of capturing and sequestering carbon dioxide in carbon dioxide bearing gases of interest comprising: (a) capturing carbon dioxide by reacting a gas of interest with an aqueous alkali metal carbonate solution to form a bicarbonate solution; and (b) sequestering said captured CO<sub>2</sub> by reacting with a material selected from waste materials containing a metal selected from alkaline earth metals including calcium and magnesium, and iron in non-carbonate form or mixtures thereof.

**Assignees:** UNIV MICHIGAN TECH; KAWATRA SURENDRA KOMAR; SIMMONS JOHN J; EISELE TIMOTHY C; MICHIGAN TECHNOLOGY UNIV; MICHIGAN TECHNOLOGY UNIVERSITY



219. Family 51504944 (JP2012513944 T2)

[View in PatBase](#)

Extended Family Number: 42613795

Title

[MT] A method of capturing CO2

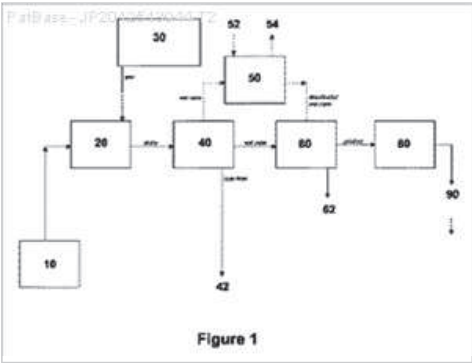
Abstract

[EN] Methods of sequestering carbon dioxide (CO2) are provided. Aspects of the methods include precipitating a storage stable carbon dioxide sequestering product from an alkaline-earth-metal-containing water and then disposing of the product, e.g., by placing the product in a disposal location or using the product as a component of a manufactured composition. Also provided are systems for practicing methods of the invention.

1st Main Claim

[MT] including the process of removing a proton without process of removing said proton 2.

is, to use the base, the process according to claim 1.



220. Family 51355427 (CN102502749 A)

[View in PatBase](#)

Title

[EN] METHOD FOR PREPARING ROSE CALCIUM CARBONATE FROM LOW-GRADE LIMESTONE

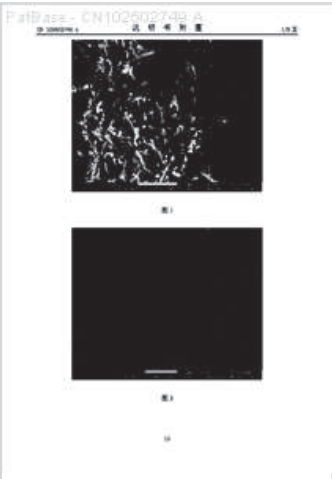
Abstract

[EN] The invention discloses a method for preparing rose calcium carbonate from low-grade limestone, which comprises the following steps: 1) proportionally calcining low-grade limestone and blind coal to prepare calcium oxide; 2) screening under vibrations to remove coal ash and lime powder, thereby obtaining lumpy lime; 3) adding water to slake the lumpy lime, removing impurities by hydrocyclone and vibration screening to obtain fine emulsion slurry, adding a whitener, and aging to obtain the Ca(OH)<sub>2</sub> prime slurry; 4) after regulating the temperature and concentration of the Ca(OH)<sub>2</sub> prime slurry, adding a crystal form control agent, carrying out bubbling carbonation reaction, and adding a dispersant; when the PH value of the slurry is lower than or equal to 7, stopping carbonation to obtain a cured slurry; and 5) after the cured slurry is thickened, dehydrating to obtain the rose calcium carbonate. Compared with common light calcium carbonate, the rose calcium carbonate disclosed by the invention has the advantages of higher crystal completeness, high surface porosity, high light scattering coefficient and stronger covering power; and the invention is applicable to the industries of paper making, rubber, plastics and paint.

1st Main Claim

[MT] CN 1. A low-grade limestone prepared using calcium carbonate rosettes method comprising the following steps: 1) according to the ratio will be low-grade limestone and anthracite and calcined to form calcium oxide; 2) by vibration screening to remove ash and lime powder, prepared to block lime; 3) by adding water to digest massive lime, spin-liquid separation and vibration sieving method for removing impurities get refined whey and adding brighteners, subjected to aging, to obtain Ca (OH) <sub>2</sub> raw pulp; 4) After adjusting the Ca (OH) <sub>2</sub> the temperature and concentration of raw pulp, adding crystalline control agent, then bubbling carbonation reaction, and adding a dispersant; when slurry PH (7, stop the carbonation, get cooked pulp; 5) cooked pulp by-enriched, dehydration cake is rose-shaped calcium carbonate.

**Assignees:** FUJIAN WANQI NON METAL MATERIALS CO LTD; FUJIAN WANQI NONMETALLIC MATERIALS CO LTD



## 221. Family 71475450 (CN108640542 A)

[View in PatBase](#)

### Title

[EN] GEOPOLYMERIC CEMENT SOLIDIFYING HEAVY METALS AND STORING CO<sub>2</sub> AND PREPARATION METHOD THEREOF

### Abstract

[EN] The invention belongs to the technical field of alkali-activated cement, and particularly relates to geopolymeric cement solidifying heavy metals and storing CO<sub>2</sub> and a preparation method thereof. By loading waste ash and one or more of granulated blast-furnace slag particles, CaO, Ca(OH)<sub>2</sub>, NaOH, MgO and Na<sub>2</sub>SiO<sub>3</sub> into a ball-milling tank of a ball-milling machine, introducing the CO<sub>2</sub> gas into the ball-milling tank and conducting ball-milling for 2-6 hours, the geopolymeric cement solidifying the heavy metals and storing the CO<sub>2</sub> is prepared. By means of the scheme, heavy metal pollution can be controlled from the source, the heavy metal extracting toxicity of the geopolymeric cement is very low, harmlessness, reduction and recycling of the solid waste are achieved, meanwhile, a CO<sub>2</sub> storage technology is achieved, and the CO<sub>2</sub> discharging amount is reduced.

### 1st Main Claim

[MT] 1. A method for curing heavy metal sequestration ready CO<sub>2</sub>geopolymer cement production method, characterized in that: The waste ash, and taken from the granulated blast furnace slag particles, CAO, Ca(OH)<sub>2</sub>, NAOH or Na<sub>2</sub>SIO<sub>3</sub>, MGO, one or more raw materials, together into a ball mill jar, the jar mill pass into CO<sub>2</sub>gas, were milling 2-6 hours to obtain a curing heavy metal sequestration ready CO<sub>2</sub>geopolymer cement.

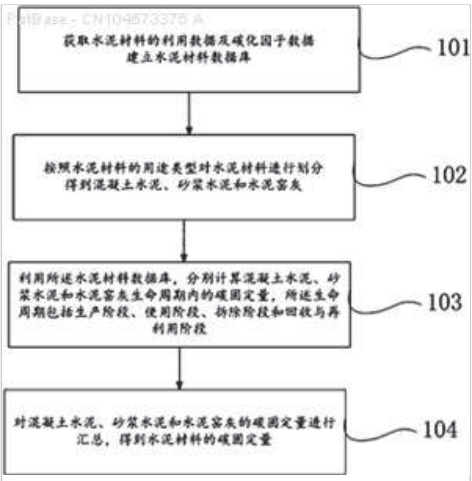
**Assignees:** UNIV FUZHOU; FUZHOU UNIV

222. Family 59211957 (CN104573375 A)

[View in PatBase](#)

**Title**  
[EN] CEMENT MATERIAL CARBON SEQUESTRATION CALCULATION METHOD AND DEVICE

**Abstract**  
[EN] The invention provides a cement material carbon sequestration calculation method and device. The method includes the steps of obtaining use data and carbonation factor data of a cement material to establish a cement material database; classifying the cement material into concrete cement, mortar cement and cement kiln dust according to the use types of the cement material; respectively calculating the amount of carbon sequestration of the concrete cement, the mortar cement and the cement kiln dust in the life cycle through the cement material database, wherein the life cycle comprises a production stage, a use stage, a removing stage and a recycling stage; summarizing the amount of carbon sequestration of the concrete cement, the mortar cement and the cement kiln dust to obtain the amount of carbon sequestration of the cement material. The cement material carbon sequestration calculation method and device can comprehensively and accurately calculate the amount of carbon sequestration of different cement materials in different stages, have important significance for global missing carbon sink study and provide basis for negotiations of response to climate changes for China.



1st Main Claim

[MT] 1 A cement material fixed carbon accounting method, wherein the method comprises:

Acquiring data and carbonation cement material factor data, the establishment of cement material database;

The use according to the type of cement materials for cement materials division, to give concrete cement, mortar, cement and cement kiln dust; use the cement material database, respectively calculate the carbon fixed amount of cement concrete, mortar, cement and cement kiln dust life cycle, including the production phase of the life cycle, use phase, demolition phase and recycling and reuse phases; concrete cement, mortar, cement and carbon fixed amount of cement kiln dust summarize, a fixed amount of cement to obtain a carbon material.

**Assignees:** INST APPLIED ECOLOGY CAS; OF APPLIED ECOLOGY CHINESE ACADEMY OF SCIENCES INST

223. Family 107296216 (KR20250043166 A)

[View in PatBase](#)

Title

[EN] CONCRETE MINERAL CARBONATION METHOD USING ALKALINE AQUEOUS SOLUTION

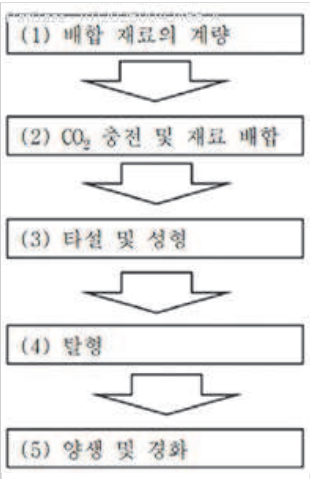
Abstract

[MT] The present invention relates to a method for carbonizing concrete minerals using an alkaline aqueous solution. The present invention comprises a method of mixing an alkaline aqueous solution as mixing water instead of aggregate and water into fresh cement, and simultaneously injecting gaseous or liquid carbon dioxide (CO<sub>2</sub>) to induce a carbonation reaction with calcium ions (Ca<sup>2+</sup>) dissolved in an extremely early cement hydration process, thereby performing a mineral carbonation process. The alkaline aqueous solution promotes chemical dissociation and ionization of the injected CO<sub>2</sub>, and controls the pH, which decreases during the reaction process, without a separate additive, thereby maximizing mineral carbonation that permanently stores CO<sub>2</sub> in the form of minerals inside the cement.

1st Main Claim

[MT] A cement mixture is obtained by mixing aggregate and an alkaline aqueous solution with fresh cement as mixing water, and injecting gaseous or liquid carbon dioxide (CO<sub>2</sub>) at the same time as the mixing to perform a mineral carbonation process.  
Casting and molding the above cement mixture,  
A method for mineral carbonation of concrete using an alkaline aqueous solution, comprising curing a molded article after the molding described above.

**Assignees:** SEOUL NATIONAL UNIV R AND DB FOUNDATION; SEOUL NAT UNIV R AND DB FOUNDATION; INDUSTRIAL ACADEMIC COOPERATION GROUP SEOUL NATIONAL UNIV



224. Family 90795995 (CN114290511 A)

[View in PatBase](#)

Title

[EN] METHOD FOR ENHANCING SOLID CONTENT OF CARBON DIOXIDE IN CEMENT-BASED MATERIAL

Abstract

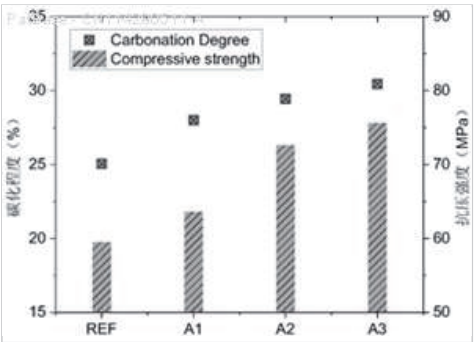
[EN] A method for enhancing carbon dioxide solid content in a cement-based material mainly comprises the following steps: uniformly mixing a CO2 absorbent with the cement-based material, selecting compression molding or pouring molding according to the state of the mixture, demolding after molding, and carrying out CO2 curing. According to the invention, the CO2 absorbent is added into the cement-based material, so that the mixture of the cement-based material and the CO2 absorbent absorbs CO2 gas before molding or in the curing process, and the part of CO2 gas can be released along with the proceeding of the subsequent curing process, thereby achieving the carbonization process from inside to outside. According to the method, the CO2 solid storage degree of the cement-based material can be improved, the compactness and strength of the material are improved, and compared with methods of greatly increasing CO2 pressure and the like in the curing process, the cost is low, the process is simple, and CO2 can rapidly migrate and react in the cement-based material.

1st Main Claim

[MT] 1. A method of reinforcing CO2 in a cement-based material, characterized by comprising the steps of:

- (1) Formulating a CO2 absorbent solution;
- (2) Homogeneously mixing the CO2 absorbent solution formulated in step (1) with the cement-based material to obtain the CO2 absorbent containing cement-based material, press forming, demolding, precuring, or pre-curing, re-demolding before demolding; or direct casting, precuring, re-demolding;
- (3) Placing the CO2 absorbent-containing cementitious base material block after step (2) into a CO2 curing tank for CO2 curing.

Assignees: HUNAN UNIV; UNIV HUNAN



## 225. Family 46814501 (US2010132591 AA)

[View in PatBase](#)

**Extended Family Number:** 42613795

### Title

[EN] HYDRAULIC CEMENTS COMPRISING CARBONATE COMPOUND COMPOSITIONS

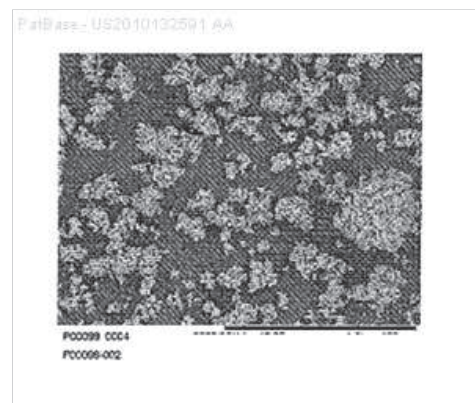
### Abstract

[EN] Hydraulic cement compositions that include a carbonate compound composition, e.g., a salt-water derived carbonate compound composition containing crystalline and/or amorphous carbonate compounds, are provided. Also provided are methods of making and using the hydraulic cements, as well as settable compositions, such as concretes and mortars, prepared therefrom. The cements and compositions produced therefrom find use in a variety of applications, including use in a variety of building materials and building applications.

### 1st Main Claim

[EN] **1.** A method comprising: contacting an alkaline-earth-metal-containing water with an industrial waste stream CO<sub>2</sub> source, wherein said alkaline-earth-metal-containing water comprises strontium; subjecting said alkaline-earth-metal-containing water to carbonate compound precipitation conditions sufficient to produce a precipitated metastable carbonate compound composition comprising CO<sub>2</sub> from said CO<sub>2</sub> source and strontium present in the carbonate composition in an amount ranging from 3 to 10,000 ppm, wherein said metastable carbonate compound composition is characterized by being more stable in salt water than in fresh water; and using said carbonate compound composition to produce a hydraulic cement composition.

**Assignees:** RYAN CECILY; CONSTANTZ BRENT R; CLODIC LAURENCE; CALERA CORP



## 226. Family 1687405 (DE2801702 A1)

[View in PatBase](#)

### Title

[EN] CONTROLLED SETTING, REDUCED SHRINKAGE PORTLAND CEMENT MIX - CONTG. ACID (SALTS) AND/OR CARBON DI:OXIDE

### Abstract

[EN] A Portland cement mix. comprises ground Portland cement with(out) gypsum, together with aggregate, sufficient water for hydraulic setting and added CO<sub>2</sub> to control setting and stabilise the cement. Pref. 0.1-6.0 weight percent CO<sub>2</sub> is added and the mix also contains an acid (salt) chosen from CaCl<sub>2</sub>, MgCl<sub>2</sub>, HCl, H<sub>2</sub>SO<sub>4</sub>, H<sub>3</sub>PO<sub>4</sub> and/or HNO<sub>3</sub> so as to accelerate silicate hydration. The acid salt is added in an amt. of 0.1-5.0 weight percent and then 0.3-3.0 weight percent CO<sub>2</sub> is added. The CO<sub>2</sub> and the acid (salts) maintain fluidity of the cement slurry and minimise cement shrinkage during drying and atmospheric carbonation.

### 1st Main Claim

[MT] 1 Claims UE CHE 1 \* Portland cement mixture, characterized in that it has a ground Portland cement with or without gypsum addition, aggregate, sufficient water to effect hydraulic solidification contains the cement and that their carbon dioxide was added in one of the like amount to the solidification of the mixture control and can stabilize the hydrated cement segment.

**Assignees:** WESTVACO CORP

227. Family 70677430 (TW201833055 A)

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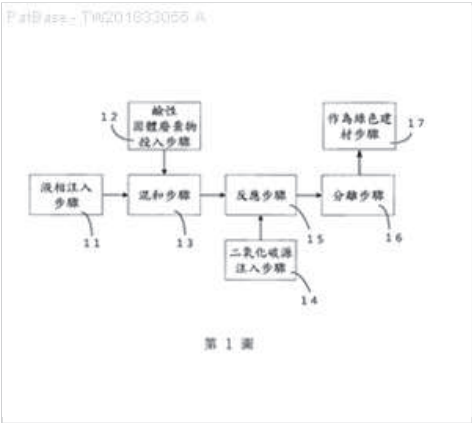
**Title**  
[EN] A METHOD OF MODIFYING ALKALINE SOLID WASTES AS GREEN CONSTRUCTION MATERIALS

**Abstract**  
[EN] A method of using CO<sub>2</sub>-containing flue gas for stabilizing alkaline solid wastes was proposed to reduce the activity and alkalinity of solid wastes. The method includes seven steps: (1) liquid solution injection, (2) alkaline solid waste injection, (3) mixing, (4) CO<sub>2</sub>-containing gas injection, (5) reaction, (6) separation and (7) utilization as green materials. The method was intended to provide a green solution to using the CO<sub>2</sub> composition in the flue gas to stabilize the alkaline solid wastes for further utilization as green construction materials. In this case, the conventional stabilization methods using long period of steam treatment under high temperatures and pressure can be avoided to minimize the land requirement and energy/material consumption. In addition, the stabilized solid wastes via this method are suitable to use as green construction materials since the volume instability and highly alkaline properties of cement and/or concrete can be significantly reduced.

**1st Main Claim**

[MT] 1. A species of 鹼 solid body waste abandoned as a green building materials, color was changed qualitative growth method special levy flattened using a source of gas, and carbon dioxide emissions of solid waste abandoned, 鹼 body beneath the liquid phase medium anti should, in stabilization of 鹼 solid body waste abandoned active substances, really security given, solid body waste abandoned, as a green building materials, improved color sik should avoid day after modeling construct material out of the body of the expansion phenomenon. Now accumulate

**Assignees:** CHIANG PEN CHI



## 228. Family 698210 (GB1390814 A)

[View in PatBase](#)

### Title

[EN] DESULPHURIZING PROCESS FOR A MOLTEN PIG IRON AND A DESULPHURIZING AGENT

### Abstract

[EN] 1390814 Desulphurizing agent AIKOH CO Ltd 5 May 1972 [8 May 1971] 21102/72 Heading C7M A desulphurizing agent for molten pig iron comprises in wt per cent. 32-65 Na<sub>2</sub>CO<sub>3</sub>, 5-45 NaOH and 10-30 water. It may also contain up to 20 CaCO<sub>3</sub> and/or Ca(OH)<sub>2</sub>, up to 18 of at least one of CaB<sub>4</sub>O<sub>7</sub>A6H<sub>2</sub>O, CaB<sub>4</sub>O<sub>7</sub>A4H<sub>2</sub>O, Na<sub>2</sub>B<sub>4</sub>O<sub>7</sub>, Na<sub>2</sub>B<sub>4</sub>O<sub>7</sub>A1DH<sub>2</sub>O, or CaF<sub>2</sub> and 4-12 of Portland cement, blast furnace cement, white cement, iron cement or alumina cement. The agent is formed by mixing the components in air, preferably for 5-15 mins. until a part or the whole of the NaOH is converted to Na<sub>2</sub>CO<sub>3</sub>. The desulphurizer is either added to the ladle prior to adding the molten pig iron or to the pig iron while it is being blown with nitrogen.

### 1st Main Claim

[EN] 1. A desulphurizing agent for a molten pig iron which comprises 32 to 65 percent by weight of sodium carbonate, 5 to 45%, by weight of sodium hydroxide and 10 to 30 % by weight of water content.

**Assignees:** AIKOH CO

## 229. Family 49245995 (US2011173139 AA)

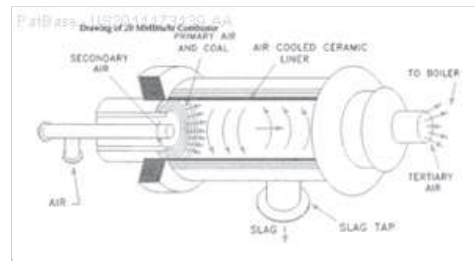
[View in PatBase](#)

### Title

[EN] SLAGGING COAL COMBUSTOR FOR CEMENTITIOUS SLAG PRODUCTION, METAL OXIDE REDUCTION, SHALE GAS AND OIL RECOVERY, ENVIROMENTAL REMEDIATION, EMISSION CONTROL AND CO2 SEQUESTRATION

### Abstract

[EN] Systems, methods and processes teach by specific examples how the cost of sequestering carbon dioxide (CO2) can be totally offset and turned into profits during coal powered electricity generation from revenue and co-benefits. The process is provided whereby fly ash-carbon mixtures, or de-volatilized coal char, or anthracite coal culm is co-fired in an air-cooled, slagging combustor with limestone or similar slag fluxing materials converts the ash into cementitious slag with properties similar to ground granulated blast furnace slag.



### 1st Main Claim

[EN] 1. A process wherein fly ash-carbon mixtures, or de-volatilized coal char, or anthracite coal culm is co-fired in an air-cooled, slagging combustor with limestone or similar slag fluxing materials to convert ash into cementitious slag with properties similar to ground granulated blast furnace slag.

**Assignees:** ZAUDERER BERT

230. Family 98643370 (KR20230122240 A)

[View in PatBase](#)

Title

[EN] METHOD FOR OPTIMAL MIX DESIGN OF SLAG BLENDED CONCRETE CONSIDERING CARBONATION AND FROST DURABILITY AND RECORDING MEDIUM THEREOF

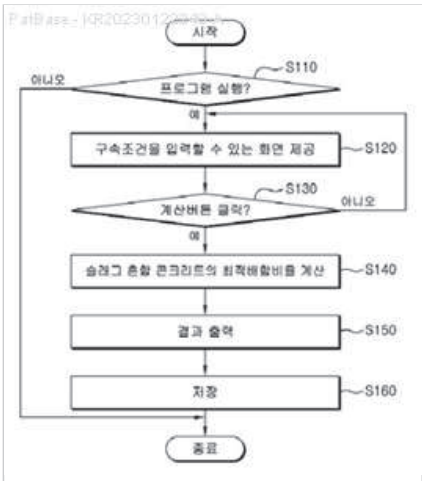
Abstract

[EN] The present invention relates to a method for designing optimal blending of slag-blended concrete. The method comprises: a step in which a computer device provides a screen for entering constraints for blending slag-blended concrete when a program for designing optimal blending of slag-blended concrete is executed; a step in which the computer device calculates, when the constraints are entered, the optimal blending of slag-blended concrete by considering a preset target function and the constraints; and a step in which the computer device outputs the calculated optimal blending result on the screen. According to the present invention, the method has effects of providing the lowest production costs and producing a relatively small amount of carbon dioxide as the method is implemented by considering carbonation durability and frost durability and thus can provide optimal blending design information of eco-friendly slag-blended concrete.

1st Main Claim

[MT] 1. Providing a screen capable of inputting constraint conditions for blending slag mixed concrete, if a program for optimal blending design of slag mixed concrete is executed on a computer device for optimal blending design of slag mixed concrete; Calculating an optimal blending of the slag mixed concrete in consideration of a preset target function and a constraint condition when constraint conditions are input from the computer device ; and outputting the optimal blending result calculated by the computer device to a screen .

**Assignees:** KNU IND COOPERATION FOUNDATION; KNU IND COOPERATION FOUND



## 231. Family 1883830 (GB2166427 A1)

[View in PatBase](#)

### Title

[EN] COMPOSITION - SILICATE BOUND PUMICE, PULVERISED FUEL ASH, LIGHT EXPANDED CLAY AGGREGATES, CINTERED CLAY, FURNACE BOTTOM ASH, SAND AND OR AERATED CONCRETE

### Abstract

[EN] A composite material, bonding light weight aggregates with the alkali metal silicates such as those of sodium and potassium and alkaline earth metal silicates such as those of magnesium and calcium, having a mean weight ratio of silica to alkali metal oxide or alkaline earth metal oxide of 4:1 to 1:1 with varying densities, either as soluble glass, powder, solution, and/or clay loaded solutions produces bonding of a variety of aggregates from fine to large aggregates, either separately or in a variety of combinations of both aggregate sizes and materials, wholly or partly substituting cement and/or lime as the bonding agent. The aggregates may be mixed dry in a mechanical mixer to which the desired quantities of silicate/s and water are added together with fluorosilicate if required. The material can be cast into moulds and may be vibrated or compressed, or alternatively extruded. The material can, when sufficiently set, be kiln, or autoclave cured.

### 1st Main Claim

[EN] 1. A composite material containing pumice, pulverised fuel ash, light expanded clay aggregates, cintered clay, furnace bottom ash, sand or aerated concrete either separately or in a variety of combinations of materials, and at least one of the alkali metal silicates such as those of sodium and potassium.

**Assignees:** BROWN KENNETH MCKENZIE; MCKENZIE BROWN K

232. Family 75594995 (US2021120750 AA)

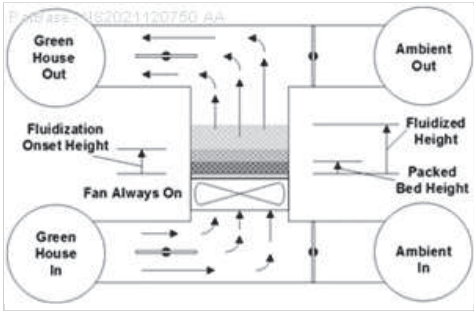
[View in PatBase](#)

Title

[EN] FLUIDIZED BED EXTRACTORS FOR CAPTURE OF CO2 FROM AMBIENT AIR

Abstract

[EN] Methods and apparatus for capturing carbon dioxide from ambient air and delivering said carbon dioxide to an enclosed environment are described. In general, the methods and apparatus comprise contacting a packed bed or fluidized bed device with a stream of ambient air, wherein the packed bed or fluidized bed device comprises a humidity-sensitive sorbent material that adsorbs carbon dioxide from the ambient air; contacting the packed bed or fluidized bed device with a stream of humid air to release the adsorbed carbon dioxide; delivering the released carbon dioxide to an enclosed environment; and optionally, repeating the steps of contacting the packed bed or fluidized bed device with ambient air and humid air in an alternating fashion.



1st Main Claim

[EN] 1. A method for capturing carbon dioxide from a first gas stream and releasing it into a second gas stream, the method comprising:  
a) contacting a packed bed or fluidized bed with a stream of the first gas, wherein the packed bed or fluidized bed comprises a humidity-sensitive sorbent material that adsorbs carbon dioxide from the first gas stream, and wherein the water vapor pressure in the first gas is less than the equilibrium water vapor pressure for a gas in contact with the sorbent;  
b) contacting the packed bed or fluidized bed with a stream of the second gas, wherein the water vapor pressure in the second gas is greater than that of the first gas, thereby releasing the adsorbed carbon dioxide and resulting in a net transfer of carbon dioxide from the first gas stream to the second gas stream; and  
c) optionally, repeating steps (a) and (b).

Assignees: CARBON SINK INC

233. Family 103110538 (CN118184290 A)

[View in PatBase](#)

Title

[EN] METHOD FOR PREPARING GYPSUM BOARD FROM SINTERING FLUE GAS SEMI-DRY DESULFURIZATION ASH AND STEEL SLAG WASTE

Abstract

[EN] The invention relates to a method for preparing a gypsum board from sintering flue gas semi-dry desulfurization ash and steel slag waste. The method comprises the following steps: 1) preparing calcium sulfate whiskers by taking the sintering flue gas semi-dry desulfurization ash as a raw material and adopting a one-step acidification method; 2) preparing steel slag waste residue slurry, adding calcium sulfate whiskers according to the weight ratio of the steel slag waste residue to the calcium sulfate whiskers being 1: (0.1-0.2), and fully stirring to obtain gypsum board raw material slurry; (3) transferring the gypsum board raw material slurry to a curing tank, stirring for not less than 60 minutes at the temperature of 20-30 degrees centigrade in the curing tank, dehydrating the slurry by adopting a vacuum belt type dehydration mode, and controlling the moisture content of the dehydrated slurry to be 45-55 percent; and injecting the dehydrated slurry into a gypsum board template. The method comprises the following steps: firstly, forming calcium sulfate whiskers from sintering flue gas semi-dry desulfurization wastes, then generating gypsum board slurry by utilizing the strength and toughness of the calcium sulfate whiskers and converter waste residues under certain chemical reaction conditions, and then carrying out constant-temperature steam curing to form the solid calcium silicate board.



1st Main Claim

[MT] 1. A process for preparing gypsum board by sintered flue gas semi-dry removal of sulfur ash and slag waste, characterized by comprising the following process steps:

- 1) Preparation of sulfur calcium whiskers using a one-step acidification method using sintered flue gas semi-dry degreening of sulfuric acid as a raw material;
- 2) Preparation of slag sludge slurry, according to the weight ratio of slag sludge to sulfuric acid calcium whisker of 1: (0.1-0.2), add sulfuric acid calcium whiskers, thoroughly stir to obtain gypsum board raw material slurry;
- 3) transfer the gypsum board raw material slurry to the curing tank, the curing tank temperature is 20 to 30 degrees centigrade stirring time is not less than 60 minutes, the slurry is dehydrated, After dewatering the water content of the slurry is controlled at 45% ~ 55%; after dewatering the slurry is injected into the gypsum board template, the gypsum board template is placed into the steaming equipment for steaming, after demolding, to obtain gypsum board products.

Assignees: FUJIAN MUYEGU TECH CO LTD

234. Family 97426268 (CN116161914 A)

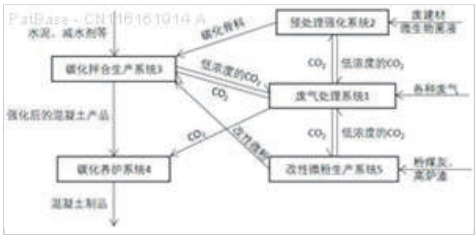
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Title

[EN] METHOD FOR PREPARING PLAIN CONCRETE FROM WASTE GAS AND WASTE BUILDING MATERIALS BY USING MINERALIZED BACTERIA

Abstract

[EN] The invention discloses a method for preparing plain concrete from waste gas and waste building materials by using mineralizing bacteria, which comprises the following steps: treating and recycling waste gas and waste building materials from different sources, and attaching generated calcium carbonate to the surface of aggregate through the mineralization effect of microorganisms, so that the pore strength of the aggregate is improved, and the void ratio is reduced; meanwhile, modified micro powder is produced to replace part of cement, the carbonization efficiency of concrete is enhanced, more CO<sub>2</sub> is absorbed, the carbonization strengthening effect of carbon dioxide on recycled building materials is enhanced through the technical means and methods of controlling temperature and pressure, spraying lime water to provide a reaction calcium source and the like in the later mixing and curing process, CO<sub>2</sub> is continuously absorbed, and the recycling efficiency of the recycled building materials is improved. Concrete products capable of being used for road subbase layers and non-structural areas are manufactured, carbon dioxide is absorbed in the processing and curing process of building materials, therefore, the quality of the products is improved, and a set of complete production device and method are provided in combination with the production technology.



1st Main Claim

[MT] 1. A method for preparing concrete from waste building materials and waste exhaust gases using mineralized bacteria, comprising the steps of: Providing a plurality of concrete components;

S1. Recycling exhaust gases from high carbon emission areas such as cement plants and bitumen blending stations;

S2. The crushed waste building material is cleaned, after which the washed aggregate is sprayed with microbiological mineralized bacterial liquid, and passed into the high CO content obtained after the treatment in step S1<sub>2</sub>The waste gas strengthens the aggregate;

S3. The flue gas of step S1 is introduced into the fly ash and/or blast slag, and the microorganism mineralized bacterial liquor is sprayed, mixed uniformly so that the bacteria are sufficiently solidified onto the fine powder to be modified, and after solidification, oven-dried milling is carried out;

S4. Thoroughly blending the aggregate obtained in step S2, the modified fine powder obtained in step S3, water, cement, and water reducing agent, and introducing the exhaust gas from step S1 during blending, pouring the mixture into a mold after blending uniformly, and performing maintenance after compacting;

S5. The concrete product prepared in step S4 is maintained, when the concrete product is maintained, lime water is sprayed on the concrete product, the whole maintenance process is in CO<sub>2</sub>In the atmosphere of the exhaust gas.

**Assignees:** SHANDONG JIAOTONG UNIV; UNIV SHANDONG JIAOTONG

## 235. Family 98728691 (CN116637478 A)

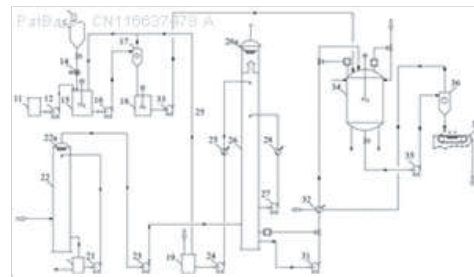
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### Title

[EN] CARBON DIOXIDE MINERALIZATION METHOD AND CARBON DIOXIDE MINERALIZATION DEVICE

### Abstract

[EN] The invention relates to a carbon dioxide mineralization method and a carbon dioxide mineralization device. The carbon dioxide mineralization method comprises the following steps: mixing an absorption liquid and industrial solid wastes at room temperature to obtain mortar; carrying out solid-liquid separation on the mortar to obtain clear liquid and thick slurry; enabling the clear liquid to absorb carbon dioxide in the flue gas to obtain carbon-rich absorption liquid; carrying out mineralization reaction on the carbon-rich absorption liquid and the thick slurry at 180-220 degrees centigrade to obtain mineralized slurry; performing solid-liquid separation on the mineralized slurry to obtain mineralized ash and mineralized clear liquid; wherein the absorption liquid comprises inorganic alkali and organic alkali, and the organic alkali comprises at least two of monoethanolamine, diethanolamine, triethanolamine, 3-methylaminopropylamine, N-methyldiethanolamine, piperazine, diethylenetriamine, triethylene tetramine, tetraethylenepentamine and 2-amino-2-methyl-1-propanolamine. According to the method, the CO<sub>2</sub> capture rate and the CO<sub>2</sub> utilization rate are greatly improved, the consumption of the organic alkali is low, the regeneration energy consumption of the absorption liquid is low, and the overall economy is good.



### 1st Main Claim

[MT] 1. A method of mineralization of carbon dioxide comprising the steps of:

Mixing the absorbent solution with industrial solid waste at room temperature to obtain mortar;

Separating the mortar solid liquid, clear liquid, and thick slurry;

Allowing the clear liquid to absorb carbon dioxide in flue gas to obtain a carbon-rich absorbent liquid;

The carbon-rich absorbent liquor and the concentrated slurry are mineralized at 180 degrees centigrade to 220 degrees centigrade to obtain a mineralized slurry;

Separating the mineralized slurry solid liquid to obtain mineralized ash and mineralized clear liquid;

Wherein the absorption liquid comprises an inorganic base including monoethanolamine, diethanolamine, triethanolamine, 3-methylaminopropylamine, N-methyldiethanolamine, piperazine, ethylene triamine, and an organic base, At least two of the three ethylene tetramine, the tetra ethylene pentaamine, and the 2-amino-2-methyl-1-propanolamine.

**Assignees:** GUANGZHOU DONGFANG ELECTRIC POWER CO LTD; GUANGZHOU ZHUJIANG ELECTRIC POWER CO LTD

236. Family 60010504 (CN104817102 A)

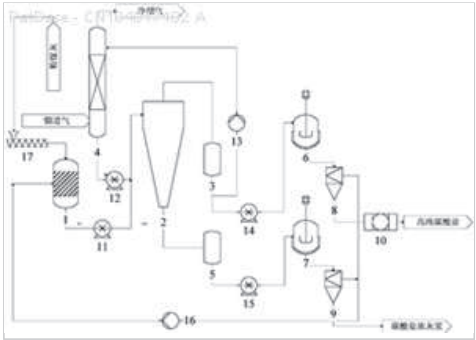
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Title

[EN] SYSTEM DEVICE AND PROCESS FOR LIQUID-PHASE INDIRECT CAPTURE OF CARBON DIOXIDE IN MINERALIZATION SMOKE

Abstract

[EN] The invention discloses a system device and process for liquid-phase indirect capture of carbon dioxide in mineralization smoke. The system device is arranged on a bypass of a flue and comprises an alkaline pretreatment unit, a fly ash CO<sub>2</sub> capture unit, a fly ash carbonation unit and a separation and circulation unit. The main flow of the process comprises desiliconization pretreatment, capture of the CO<sub>2</sub> in the smoke in an absorption tower by using hydraulic cyclone clear liquid, carbonation of the clear liquid in the reaction kettle, carbonation in a slurry reaction kettle and reagent regeneration. Through an indirect process, valuable metals such as Ca, Mg and Al in the solid waste are recovered, so a high-purity carbonate product can be produced, and the problem of difficulty for realizing continuous production by using a slurry bed reaction kettle in conventional mineralization is solved; compared with a process for capturing mineralized CO<sub>2</sub> by using ore in foreign countries, the process has the advantages that the reaction temperature and pressure are greatly reduced, and the used chemical reagent can be recycled; compared with other CO<sub>2</sub> capture technologies, the process has lower decarburization cost and a better removal effect.



1st Main Claim

[MT] 1 An indirect trapping system apparatus mineralized liquid carbon dioxide in the flue gas is provided in the bypass flue, characterized in that it includes the following elements:

Alkaline pretreatment unit, comprising means for heating the silicon alkaline de-stirred tank (1), heating the stirring tank (1) is connected for adding fly ash feeder (17) into the vessel;

Fly CO<sub>2</sub> capture unit, including an inlet connected to the flue gas of CO<sub>2</sub> absorber (4) and a heated stirred tank (1) the material pipeline connected hydrocyclone (2), the supernatant was separated and mortar in hydrocyclone (2), located hydrocyclone (2) above the outlet connection serum supernatant tank (3), Located hydrocyclone (2) below the outlet connection mortar mortar tank (5), the supernatant tank (3) serum outlet is divided into two, all the way to pick CO<sub>2</sub> absorber (4), the CO<sub>net flue 2</sub> absorber (4) to return to the top of the flue efflux, the CO<sub>(4) bottom 2</sub> absorber of carbon-rich serum Back to the hydrocyclone (2);

Fly carbonation unit, including serum and serum tank reactor (3) is another way to connect supernatant outlet (6) and a mortar tank (5) connected to the outlet slurry reactor (7); separation and recycling unit comprises a pick serum reactor (6) outlet for solid-liquid separation a cyclone separator (8) and the ground slurry reactor (7) of the solid-liquid separation cyclone di (9), a cyclone separator (8) is provided with outlet pipeline extraction means (10).

Assignees: HUANENG POWER INT INC; HUANENG CLEAN ENERGY RES INST

## 237. Family 73298531 (CN109368642 A)

[View in PatBase](#)

### Title

[EN] METHOD FOR IMPROVING EFFICIENCY OF ABSORBING CO<sub>2</sub> BY NEWLY-STIRRED CONCRETE

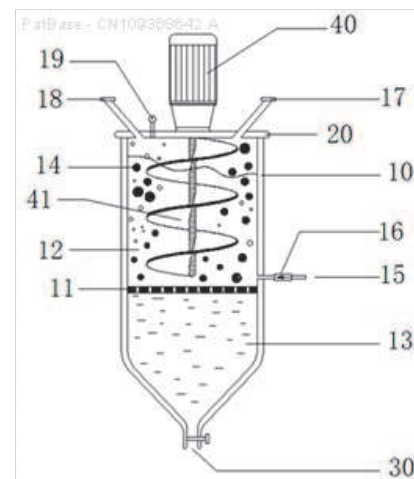
### Abstract

[EN] The invention discloses a method for improving the efficiency of absorbing CO<sub>2</sub> by newly-stirred concrete. A stirring mill is introduced into a stirring device of the concrete to stir cement slurry alone, and stirring and wet milling are integrated through the stirring mill. During stirring, through wet milling, hydration products on the surfaces of cement particles and nano-calcium carbonate carbonized and deposited on the surfaces of the particles are stripped in time, so that the cement particles constantly expose fresh surfaces; and the contact areas between the CO<sub>2</sub> and the cement particles as well as between the CO<sub>2</sub> and the hydration products are enlarged, a cement hydration reaction is accelerated, and thus the speed of absorbing the CO<sub>2</sub> by the concrete slurry is greatly increased. According to the method, the problem that the CO<sub>2</sub> absorption speed is decreased due to deposition of nano-calcium carbonate particles around the cement particles can be effectively avoided, the absorption speed of the CO<sub>2</sub> is greatly increased, and the production efficiency of the concrete is greatly improved.

### 1st Main Claim

[MT] 1. A method to enhance the efficiency of the new concrete to absorb carbon dioxide, characterized in that: In the concrete mixing process introduced stirred mill, stirred mill grinding means for the cement slurry, and pass into CO<sub>2</sub> gas, to achieve the cement slurry over CO<sub>2</sub> sequestration and cured; The grout in the cement particle surface generated and deposited nano-calcium carbonate particles timely release of cement particles constantly exposing fresh surface; And abrasive action can cement particles agglomerate and nano calcium carbonate particles and cement particles agglomerate break in a timely manner.

**Assignees:** UNIV CHINA MINING; CHINA UNIV OF MINING AND TECHNOLOGY



238. Family 6446187 (SU893938 T)

[View in PatBase](#)

Title  
[EN] CONCRETE MIX

Abstract  
[MT] 1

The invention relates kstroitel'nym materials, in particular to the composition of the concrete mixture containing modifying additive.  
Known betonna mixture 1, comprising , wt percent:

Cement 23  
Aggregate68

Sodium Phosphate0,46  
Ammonium iron  
sulphate0.20

Water8,34

The closest to the proposed technical essence and achieved result is a mixture of 2, comprising a betonna , wt percent.:

Portland10-23  
Water3,5-15  
sodium nitrite

sodium tetraborate .0.1-0.2 0.03-0.2  
zapolnitel'ostal'noe

disadvantage of the known concrete -mixtures lies in corrosion valve at the zkspluatatsii concrete products in a corrosive environment.

The purpose of the invention - prevention of corrosion of reinforcement in the operation of reinforced concrete products in a corrosive environment.

Said object is achieved in that the betonna mixture for producing concrete products, comprising Portland cement, water, sodium nitrite sodium, boron-containing compound and filler, contains as borsoderzha10 present compound of the boric acid in the following component ratio, in wt percent : Portlandaement20-25

water.10-15  
Sodium Shtrit .-.0.01-0.03  
"5  
Boric Acid mmand0.06.03  
zapolnitel'ostal'noe

specific formulations the proposed concrete mixture are shown in Table. 1.

Sodium nitrite and boric acid is introduced

into the concrete mixture with water mixing 20 .

In the presence of sodium nitrite and boric acid at a ph of the liquid phase 11;50-8,00 on the surface of reinforcing steel is created the Vd: ma visually uniform passive film fuse vj (a from corrosion. Reinforcement in the concrete specimens made from the proposed betetyuy mixture, when stored for 5 months - in a building, comprising a pair of Ldf noi knsloty, is not subjected to corrosion, remains clean and blest boiling..

DI vyzhzheni efficiency pancake complex additive (nitrite plus boric acid) on the pasoshadiyu steel reinforcement investigated the

behavior of steel in

Ca(OH)<sub>2</sub> us. f 1.2 g/L NaNO<sub>2</sub>,

Ca(OH)<sub>2</sub> 2. + 1.2 g / l of NaNO<sub>2</sub> + 10 g/l of Na<sub>2</sub>B<sub>4</sub>O<sub>7</sub>·10 H<sub>2</sub>O (known)

Ca(OH)<sub>2</sub> 2. + 1.2 g / l of NaNO<sub>2</sub> + 2 g/l of H<sub>3</sub>BO<sub>3</sub>

Ca (OH)<sub>2</sub>, sat. + 1.2 g / l of NaNO<sub>2</sub> + 3 g/l of n<sub>2</sub>vo<sub>2</sub>

Ca (OH)<sub>2</sub>, sat. + 2 g/l of NaNO<sub>2</sub> + 2 g/l of n<sub>2</sub>vo<sub>2</sub>

a saturated solution of sodium hydroxide dihydrate with n<sub>2</sub>menen<sub>2</sub> ph by carbon dioxide air from 11.5 to 8.00.

Data on the state of the samples to the zavnsimosti the species and konientratsii additives are shown in Table. 2.

Predlagaema betonna mixture can be used for producing concrete products operating in an atmosphere, comprising a pair of acids.

T A B L and d a 1

0.00015

insignificant point corrosion (2-3 at the sample)

The same

clean , blest cartilage , no points of corrosion

the same

5 893938

formula of the invention , Portland Cement 20-g25

Betonna mixture for the manufacture of zhelezobe-nitrite iatri 0.01-0.03 ton of products, comprising a portland cement.Boric Acid 0.02-0.03 water, sodium nitrite sodium, boron-containing compounds S Zapoliitel' Rest nne and a filler, characterized in that, in order to prevent Source h nnformatsnn, corrosion valve at the zkspluatatsii in iron-tye principles into consideration in the examination of concrete products in the aggressive environment of the ONAI. Copyright svidetel'ssho USSR and 567698, contains as the boron soednne- |cl. From 04 to 13/22, 1975.

nn boric acid md following sootio-. 2, Copyright certificate USSR N 563384,

pyunii ., wt percent :CL. From 04 to 13/22, 1976.

Water10-15

### 1st Main Claim

[MT] 1

The invention relates kstroitel'nym materials, in particular to the composition of the concrete mixture containing modifying additive.

Known betonna mixture 1, comprising , wt percent:

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Aggregate68

Sodium Phosphate0,46

Ammonium iron

sulphate0.20

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The closest to the proposed technical essence and achieved result is a mixture of 2, comprising a betonna , wt percent.:

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zapolnitel'ostal'noe

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The purpose of the invention - prevention of corrosion of reinforcement in the operation of reinforced concrete products in a corrosive environment.

Said object is achieved in that the betonna mixture for producing concrete products, comprising Portland cement, water, sodium nitrite sodium, boron-containing compound and filler, contains as borsoderzha10 present compound of the boric acid in the following component ratio, in wt percent : Portlandaement20-25

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zapolnitel'ostal'noe

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DI vyzhzheni efficiency pancake complex additive (nitrite plus boric acid) on the pasoshadiyu steel reinforcement investigated the behavior of steel in

Ca(OH)<sub>j</sub> us. f 1.2 g/L NaNO<sub>j</sub>,

Ca(OH)<sub>2</sub> . + 1.2 g / l of NaNO<sub>j</sub> + 10 g/l of NajB407IO H<sub>j</sub>O (known)

Ca(OH)<sub>2</sub> . + 1.2 g / l of NaNO<sub>j</sub> + 2 g/l of H<sub>j</sub>BO<sub>a</sub>

Ca (OH), sat. + 1.2 g / l of NaNO<sub>j</sub> + 3 g/l of nzvoz

Ca (OH), sat. + 2 g/l of NaNO<sub>j</sub> + 2 g/l of nzvoz

a saturated solution of sodium hydroxide dihydrate with nzmenenin ph by carbon dioxide air from 11.5 to 8.00.

Data on the state of the samples to the zavnsimosti the species and konientratsii additives are shown in Table. 2.

Predlagaema betonna mixture can be used for producing concrete products operating in an atmosphere, comprising a pair of acids.

T A B L and d a 1

0.00015

insignificant point corrosion (2-3 at the sample)

The same

clean , blest cartilage , no points of corrosion

the same

5 893938

formula of the invention , Portland Cement 20-g25

Betonna mixture for the manufacture of zhelezobe-nitrite iatri 0.01-0.03 ton of products, comprising a portland cement. Boric Acid 0.02-0.03 water, sodium nitrite sodium, boron-containing compounds S Zapoliitel' Rest nne and a filler, characterized in that, in order to prevent Source h nnformatsnn, corrosion valve at the zkspluatatsii in iron-tye principles into consideration in the examination of concrete products in the aggressive environment of the ONAI. Copyright svidetel'ssho USSR and 567698, contains as the boron soednne- |cl. From 04 to 13/22, 1975.

nn boric acid md following sootio-. 2, Copyright certificate USSR N 563384,

pyunii ., wt percent :CL. From 04 to 13/22, 1976.

Water10-15

**Assignees:** BRESTSKIJ INSTR I; BREST STATE CIVIL ENGINEERING INST

## 239. Family 108498226 (WO25133206 A1)

[View in PatBase](#)

### Title (EP4574766 A1)

[EN] PROCESS FOR PRODUCING SODIUM CARBONATE

### Abstract (EP4574766 A1)

[EN] A method for the manufacture of sodium carbonate or sodium bicarbonate, wherein said method comprises a limestone calcining step in a limekiln to produce lime (CaO) and a gas comprising carbon dioxide (CO<sub>2</sub>), using limestone and a carbonaceous combustible, wherein the said carbonaceous combustible comprises biochar, and the biochar comprises at most 50 percent by weight of volatile matter on a dry base.

### 1st Main Claim (EP4574766 A1)

[EN] 1. A method for the manufacture of sodium carbonate or sodium bicarbonate,

- wherein said method comprises a limestone calcining step in a limekiln to produce lime (CaO) and a gas comprising carbon dioxide (CO<sub>2</sub>),
- using limestone and a carbonaceous combustible,

#### characterized in that:

- - the said carbonaceous combustible comprises biochar, and
- - the biochar comprises at most 50 percent by weight of volatile matter on a dry base.

**Assignees:** SOLVAY

240. Family 54925911 (CN103335911 A)

[View in PatBase](#)

Title

[EN] METHOD FOR DETERMINING CONTENT OF MORTAR OF SURFACES OF LIMESTONE RECYCLED AGGREGATES

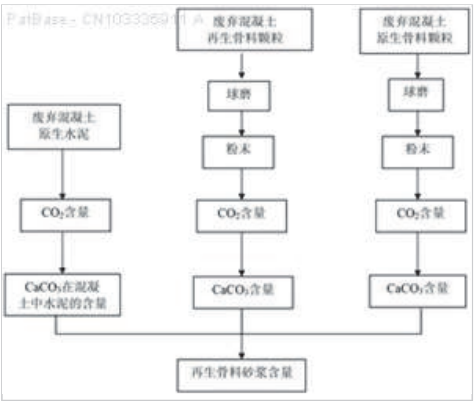
Abstract

[EN] Provided is a method for determining content of mortar of surfaces of limestone recycled aggregates. The method comprises the following steps. Recycled aggregates are ground to a certain fineness. Each component is dissolved in acid environment selectively. Calcium carbonate in the limestone component is dissolved and releases CO<sub>2</sub>, while the mortar component cannot be dissolved basically. By determination of the content of the released CO<sub>2</sub>, the content of calcium carbonate of the recycled aggregates is calculated, and the content of the residual mortar can be obtained by deduction of the content of calcium carbonate. The method achieves the quantitative analysis of mortar of surfaces of recycled aggregates, and has important and practical meanings for the study of performances of recycled aggregates and performances of configured recycled concrete.

1st Main Claim

[MT] Claim 1/1 A limestone surface quality recycled aggregate mortar method for determining the content, characterized in that it comprises the following steps: (1) the recycled aggregate treated placed in a small planetary ball mill grinding 1~2h, making 80 ym sieve is less than 5 percent; (2) the powder after grinding to 105 plus or minus 5. C drying process; (3) BL05-1 cement carbon dioxide detector, measured according to GB / T12960-2007 "quantitative determination of cement components," the carbon dioxide content in cement alkali asbestos absorption gravimetric method, weighed 0. 5000~1. 0000g sample, using phosphoric acid in step (2) obtained powder was dissolved by heating to control the gas flow rate of 50~100mL / min, the powder sufficient reaction CO<sub>2</sub>, through a chemical reaction equation is derived to calculate the recycled aggregate carbonate mass percentage of the calcium content D1; (4) the use of the step (1) to (3) determination of the quality of the same practices native aggregate percentage content of calcium carbonate D2; (5) the use of step (3) Determination of cement in the same practice mass percentage content of calcium carbonate D3, and according to the native mix concrete, calculate the percentage of cement quality content in the original concrete D4, calculated as calcium carbonate cement content in concrete mass percentage content of X1; (6) according to the following formula calculate surface mortar quality recycled aggregate percentage content D.

**Assignees:** GUANGXI INST OF BUILDING RES AND DESIGN; UNIV GUANGXI; GUANGXI UNIV

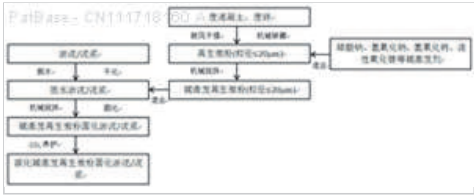


241. Family 81221273 (CN111718160 A)

[View in PatBase](#)

**Title**  
[EN] ALKALI-ACTIVATED REGENERATED MICRO-POWDER-SOLIDIFIED DEHYDRATED SLUDGE/SLURRY AND PREPARATION METHOD THEREOF

**Abstract**  
[EN] The invention provides alkali-activated regenerated micro-powder-solidified dewatered sludge/slurry and a preparation method thereof. The method comprises the following steps: 1, dehydrating and drying sludge/slurry; preparing regenerated micro-powder by utilizing building solid wastes; determining the composition proportion of SiO<sub>2</sub>, CaO, Fe<sub>2</sub>O<sub>3</sub> and Al<sub>2</sub>O<sub>3</sub> minerals in the regenerated micro-powder and potential hydration activity; preparing a corresponding alkali activator, and uniformly mixing the alkali activator with the regenerated micro-powder to generate alkali-activated regenerated micro-powder; uniformly mixing the alkali-activated regenerated micro-powder with a proper amount of the dehydrated sludge/slurry to solidify the sludge/slurry; and performing CO<sub>2</sub> maintenance treatment on the alkali-activated regenerated micro-powder-solidified dehydrated sludge/slurry. The invention provides the alkali-activated regenerated micro-powder-solidified dehydrated sludge/slurry with high resource utilization rate and environmental friendliness, and the preparation method thereof.



**1st Main Claim**

[MT] 1. An alkali-activated sludge dewatering curing renewable powder / mud, characterized in that it consists of the following parts by weight of feedstock preparation obtained:

再生微粉:	100 份;
粉煤灰:	0-100 份;
水:	0-600 份;
淤泥/泥浆:	200-2000 份;
碱性激发剂:	1-30 份。

**Assignees:** UNIV SHAOXING; SHAOXING COLLEGE OF ARTS AND SCIENCES

## 242. Family 52062828 (US2014165879 AA)

[View in PatBase](#)

### Title (EP2505614 B1)

[EN] PROCESS FOR PREPARING SELF-BINDING PIGMENT PARTICLES

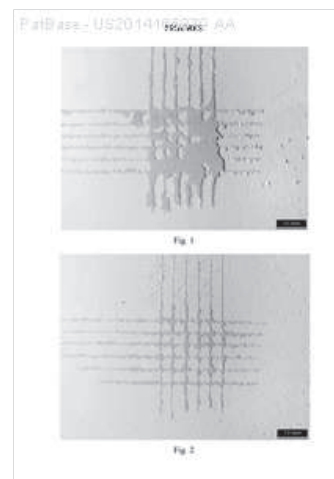
### Abstract (EP2505614 B1)

[EN] The present invention relates to a process for preparing self-binding pigment particles from an aqueous mineral pigment material suspension having a solid content of 45 to 80 wt.-% percent, based on the total weight of the suspension.

### 1st Main Claim (EP2505614 B1)

[EN] 1. Process for preparing self-binding pigment particles comprising the following steps:

- a) providing an aqueous mineral pigment material suspension;
- b) providing at least one polymeric binder, wherein the binder comprises at least one carboxymethylcellulose having a degree of carboxylation in the range of 0.4 to 2.0 and having an intrinsic viscosity in the range of 3 to 300 ml/g;
- c) mixing the binder of step b) with the aqueous mineral pigment material suspension of step a) and adjusting the solids content of the obtained suspension so that it is from 45 to 80 wt.-% percent, based on the total weight of the suspension;
- d) grinding the aqueous mineral material suspension of step c), wherein in step c) the binder is added to the aqueous mineral pigment suspension in an amount from 0.1 to 10.0 wt.-% percent, based on the total weight of the suspension.



**Assignees:** OMYA DEVELOPMENT AG; OMYA INT AG; GANE PATRICK A C; BURI MATTHIAS; MEUWLY JULIE; RENTSCH SAMUEL; OMIA INTERNEHSHNL AG; BRIDY MEUWLY JULIE; BRIDY JULIE

243. Family 55882667 (KR20140020543 A)

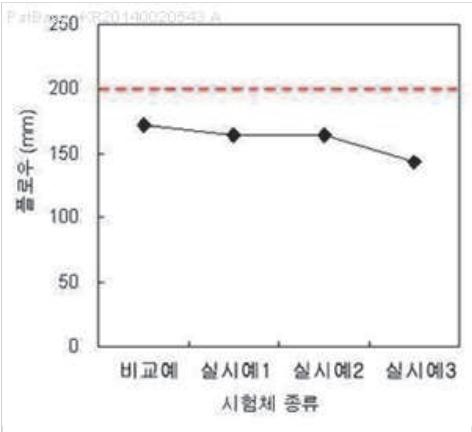
[View in PatBase](#)

**Title**  
[EN] SHOT FIBERS CEMENT COMPLEX MATERIALS FOR DECREASE OF CARBON AND LIFE CYCLE COST

**Abstract**  
[EN] The present invention relates to short fiber cement complex materials for decrease of carbon and life cycle cost, and more specifically, to short fiber cement complex materials which save limestone resources by minimizing the amount of cement used for construction and repair and preventing the deterioration of durability, provide cement materials capable of reducing the emission of carbon dioxide, and decrease life cycle cost by improving durability by adding short fiber made from PP or PET. [Reference numerals] (AA) Flow(mm); (BB) Comparative example; (CC) Example 1; (DD) Example 2; (EE) Example 3; (FF) Specimen type

**1st Main Claim**  
[MT] 1. According to cement composite material, a binder, 100 parts by weight of cement 400 ~ 500 parts by weight of talcum, gypsum parts by weight 25-35 parts by weight of industrial by-products, expanding agent 25-35 parts by weight of an alkali stimulant, 300 to 400 parts by weight of fine aggregate 25 to 35 parts by weight; 1.5 to 2.5 parts by weight of the polymer admixture; 0.005~0.015, HPMC, water reducing agent 0.2 to 0.4 parts by weight parts by weight, 0.5 to 2 parts by weight to parts by weight, the fibrous material; a binder is 22 parts by weight for 100 parts by weight of the composition being mixed in a water characterized in that the cement composite material.

**Assignees:** OUR MRO CO LTD



244. Family 47634091 (WO10132863 A1)

[View in PatBase](#)

Extended Family Number: 42613795

Title

[EN] SYSTEMS AND METHODS FOR PROCESSING CO2

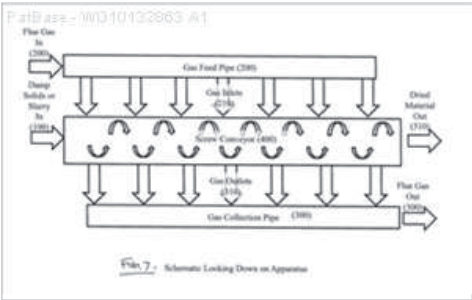
Abstract

[EN] Systems and methods for lowering levels of carbon dioxide and other atmospheric pollutants are provided. Economically viable systems and processes capable of removing vast quantities of carbon dioxide and other atmospheric pollutants from gaseous waste streams and sequestering them in storage-stable forms are also discussed.

1st Main Claim

[EN] 1. A method comprising: i) obtaining a slurry comprising a precipitated CCVsequestering carbonate and/or bicarbonate compound composition and a supernatant solution from which the carbonate compound composition was precipitated, wherein the carbonate and/or bicarbonate compound composition has a  $6^{13}\text{C}$  value less than -10 percent o and comprises aragonite, vaterite, amorphous calcium carbonate, or a combination thereof; ii) separating the CCVsequestering carbonate compound composition from the supernatant solution utilizing at least one of the following techniques: a. gravity separation; b. mechanical separation; or c. thermal evaporation; to provide a dewatered slurry comprising the CO<sub>2</sub>-sequestering carbonate compound composition at a concentration of solids of at least 20wt percent and a first portion of the supernatant solution, and an effluent solution comprising a second portion of the supernatant solution; and iii) processing the effluent solution in a first process and the CCVsequestering carbonate compound composition in a second process.

**Assignees:** BELLUR SRIKANTH; CALERA CORP; CURTIS BRIAN; ELLIOTT ROBERT W; FARSAD KASRA; SELF KYLE



245. Family 81759854 (CN111875332 A)

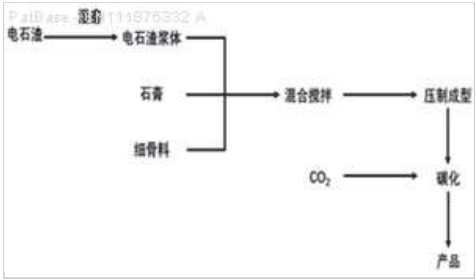
[View in PatBase](#)

Title

[EN] METHOD FOR PREPARING CARBONIZED BRICK FROM WET-MILLING CARBIDE SLAG

Abstract

[EN] The invention provides a method for preparing a carbonized brick from wet-milling carbide slag. The method comprises the following steps: carrying out wet milling on 150-300 parts of carbide slag and 75-150 parts of water to realize refining of carbide slag particles and high alkalinity of a liquid phase; preparing 120-200 parts of wet-milled carbide slag slurry, 10-35 parts of gypsum and 50-120 parts of slag as cementing materials, adding 420-865 parts of fine aggregate and 0-18 parts of water and fully and evenly stirring the components, press-shaping the the stirred raw materials, and performing maintenance in a carbonization chamber to obtain the wet-milling carbide slag carbonized brick. By adopting the method, gas carbon dioxide can be cured, and environmental pollution caused by industrial waste gas is reduced; by utilizing the advantage that the wet-milling carbide slag is easy to carbonize and is easy to react with carbon dioxide to form calcium carbonate, and precipitate and crystal growth have cohesion, the prepared brick is high in strength and short in curing age, the production efficiency is improved, and the brick can effectively replace a common brick for construction.



1st Main Claim

[MT] 1. A method for wet grinding carbide slag carbonation carbonation brick production method, characterized by comprising the steps of:

- Step 1, the 150 ~ 300 parts by weight of calcium carbide slag, carbide slag parts by mass was added 1/2 water, 0.5 to 3 parts grinding aid, adding wet stirring mill wet milling, wet milling time 0.5 ~ 1h, speed 400r / min, grinding media ratio of 1.2mm:0.8mm:0.6mm = 2:4:4 ceramic balls to obtain a median particle size D (50) = 0.9 ~ 3 micro m wet grinding carbide slag slurry;
- Step 2, take the step 1 120 ~ 200 parts of wet grinding of carbide slag slurry, 5 to 35 parts of gypsum, 50 to 120 parts slag, 420 ~ 865 parts of fine aggregate, 0 to 18 parts of water, mixed and stirred to obtain a mixed mortar 90 ~ 180s;
- Step 3, Step 2 was weighed and placed in a mortar mix molding mold for compression molding, compression molding pressure of 2 ~ 35Mpa, dwell time 30-60s, immediately after molding release;
- Step 4, Step 3, the release after molding of test pieces into the constant temperature and humidity chamber carbonization carbonization curing, carbonization chamber, CO<sub>2</sub>pressure range between 35 ~ 250Pa, CO<sub>2</sub>volume concentration of 17% to 23%, to obtain a carbon brick.

**Assignees:** UNIV HUBEI TECHNOLOGY; HUBEI UNIV OF TECHNOLOGY

246. Family 48436458 (US2011059000 AA)

[View in PatBase](#)

Extended Family Number: 42613795

Title

[EN] METHODS OF SEQUESTERING CO2

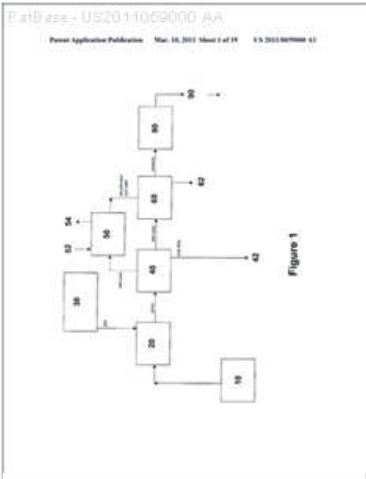
Abstract

[EN] Methods of sequestering carbon dioxide (CO2) are provided. Aspects of the methods include precipitating a storage stable carbon dioxide sequestering product from an alkaline-earth-metal-containing water and then disposing of the product, e.g., by placing the product in a disposal location or using the product as a component of a manufactured composition. Also provided are systems for practicing methods of the invention.

1st Main Claim

[EN] **21.** A method, comprising: treating at least a portion of flue gas emitted from a cement plant, wherein said flue gas comprises carbon dioxide, with a proton removing agent to produce a solution comprising carbonate ions; treating said solution with alkaline-earth-metal-ions to produce a precipitate comprising carbonate; delivering at least a portion of said precipitate to said cement plant as a feedstock.

**Assignees:** KIRK DONALD W; GILLIAM RYAN J; CONSTANTZ BRENT R; DANZIGER ROBERT; FARSAK KASRA; OMELON SIDNEY; DECKER VALENTIN; TUET PHILIP BRIAN; FERNANDEZ MIGUEL; BARD ALLEN J; RYAN CECILY; YOUNGS ANDREW; WAY J DOUGLAS; CALERA CORP



247. Family 59407819 (CN104671688 A)

[View in PatBase](#)

Title

[EN] MODIFIED CALCIUM OXIDE EXPANDING CLINKER AS WELL AS PREPARATION METHOD AND APPLICATION THEREOF

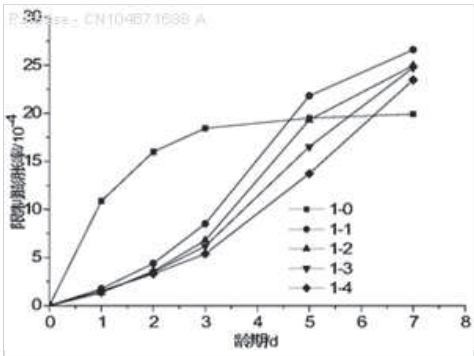
Abstract

[EN] The invention relates to a modified calcium oxide expanding clinker as well as a preparation method and application thereof. The preparation method of the modified calcium oxide expanding clinker comprises the following steps: grinding a calcium oxide expanding clinker till a certain grain size, putting the calcium oxide expanding clinker powder in a carbon dioxide atmosphere with certain humidity and forming plenty of dense calcium carbonate on the surface of the expanding clinker powder, thus preparing the modified calcium oxide expanding clinker. The modified calcium oxide expanding clinker can be mixed with a dispersion supporter, thus forming a modified calcium oxide concrete expansive agent. The modified calcium oxide expanding clinker prepared by the preparation method and the expansive agent thereof have the beneficial effects that the expansion quantity and expansion stress of the expanding clinker in cement concrete are obviously increased, thus optimizing the expansion processes of the expanding clinker and the expansive agent thereof; the weather resistance and moisture resistance of the calcium oxide expanding clinker and the expansive agent thereof are improved.

1st Main Claim

[MT] 1 a modified type of calcium oxide expansion of clinker, characterized in that it comprises a dense layer of calcium oxide and calcium-based expansion of clinker surface parcels;. The type of calcium oxide expansion cooked material comprises free lime, sulphoaluminate and anhydrite and mixtures thereof; the expansion of clinker amount of surface-modified calcium carbonate inclusions of calcium oxide expansion of clinker quality class 1wt percent -30wt percent.

Assignees: JIANGSU SUBOTE NEW MAT CO LTD; JIANGSU BOTE NEW MATERIALS CO LTD



248. Family 14203062 (JP2000239670 A2)

[View in PatBase](#)

**Title**  
[EN] METHOD FOR REUSING WASTE CONCRETE

**Abstract**  
[EN] PROBLEM TO BE SOLVED: To treat waste concrete as recyclable resources and to reuse it as a raw material for cement and the like. To react waste concrete with carbon resources or hydrocarbon resources and to effectively utilize an inflammable gas such as by-produced hydrogen and the like as a fuel for a composite power generation equipment or the like without discharging carbon dioxide in the air. SOLUTION: Aggregates are removed from waste concrete 17 to give powdery and granular materials and then a slurry containing these powdery and granular materials, carbon resources 12 and water 16 are prepared. This slurry are maintained at a temperature of 380-850 deg.C and a pressure of 10-35 MPa, which are a temperature and a pressure of water in a subcritical or supercritical state to give a solid matter composed mainly of CaCO<sub>3</sub> and inflammable gases 32 containing hydrogen, methane and carbon monoxide. The solid matter and the inflammable gases are separated and the former are used as a raw material for cement and the latter is used as fuels for a gas turbine composite power generation equipment.

**1st Main Claim**  
[MT] 1. crushed waste concrete (17) and obtaining a powder to remove the aggregate from the carbon resources (12) and said powder and water or hydrocarbon resources (16) or a slurry containing When preparing the emulsion, and then maintained at 380 ~ 850 °C 10 ~ 35MP temperature and pressure of a subcritical or supercritical water, slurry or emulsion, CaCO<sub>3</sub> Main components and solids (28) and hydrogen, methane and flammable gases including carbon monoxide (32) to produce a solids content above 28 and said flammable gas (32) and separation step to separate including ways to reuse the waste concrete.

**Assignees:** MITSUBISHI MATERIALS CORP



249. Family 46814494 (US2010063902 AA)

[View in PatBase](#)

Extended Family Number: 42613795

Title

[EN] CO2 COMMODITY TRADING SYSTEM AND METHOD

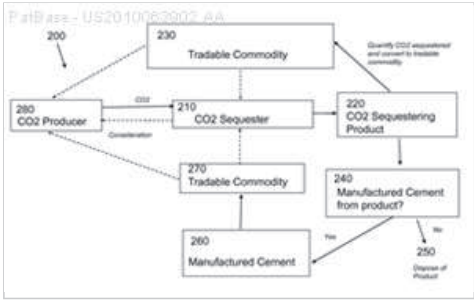
Abstract

[EN] A system and method of generating and trading a CO2 commodity that is correlated to a quantified amount of CO2 sequestered in a CO2 sequestering product comprising a carbonate and/or a bicarbonate. The tradable commodity can be purchased or sold for use in managing CO2 emissions.

1st Main Claim

[EN] 1. A computer-implemented CO<sub>2</sub> commodity trading system, comprising: a CO<sub>2</sub> sequestration converter programmed to convert a quantified amount of CO<sub>2</sub> sequestered in a CO<sub>2</sub> sequestering product into a tradable commodity.

**Assignees:** RYAN CECILY; SETTON AURELIA; YOUNGS ANDREW; O NEIL JAMES R; DANZIGER ROBERT; CAMIRE CHRIS; CONSTANTZ BRENT R; KHOSLA VINOD; CALERA CORP



250. Family 105841091 (WO24259327 A2)

[View in PatBase](#)

**Title**  
[EN] METHODS OF ISOLATING CEMENTITIOUS PRECURSORS

**Abstract**

[EN] The present disclosure provides a method of separating materials which includes providing an input material comprising one or more metal compounds, contacting the input material with a leaching agent to yield a solid residue and a solution, and performing one or more separations on the solution to isolate the one or more metal compounds. The resulting separated components may be used for carbon dioxide capture, as precursors for cementitious materials or ordinary Portland cement, or combinations thereof.

**1st Main Claim**

[EN] Attorney Docket No.: 440773-000402 CLAIMS What is claimed is: 1. A method of separating materials, comprising: providing an input material comprising one or more metal compounds, contacting the input material with a leaching agent to yield a solid residue and a solution, and performing one or more separations on the solution to isolate the one or more metal compounds. 2. The method of claim 1, wherein the input material comprises basalt, apatite, gabbro, wollastonite, skarns, anorthosite, feldspar, anorthite, pyroxene, margarite, electric arc furnace slag (EAF), reducing steel slag, oxidizing steel slag, converter steel slag, basic oxygen furnace slag, ladle slag, slow or fast cooled steel slag, blast furnace slag, granulated blast furnace slag, ground granulated blast furnace slag (GGBFS), air-cooled slag, copper slag, Solvay slag, phosphorous slag, bauxite residue/slag, zinc slag, lead slag, fly ash, bottom ash, municipal solid waste incinerated ash, recycled concrete, or combinations thereof. 3. The method of claim 1, wherein the one or more metal compounds comprise calcium, aluminum, iron, magnesium, or combinations thereof. 4. The method of claim 1, further comprising sizing the input material by grinding, milling, sieving, or combinations thereof. 5. The method of claim 1, further comprising sizing the input material by milling one or more of a ball mill, tower mill, vertical mill, pebble mill, high pressure grinding rolls, autogenous mill, rod mill, or combinations thereof. 6. The method of claim 1, wherein the leaching agent comprises an ammonium salt or a strong acid. 7. The method of claim 6, wherein the ammonium salt comprises  $\text{NH}_4\text{Cl}$ ,  $(\text{NH}_4)_3\text{PO}_4$ ,  $(\text{NH}_4)_2\text{SO}_4$ ,  $\text{NH}_4\text{NO}_3$ , or combinations thereof. Attorney Docket No.: 440773-000402 8. The method of claim 6, wherein the strong acid comprises  $\text{HCl}$ ,  $\text{HBr}$ ,  $\text{HI}$ ,  $\text{HNO}_3$ ,  $\text{H}_3\text{PO}_4$ ,  $\text{H}_2\text{SO}_4$ ,  $\text{HClO}_4$ , or combinations thereof. 9. The method of claim 1, wherein the input material and the leaching agent are present in a ratio of about 1:1 to about 1:15 by mass. 10. The method of claim 1, wherein contacting the input material with the leaching agent comprises heating the input material and the leaching agent together. 11. The method of claim 1, wherein contacting the input material with the leaching agent comprises heating the input material and the leaching agent to a temperature of about 200 degrees centigrade to about 450 degrees centigrade 12. The method of claim 1, wherein the one or more separations comprise adjusting the pH of the solution, heating the solution, or combinations thereof. 13. The method of claim 1, wherein the one or more separations comprise adjusting the pH of the solution to between about 4.0 and about 10.5 to isolate the one or more metal compounds. 14. The method of claim 1, wherein the one or more separations comprise adjusting the pH of the solution to between about 4.0 and about 5.5 to isolate the one or more metal compounds. 15. The method of claim 1, wherein the one or more separations comprise adjusting the pH of the solution to between about 5.5 to about 7.5 to isolate the one or more metal compounds. 16. The method of claim 1, wherein the one or more separations comprise adjusting the pH of the solution to between about 8.0 to about 10.5 to isolate the one or more metal compounds. 17. The method of claim 1, wherein the one or more separations comprise heating the solution to about 100 degrees centigrade to about 200 degrees centigrade to isolate the one or more metal compounds. 18. The method of claim 1, wherein the one or more separations comprise heating the solution to about 100 degrees centigrade to about 150 degrees centigrade to isolate the one or more metal compounds. Attorney Docket No.: 440773-000402 19. The method of claim 1, wherein the one or more separations comprise heating the solution to about 150 degrees centigrade to about 200 degrees centigrade to isolate the one or more metal compounds. 20. The method of claim 1, wherein the one or more separations comprise a first separation to isolate a first metal compound. 21. The method of claim 1, wherein the one or more separations comprise a first separation to isolate a first metal compound and a second separation to isolate a second metal compound. 22. The method of claim 1, wherein the one or more separations comprise a first separation to isolate a first metal compound, a second separation to isolate a second metal compound, and a third separation to isolate a third metal compound. 23. The method of claim 1, further comprising utilizing the one or more metal compounds in ordinary Portland cement production. 24. The method of claim 1, further comprising utilizing the one or more metal compounds in carbon dioxide capture. 25. The method of claim 1, further comprising recovering the leaching agent from the solution. 26. The method of claim 25, wherein recovering the leaching agent from the solution comprises applying an electric current to the solution, adjusting the temperature of the solution, contacting the solution with  $\text{CO}_2$  and ammonia, or combinations thereof. 27. The method of claim 25, wherein recovering the leaching agent from the solution comprises contacting the solution with  $\text{CO}_2$  and ammonia to produce the leaching agent and calcium carbonate. 28. The method of claim 27, wherein recovering the leaching agent does not require heat, electricity, or a combination thereof. 29. The method of claim 27, wherein the one or more metal compounds comprises calcium carbonate, and wherein the method further comprises using the calcium carbonate to produce ordinary Portland cement. Attorney Docket No.: 440773-000402 30. The method of claim 29, further comprising producing  $\text{CO}_2$  and using the  $\text{CO}_2$  to recover the leaching agent, produce ordinary Portland cement, or a combination thereof. 31. The method of claim 1, wherein the solid residue comprises silica. 32. The method of claim 1, further comprising utilizing the solid residue in ordinary Portland cement production. 33. The method of claim 1, further comprising utilizing the solid residue in carbon dioxide capture. 34. The method of claim 1, further comprising combining the solid residue with one or more alkali activators to produce a cementitious material. 35. The method of claim 1, wherein the input material comprises calcium. 36. The method of claim 1, further comprising a final separation to isolate a calcium species comprising calcium chloride, calcium carbonate, calcium bicarbonate, calcium hydroxide, calcium oxide, or combinations thereof. 37. The method of claim 36, further comprising utilizing the calcium species in ordinary Portland cement production. 38. The method of claim 36, further comprising utilizing the calcium species in carbon dioxide capture. 39. The method of claim 36, further comprising combining the calcium species with the solid residue to produce a cementitious material. 40. The



method of claim 36, further comprising combining the calcium species with one or more alkali activators to produce a cementitious material. 41. The method of claim 36, further comprising combining the calcium species with one or more alkali activators and the solid residue to produce a cementitious material.

**Assignees:** C CRETE TECH LLC

251. Family 93161786 (CN114988913 A)

[View in PatBase](#)

Title

[EN] METHOD FOR PREPARING HIGH-STRENGTH BUILDING MATERIAL THROUGH CO2 MINERALIZATION AND APPLICATION OF HIGH-STRENGTH BUILDING MATERIAL

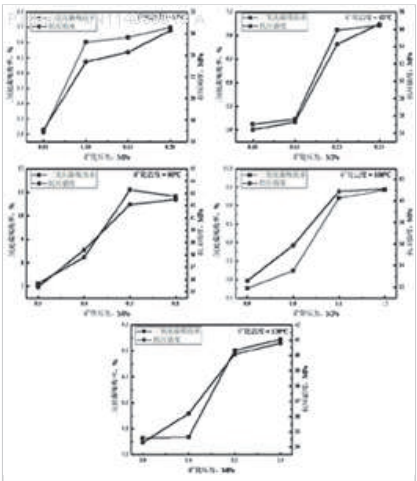
Abstract

[EN] The invention relates to the technical field of carbon dioxide utilization, in particular to B01D53/62, and more particularly relates to a method for preparing a high-strength building material through CO2 mineralization and application of the high-strength building material. The method for preparing the high-strength building material through CO2 mineralization comprises the steps that solid waste and water are mixed and then placed in a mold to be pressed into a green body, then the green body is subjected to a mineralization reaction under the action of gas containing carbon dioxide, and the high-strength building material is obtained. According to the method for preparing the high-strength building material through CO2 mineralization, flue gas or waste gas containing carbon dioxide can be directly utilized for mineralization maintenance, and resource utilization of solid waste is achieved.

1st Main Claim

[MT] 1. A method of CO2 mineralization for preparing a high-strength building material, characterized by comprising mixing solid waste and water and placing it in a mold to form an embryo, after which the embryo is subjected to a mineralization reaction under the action of a gas containing carbon dioxide, i. e., the pressure of said mineralization reaction is 0.05 to 2.3 MPa.

Assignees: JIANGSU JICUI FUNCTIONAL MATERIALS RES INST CO LTD



252. Family 99496195 (WO23203216 A1)

[View in PatBase](#)

Title (EP4265582 A1)

[EN] METHOD FOR THE PREPARATION OF A CARBONATED MINERAL COMPONENT, CARBONATED MINERAL COMPONENT AND METHOD FOR THE PREPARATION OF A HYDRAULIC BINDER

Abstract (EP4265582 A1)

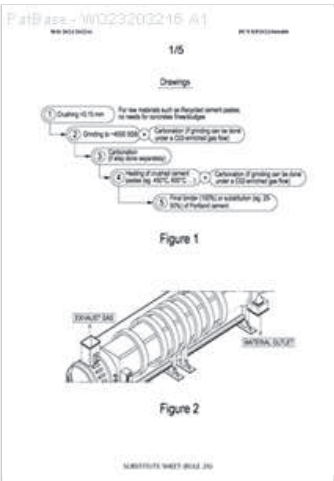
[EN] The invention relates to a method for the preparation of a carbonated mineral component in particular for the use as a substituent of cement in hydraulic binder compositions wherein a raw material comprising at least one of the group of concrete demolition waste, hardened concrete paste, hardened cement paste, or any mineral component containing hydrated calcium silicates, calcium aluminates is carbonated and heated, a carbonated mineral component manufactured in this way, a method for the preparation of a hydraulic binder using the carbonated mineral component and a cementitious component as well as a concrete composition with that hydraulic binder.

1st Main Claim (EP4265582 A1)

[EN] 1. Method for the preparation of a at least partially carbonated mineral component, in particular for the use as a substituent for cement in hydraulic binder compositions, wherein a raw material comprising at least one of the group of

- - concrete demolition waste,
  - - recycled cement paste,
  - - hardened concrete paste,
  - - hardened cement paste,
  - - concrete fines,
  - - dried concrete sludges, or
- any mineral component containing hydrated calcium silicates or calcium aluminates, is carbonated and heated or heated.

Assignees: HOLCIM TECH LTD; HOLCIM TECHNOLOGY LTD



253. Family 48265133 (WO11017609 A1)

[View in PatBase](#)

Extended Family Number: 42613795

Title  
[EN] CARBON CAPTURE AND STORAGE

Abstract  
[EN] Aspects of the invention include methods of contacting carbon dioxide with an aqueous mixture. In practicing methods according to certain embodiments, a subterranean brine is contacted with carbon dioxide to produce a reaction product, which may or may not be further processed as desired. Also provided are methods in which a brine or minerals are contacted with an aqueous composition. Aspects of the invention further include compositions produced by methods of the invention as well as systems for practicing methods of the invention.



1st Main Claim

[EN] 1. A method comprising: a. contacting carbon dioxide with an aqueous mixture to form a reaction product in the contacted aqueous mixture; wherein the reaction product comprises water and dissolved carbon dioxide carbonic acid, carbonates, or bicarbonates or a combination thereof, and b. sequestering at least a portion of the reaction product or derivative thereof in a first subterranean location.

Assignees: KENDALL TREAVOR; SELF KYLE; FERNANDEZ MIGUEL; SEEKER WILLIAM RANDALL; WEISS MICHAEL JOSEPH; CONSTANTZ BRENT R; CALERA CORP; YOUNGS ANDREW

## 254. Family 79079923 (KR102087707 B1)

[View in PatBase](#)

### Title

[EN] METHOD OF REPAIRING AND REINFORCING CROSS-SECTION OF CONCRETE STRUCTURE BY SELF HEALING USING CALCIUM HYDRATE SOLUTION ECO-FRIENDLY NANO BUBBLE WATER OF CARBON DIOXIDE AND MORTAR COMPOSITION FOR REPAIRMENT

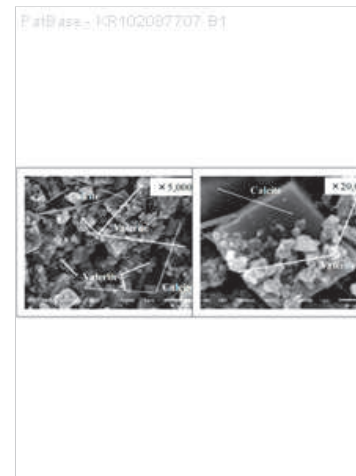
### Abstract

[EN] The present invention relates to a method of repairing and reinforcing a cross-section of a concrete structure and, more specifically, to a method of repairing and reinforcing a cross-section of a concrete structure, which forms a calcium carbonate crystal into deep portions in cracks of the structure without using organic materials to restore concrete in an original state, thereby enabling self-healing. Therefore, the method of repairing and reinforcing a cross-section of a concrete structure can prevent a problem in case of use of the organic materials, improve durability by state restoration of raw materials of the structure, extend a lifespan, and increase repairing and reinforcing effects.

### 1st Main Claim

[MT] 1. (1) cross-section of the concrete structure required for rehabilitation is chipping damage and are not part of the refined until smooth; (2) soluble in water to calcium hydroxide in the concrete section as an aqueous solution of PH 9 to 12 obtained by applying an aqueous solution of calcium hydroxide; (3) the solution was applied to the surface of the calcium hydroxide, carbon dioxide is dissolved in a mixture of water and alcohol and carbonated nano-bubbles bubbles at a nano-size can as a step of treating the carbonated nano-bubbles can, based on the total weight 100 parts by weight, 0.01 to 1.0 parts by weight of calcium oxide (CAO) is used for the step; (4) that was dissolved in the carbonated nano-bubbles can in the treatment surface 30 to 60% by weight Portland cement, cement 20-50% by weight, 5 to 30% by weight alpha-type half plaster and 0.1 to 5.0 parts by weight of the powder mixture and nitrous acid after preparing the binder prepared by mixing a binder, a filler and the repair mortar composition, aggregate mixed with water; (5) comprising the steps of coating a surface of the mortar composition for coating; applying a protective agent to the surface, in the above (3) a step of treating the carbonated nano-bubbles according to Water and alcohol are mixed in a weight ratio of 1: 1 100:0.1~100 respectively, characterized in that the reinforcement of the concrete structure cross-section.

**Assignees:** ECOENC CO LTD; LEE DONG WOO; CHOI SUN YOUNG



255. Family 70710849 (KR20180089772 A)

[View in PatBase](#)

Title

[EN] METHOD FOR COMPUTING CARBONATION OF HIGH VOLUME SLAG CONCRETE AND RECORDING MEDIUM THEREOF

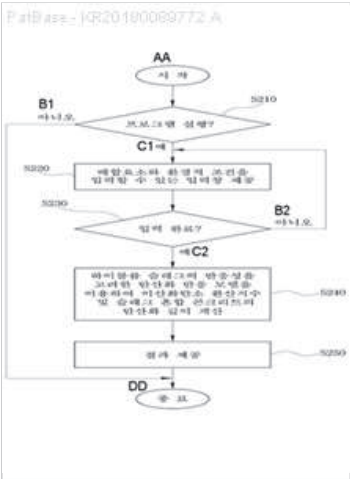
Abstract

[EN] The present invention provides a method of evaluating carbonation of high-volume slag concrete, including the steps of: providing, on a screen, a mixing element input window for inputting numerical values of mixing elements for mixing concrete and an environmental condition input window for inputting environmental conditions for concrete curing, when a program for evaluating carbonation of the high-volume slag concrete is executed in a computer; calculating a carbon dioxide diffusion index and a carbonation depth of slag mixed concrete by using a carbonation reaction model considering reactivity of high-volume slag upon completion of input through the mixing element input window and the environmental condition input window; and providing a calculated result on the screen. According to the present invention, a carbonation result of the high-volume slag concrete is easily simulated by easily inputting the mixing elements and curing conditions of the concrete without any special expertise.

1st Main Claim

[MT] 1. The carbonation of concrete-volume slag in the high rating provides a method, a computer volume for the slag concrete carbonation rating once the program is running, the value of the concrete mixing elements for intermingling the formulation components can be entered input window to enter the concrete curing can be environmental conditions for the environmental condition input window on the screen; the mixing elements to provide environmental conditions via the input window, the input window, the input is completed, taking into account the volume of the slag is a carbonation reaction model using reactive carbon dioxide spread index and slag carbonation of concrete mixture; and calculate a depth of the calculated result on a screen, including the step of providing a volume slag concrete carbonation of evaluation method.

**Assignees:** KNU IND COOPERATION FOUNDATION; KNU IND COOPERATION FOUND



256. Family 88116616 (US2021354084 AA)

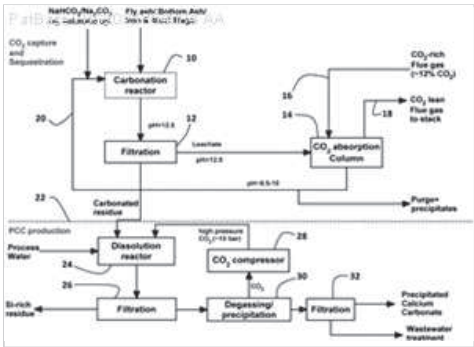
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Title (EP4255611 A1)

[EN] METHOD FOR CARBON DIOXIDE CAPTURE AND SEQUESTRATION USING ALKALINE INDUSTRIAL WASTES

Abstract (EP4255611 A1)

[EN] A method of sequestering gaseous carbon dioxide in which an oxide is carbonated by contacting it with a first aqueous carbonate solution to convert a portion of the oxide into a carbonate, which precipitates from solution. By converting the oxide to a solid carbonate, the CO<sub>2</sub> from the first carbonate solution is sequestered into the precipitate. At the same time, an aqueous hydroxide solution is formed. The aqueous hydroxide solution is contacted with gaseous carbon dioxide which sequesters the gaseous CO<sub>2</sub> into a second aqueous carbonate solution. The second solution so generated is then recycled back into the process and used to convert the oxide into the precipitated carbonate.



1st Main Claim (EP4255611 A1)

[EN] 1. A method of sequestering gaseous carbon dioxide, the method comprising: (a) carbonating an oxide or hydroxide by contacting a material comprising the oxide or hydroxide with a first aqueous carbonate solution for a time, at a temperature, and under conditions wherein: (i) at least a portion of the oxide or hydroxide is converted into a carbonate and wherein at least a portion of the carbonate so formed precipitates from the aqueous carbonate solution, to yield a precipitate; and (ii) an aqueous hydroxide solution is formed; and (b) contacting the aqueous hydroxide solution of step (a)(ii) with gaseous carbon dioxide for a time, at a temperature, and under conditions wherein at least a portion of the gaseous carbon dioxide is sequestered into a second aqueous carbonate solution.

**Assignees:** WISCONSIN ALUMNI RES FOUND; WISCONSIN ALUMNI RES FOUNDATION

257. Family 81408666 (US2021206696 AA)

[View in PatBase](#)

Title (EP3953124 B1)

[EN] PRODUCTION OF WET-CAST SLAG-BASED CONCRETE PRODUCTS

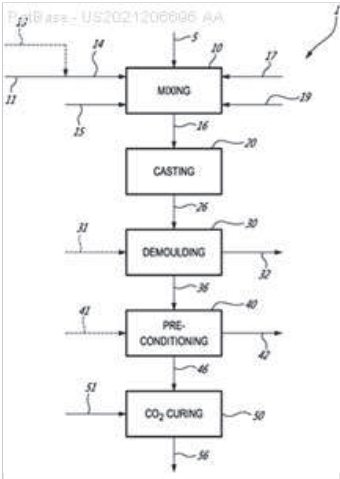
Abstract

[EN] The present description relates to a method of producing a wet-cast slag-based concrete product particularly where the wet-cast slag-based concrete product is partially or completely set inside a mould, pre-conditioned outside of the mould and then cured with carbon dioxide in a curing chamber. The wet-cast slag-based concrete product is optionally reinforced.

1st Main Claim (EP3953124 B1)

[EN] 1. A method of producing a wet-cast slag-based concrete product comprising steps of:

- providing a slag-based binder, an aggregate and water;
- mixing the slag-based binder, the aggregate and the water to produce a non-zero-slump concrete composition comprising a first water to slag-based binder ratio by weight of greater than 0.2;
- casting the non-zero-slump concrete composition by transferring the non-zero-slump concrete composition into a mould;
- setting the non-zero-slump concrete composition within the mould to produce a slag-based intermediate comprising a second water to slag-based binder ratio by weight that is less than the first water to slag-based binder ratio by weight;
- demoulding the slag-based intermediate to produce a demoulded intermediate;
- pre-conditioning the demoulded intermediate to produce a demoulded pre-conditioned slag-based intermediate comprising a third water to slag-based binder ratio by weight that is less than the first water to slag-based binder ratio by weight and that is also less than the second water to slag-based binder ratio by weight; and
- curing the demoulded pre-conditioned slag-based intermediate with carbon dioxide to produce the wet-cast slag-based concrete product,
- wherein
- the step of casting of the non-zero-slump concrete composition is free of pressing/compaction.



Assignees: CARBICRETE INC

258. Family 46814497 (US2010083880 AA)

[View in PatBase](#)

Extended Family Number: 42613795

Title

[EN] REDUCED-CARBON FOOTPRINT CONCRETE COMPOSITIONS

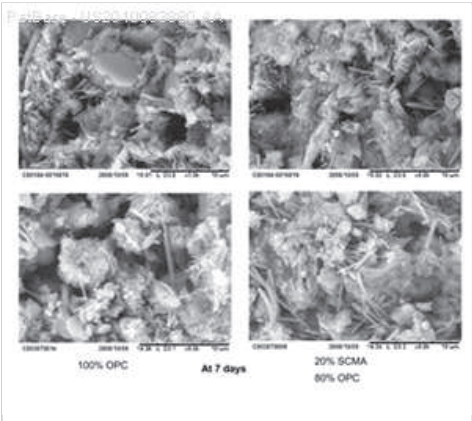
Abstract

[EN] Reduced-carbon footprint concrete compositions, and methods for making and using the same, are provided. Aspects of the reduced-carbon footprint concrete compositions include CO<sub>2</sub>-sequestering carbonate compounds, which may be present in the hydraulic cement and/or aggregate components of the concrete. The reduced-carbon footprint concrete compositions find use in a variety of applications, including use in a variety of building materials and building applications.

1st Main Claim

[EN] 1. A method comprising: a) producing a synthetic carbonate component from a divalent cation-containing solution and an industrial waste gas comprising CO<sub>2</sub> and b) incorporating the synthetic carbonate component into a reduced-carbon footprint concrete composition, wherein the reduced-carbon footprint concrete composition has a reduced carbon footprint relative to an ordinary concrete composition.

Assignees: YOUNGS ANDREW; CONSTANTZ BRENT R; HOLLAND TERENCE C; CALERA CORP



## 259. Family 97641687 (CN116239401 A)

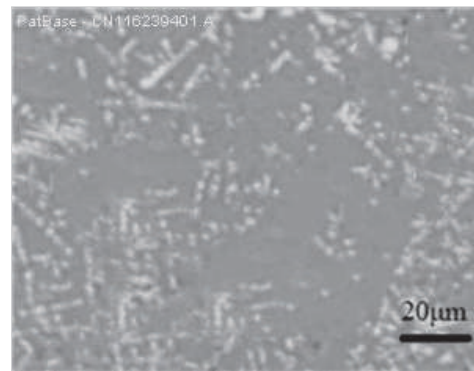
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### Title

[EN] METHOD FOR TREATING LIQUID STEEL SLAG IN STEEL PLANT

### Abstract

[EN] The invention provides a steel plant liquid steel slag treatment method, and belongs to the technical field of steel making. Comprising the following steps: S1, adding a steel slag modifier into liquid steel slag of a steel plant, heating for reaction, then cooling and filtering to obtain a primary treatment product, and keeping a solid for later use; s2, adding a Si/C reducing agent into the primary treatment product, carrying out microwave heating, introducing inert gas containing CO, carrying out reduction gasification reaction, filtering, collecting solids, pouring out liquid steel slag, cooling, recovering waste heat, naturally pulverizing the liquid steel slag while recovering the waste heat, feeding the liquid steel slag into magnetic separation equipment, carrying out magnetic separation on iron particles, and recovering tailings; and S3, combining solids in the step S1 and the step S2, and using the combined solids as a phosphorus-containing fertilizer. By the adoption of the method, the phosphorus content and the oxygen content in the liquid steel slag are greatly reduced, waste heat can be recycled, the generated by-product phosphorus-containing fertilizer promotes plant growth, the tailings serve as fine aggregate to be used in concrete products such as roads and building materials, and the method has wide application prospects.



### 1st Main Claim

[MT] 1. A method of treating liquid slag in a steelmaking plant, comprising the steps of: Providing a steelmaking plant having a first surface and a second surface;

S1. Add slag modifier to the steelmaking plant's liquid slag, heat to 1450-1550 degrees centigrade, stir the reaction, then cool to 1000-1050 degrees centigrade, filter, The product of the primary work-up was obtained, the solid was retained;

S2. To the primary treatment product obtained in step S1, Si/C reducing agent is added, microwave heated to 1600-1700 degrees centigrade, inert gas containing CO is passed, reduction gasification reaction, filtration, solid collection, liquid steel slag is poured out, and the resulting product is treated with a reducing agent. And cooling, residual heat recovery, While the waste heat is recovered, the liquid steel slag is naturally powdered, sent to the magnetic separation equipment, the magnetic separation particles, and the tail slag is recovered;

S3. The solids in step S1 and step S2 are combined and used as phosphorus-containing fertilizer;

The Si/C reducing agent was prepared as follows:

T1. Dissolve the alkyl orthosilicate in an organic solvent, add an aqueous solution containing emulsifier and poroglycine, emulsify, adjust the pH of the solution, centrifuge, wash, dry, to produce porous hollow SiO<sub>2</sub>Nanospheres;

T2. The porous hollow SiO prepared in step T1<sub>2</sub>The nanospheres are dispersed in water, add polydopamine hydrochloride and catalyst, heat the reaction stirred, filter, wash, dry, to make polydopamine-modified porous hollow SiO<sub>2</sub>Nanospheres;

T3. Polydopamine modified porous hollow SiO from step T2<sub>2</sub>The nanospheres and magnesium powder are mixed uniformly, under inert gas protection, calcined reaction, the product is added to dilute hydrochloric acid and stirred reaction, to produce Si/C reducing agent.

**Assignees:** HEBEI ZHENGANG ENERGY TECH RESEARCH AND DEVELOPMENT CO LTD

## 260. Family 108047562 (CN120004565 A)

[View in PatBase](#)

### Title

[MT] MINING CEMENTING FILLING MORTAR MATERIAL FOR MINERALIZATION AND STORAGE OF CO<sub>2</sub> AND PREPARATION METHOD THEREOF

### Abstract

[MT] [0001] The present application discloses a mineralized CO<sub>2</sub> sequestration cementing filling mortar material for mining and a preparation method thereof, and relates to the technical field of low-carbon and environmentally friendly mortar materials. The raw materials thereof include: microorganisms producing carbonic anhydrase, aggregates, a calcium source solution, and nano zinc oxide; wherein the calcium source solution is an aqueous solution of calcium chloride, calcium nitrate or calcium acetate, and the calcium source solution includes a premixed calcium source solution and a gradient calcium source solution. Calculated according to Ca<sup>2+</sup>, the Ca<sup>2+</sup> concentration in the premixed calcium source solution is 0.5 mol/L, and the gradient calcium source solution is 2 mol/L. The premixed calcium source solution is premixed with the aggregate for use; the particle size of the nano zinc oxide is 50-100 nm; the carbon dioxide sequestration amount can be increased to achieve the requirements of low carbon and carbon reduction, and the reaction rate of CO<sub>2</sub> hydration to generate HCO<sub>3</sub><sup>-</sup> / CO<sub>3</sub><sup>2-</sup> can be significantly increased, and its generation can be accelerated, thereby accelerating the CO<sub>2</sub> hydration reaction and subsequent gelation, and improving the environmental protection and low carbon performance.

### 1st Main Claim

[MT] 1. A cementing filling mortar material for mineralization and storage of CO<sub>2</sub>, characterized in that its raw materials include: microorganisms producing carbonic anhydrase, aggregates, calcium source solution, and nano zinc oxide;

The calcium source solution is an aqueous solution of calcium chloride, calcium nitrate or calcium acetate, and the calcium source solution includes a premixed calcium source solution and a gradient calcium source solution. According to Ca<sup>2+</sup> calculation, the Ca<sup>2+</sup> concentration in the premixed calcium source solution is 0.5 mol/L, and the Ca<sup>2+</sup> concentration in the gradient calcium source solution is 2 mol/L. The premixed calcium source solution is premixed with the aggregate before use; the particle size of the nano zinc oxide is 50-100 nm;

The premixed calcium source solution also contains premixed gelling agent, the mass ratio of the premixed gelling agent to the premixed calcium source solution is 1:5, the premixed gelling agent is prepared by mixing the bacterial solution, aggregate and the calcium source solution, the volume ratio of the bacterial solution to the aggregate is 1:1, and the Ca<sup>2+</sup> concentration in the calcium source solution is 2 mol/L.

## 261. Family 52218144 (US2012275987 AA)

[View in PatBase](#)

**Extended Family Number:** 42613795

### Title

[EN] SYSTEMS AND METHODS FOR CARBON SEQUESTRATION OF SYNTHESIS GAS

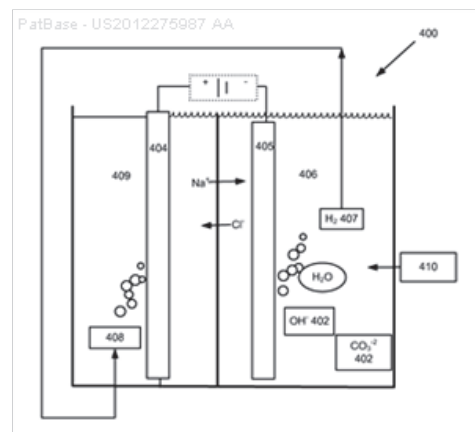
### Abstract

[EN] Provided are methods for sequestering carbon dioxide from a synthesis gas to provide a gaseous and an aqueous product. A recovery method and system for combusting the gaseous product and utilizing the aqueous product is provided. Methods and systems are described for utilizing the aqueous product in an electrochemical or a precipitation reaction. Compositions of sequestered carbon dioxide are provided.

### 1st Main Claim

[EN] 1. A method comprising: a) contacting a synthesis gas stream with a first reactive solution to form a product solution and a product gas with a reduced carbon dioxide concentration wherein the product solution comprises carbonate, bicarbonate or any combination thereof; b) utilizing a portion of the product solution as a catholyte in an electrochemical reaction; and c) processing the product gas.

**Assignees:** TUET PHILIP BRLAN; PUN BETTY KONG LING; HIZA MICHAEL D; SOM MANOJ R

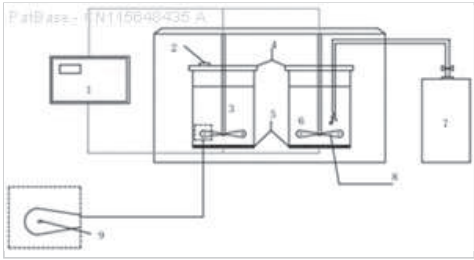


262. Family 95774832 (CN115648435 A)

[View in PatBase](#)

**Title**  
[EN] SOLID WASTE-BASED FOAM LIGHT SOIL PRODUCTION DEVICE AND METHOD FOR ADJUSTING CONSISTENCY THROUGH CARBONIZATION

**Abstract**  
[EN] The invention relates to a solid-waste-based foam light soil production device and method for adjusting the consistency through carbonization, and belongs to the field of foam light soil preparation, the solid-waste-based foam light soil production device comprises a mix proportion parameter system and a mixing system, the mix proportion parameter system can obtain the optimal amount of carbon dioxide, and carbonized slurry is adjusted to the proper consistency; solid waste slurry is treated through CO<sub>2</sub>, after carbon dioxide is introduced, part of free magnesium oxide and calcium oxide in calcium or magnesium-containing solid waste slurry react with the carbon dioxide to generate nano calcium carbonate and magnesium carbonate, and the nano calcium carbonate and magnesium carbonate are attached to the surfaces of solid waste particles, so that on one hand, the attachment and growth sites of hydration products are increased through generation of the nano materials; and on the other hand, the specific surface area of solid particles in the slurry is increased, so that the yield stress, shaping viscosity and other rheological properties of the solid waste slurry are changed. By controlling the proper carbonization rate and consistency, the prepared light soil is more uniform and fine in bubble size and higher in overall strength, and strength supplementation of the solid waste-based foam light soil is achieved.



**1st Main Claim**

[MT] 1. A waste-based foam lightweight soil production apparatus for adjusting consistency by carbonization, comprising: A mix ratio parameter system and a mix system;

The mix ratio parameter system includes a reference slurry bottle, a reference carbonized slurry bottle, a reference Co.<sub>2</sub>A gas cylinder and a controller, the reference slurry cylinder and the reference carbonized slurry cylinder respectively for holding a reference cement slurry and a carbonized slurry, the reference slurry cylinder and the reference carbonized slurry cylinder each being provided with a mass sensor at the bottom, the top being provided with a cap, and the cap being provided with a spout and a paddle hub, Both the reference slurry bottle and the reference carbonized slurry bottle were connected to the stirring blade via a stirring blade spindle interface, with the stirring blade fitted with a resistance sensor;

Baseline Co.<sub>2</sub>The gas bottle is connected to the reference carbonized slurry bottle for introducing CO into the reference carbonized slurry bottle, Benchmark Co.<sub>2</sub>CO is provided at the outlet of the cylinder, A margin detection table for real-time detection of Co.<sub>2</sub>Balance; the mass sensor, stirring blade spindle, resistance sensor, and Co.<sub>2</sub>The margin detection tables are all connected to the controller;

The blending system comprises a carbonization chamber, Co.<sub>2</sub>An air tank and a foaming chamber for completing the mixing, carbonization, foaming and pumping-out processes.

**Assignees:** SHANDONG UNIV; UNIV SHANDONG

## 263. Family 87438985 (CN113494265 A)

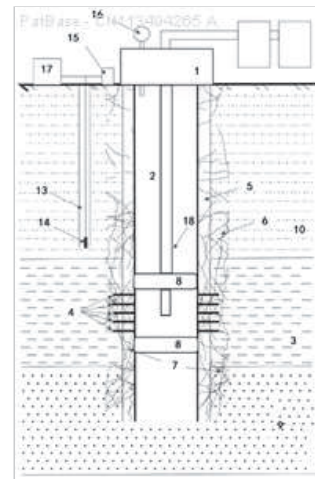
[View in PatBase](#)

### Title

[EN] METHOD FOR BLOCKING LEAKAGE ALONG ABANDONED WELL IN GEOLOGICAL STORAGE PROCESS OF CARBON DIOXIDE

### Abstract

[EN] The invention provides a method for blocking leakage along an abandoned well in the geological storage process of carbon dioxide. The method comprises the following steps that perforating is carried out by adopting a stable cover layer above a geological storage layer of carbon dioxide; a shaft with leakage risk, drilling annular cement and a surrounding rock fracture zone communicate with one another; and lime milk turbid liquid is injected into a perforation interval, so that lime milk in a gap reacts with leaked carbon dioxide to form hardened and compact calcium carbonate, and a carbon dioxide leakage channel is blocked. According to the method for blocking leakage along the abandoned well in the geological storage process of carbon dioxide, the crack channel leaking along the abandoned well in the geological storage process of carbon dioxide can be effectively blocked, meanwhile, a surrounding rock broken zone and crack-containing drilling well annulus cement can be cemented into a compact whole, and the risk of leaking along the abandoned well in the geological storage process of carbon dioxide is greatly reduced. The injected lime milk turbid liquid reacts with carbon dioxide leaked along the abandoned well to generate common calcium carbonate and water in the stratum, the geological environment pollution risk is extremely low, and the plugging process is safe and environmentally friendly.



### 1st Main Claim

[MT] 1. A method of blocking leaks along a waste well during geological sequestration of carbon dioxide, characterized by comprising the steps of:

Step 1: perforating, i. e. perforating the inner wall of the wellbore corresponding to the thickness of the stable cover layer, connecting the split of the drilling annulus cement and the perlite crushing zone;

Step 2: Injection of the milk of lime suspension, i. e. injection of the milk of lime suspension in said perforated hole, so that the milk of lime suspension enters into said split, reacts with leaking carbon dioxide to form calcium carbonate, thereby blocking the leaking passage of carbon dioxide.

**Assignees:** CT HYDROGEOLOGY AND ENV GEOLOGY CGS

264. Family 48394688 (US2011054084 AA)

[View in PatBase](#)

Extended Family Number: 42613795

Title

[EN] HYDRAULIC CEMENTS COMPRISING CARBONATE COMPOUND COMPOSITIONS

Abstract

[EN] Hydraulic cement compositions that include a carbonate compound composition, e.g., a salt-water derived carbonate compound composition containing crystalline and/or amorphous carbonate compounds, are provided. Also provided are methods of making and using the hydraulic cements, as well as settable compositions, such as concretes and mortars, prepared therefrom. The cements and compositions produced therefrom find use in a variety of applications, including use in a variety of building materials and building applications.

1st Main Claim

[EN] **21.** A composition, comprising a carbonate selected from the group consisting of vaterite, aragonite, amorphous calcium carbonate, and combination thereof, wherein said composition upon combination with water, setting, and hardening has a compressive strength in a range of 20-70 MPa.

Assignees: RYAN CECILY; CONSTANTZ BRENT R; CLODIC LAURENCE; CALERA CORP



265. Family 48766855 (US2011091955 AA)

[View in PatBase](#)

Title

[EN] METHODS AND SYSTEMS FOR TREATING INDUSTRIAL WASTE GASES

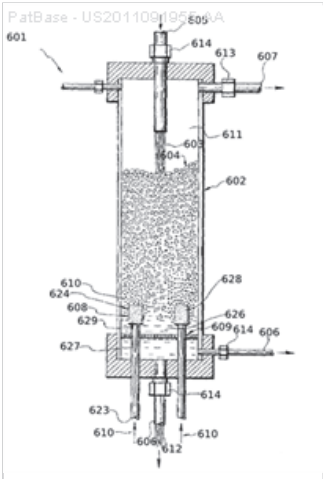
Abstract

[EN] Systems and methods for lowering levels of carbon dioxide and other atmospheric pollutants are provided. Economically viable systems and methods capable of removing vast quantities of carbon dioxide and other atmospheric pollutants from gaseous waste streams and sequestering them in storage stable forms are also discussed.

1st Main Claim

[EN] 1. A method, comprising: (i) contacting a gaseous stream comprising CO<sub>2</sub> with a catalyst to form a solution comprising hydrated CO<sub>2</sub>; and (ii) treating the solution to produce a composition comprising a metastable carbonate.

**Assignees:** CHANDRA DIVYAM; CONSTANTZ BRENT R; BRESSON JAMES; CALERA CORP



## 266. Family 107716264 (IN202341069772 A)

[View in PatBase](#)

### Title

[EN] VALIDATION PROCESS DESIGN A MIX PROPORTION FOR SELF COMPACTING CONCRETE BY USING FLYASH

### Abstract

[EN] Cement manufactured release large amount of carbon dioxide. So there is an instantaneous require to manage the use of cement. This research mainly deals with the replacement of cement by fly ash taken in variable proportions and analysing the effects of fly ash concrete. The concrete mix is prepared by varying the proportions of fly ash for 30 percent, of cubes cured in normal water up to for 7 and 28 days. Compressive strength for hardened concrete are verified and the results are analysed.

### 1st Main Claim

[EN] 1. The self-healing mechanism is introduced in the concrete which helps to repair the cracks by producing calcium carbonate crystals which block the micro-cracks and pores in the concrete

## 267. Family 107715925 (IN202341069922 A)

[View in PatBase](#)

### Title

[EN] VALIDATION PROCESS DESIGN A MIX PROPORTION FOR SELF COMPACTING CONCRETE BY USING FLYASH

### Abstract

[EN] Cement manufactured release large amount of carbon dioxide. So there is an instantaneous require to manage the use of cement. This research mainly deals with the replacement of cement by fly ash taken in variable proportions and analysing the effects of fly ash concrete. The concrete mix is prepared by varying the proportions of fly ash for 30 percent, of cubes cured in normal water up to for 7 and 28 days. Compressive strength for hardened concrete are verified and the results are analysed.

### 1st Main Claim

[EN] 1. The self-healing mechanism is introduced in the concrete which helps to repair the cracks by producing calcium carbonate crystals which block the micro-cracks and pores in the concrete

## 268. Family 107716088 (IN202341069746 A)

[View in PatBase](#)

### Title

[EN] VALIDATION PROCESS DESIGN A MIX PROPORTION FOR SELF COMPACTING CONCRETE BY USING FLYASH

### Abstract

[EN] Cement manufactured release large amount of carbon dioxide. So there is an instantaneous require to manage the use of cement. This research mainly deals with the replacement of cement by fly ash taken in variable proportions and analysing the effects of fly ash concrete. The concrete mix is prepared by varying the proportions of fly ash for 30 percent, of cubes cured in normal water up to for 7 and 28 days. Compressive strength for hardened concrete are verified and the results are analysed.

### 1st Main Claim

[EN] 1. The self-healing mechanism is introduced in the concrete which helps to repair the cracks by producing calcium carbonate crystals which block the micro-cracks and pores in the concrete

## 269. Family 91143297 (US2023357004 AA)

[View in PatBase](#)

### Title (EP4232407 A1)

[EN] A METHOD FOR THE PRODUCTION OF HYDROGEN

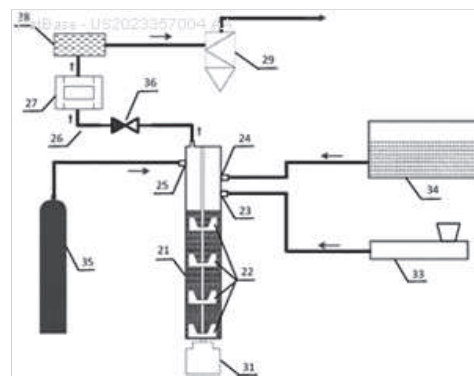
### Abstract

[EN] The present invention relates to a process of producing hydrogen gas from water, an iron-containing coal combustion product and carbon dioxide or a carbon dioxide precursor. The process is a spontaneous process that does not involve the implementation of external heating or electricity. The process further provides the recycling of the coal combustion product such as an iron slag or ash and may also be used for carbon dioxide sequestering.

### 1st Main Claim

[EN] **1.** A process for producing H<sub>2</sub>, the process comprising a step of contacting water, an iron-containing coal combustion product, and a CO<sub>2</sub> source selected from the group consisting of CO<sub>2</sub> and a CO<sub>2</sub> precursor thereby producing H<sub>2</sub>, wherein the process is performed in a reactor in the absence of external heating.

**Assignees:** TYKHE TECH PTE LTD; TYCO TECH PTY LTD; SRECKO VUKSAN; SAAR REUVEN



## 270. Family 95919977 (WO23016934 A1)

[View in PatBase](#)

### Title (EP4134355 A1)

[EN] SELF-FOAMING GYPSUM COMPOSITIONS

### Abstract (EP4134355 A1)

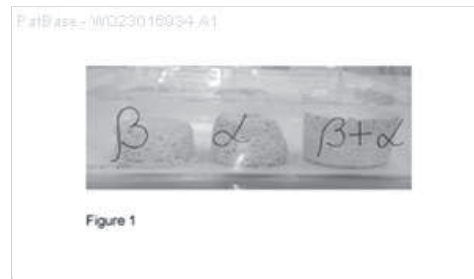
[EN] A dry gypsum composition, in particular for preparing foamed gypsum compositions, comprises: a) 10 - 50 wt.- percent of a gypsum based binder; b) 30 - 60 weight percent of aggregates, optionally comprising lightweight aggregates; c) 1 - 15 wt.- percent, especially 2 - 9 weight percent, of a foaming agent capable of producing carbon dioxide; d) 0.5 - 10 weight percent, especially 1 - 6 weight percent, of an acidic agent, capable of reacting with the foaming agent under aqueous conditions for generation of carbon dioxide; whereby the proportions are given with respect to the total weight of the dry gypsum composition.

### 1st Main Claim (EP4134355 A1)

[EN] 1. Dry gypsum composition, in particular for preparing foamed gypsum compositions, comprising:

- a) 10 ? 50 wt.- percent of a gypsum based binder;
  - b) 30 - 60 weight percent of aggregates, optionally comprising light weight aggregates;
  - c) 1 ? 15 wt.- percent, especially 2 ? 9 weight percent, of a foaming agent capable of producing carbon dioxide;
  - d) 0.5 ? 10 weight percent, especially 1 - 6 weight percent, of an acidic agent, capable of reacting with the foaming agent under aqueous conditions for generation of carbon dioxide;
- whereby the proportions are given with respect to the total weight of the dry gypsum composition.

**Assignees:** SIKA TECH AG



271. Family 105896807 (KR20240176049 A)

[View in PatBase](#)

Title

[EN] METHOD OF MANUFACTURING ALKALI ACTIVE SLAG CONCRETE USING CARBON DIOXIDE DISSOLVED MIXING WATER

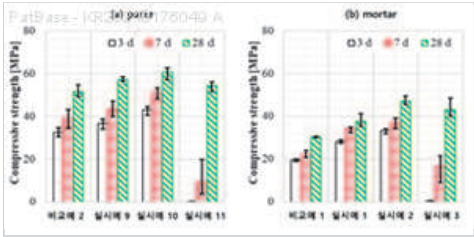
Abstract

[MT] The present invention relates to a process for preparing blended water, comprising the steps of (S1) bubbling carbon dioxide into an aqueous alkali hydroxide solution; And (S2) adding and mixing slag and aggregate into the compounding water and alkali-activated slag concrete produced therefrom. The alkali-activated slag concrete produced therefrom. It is not only possible to sustainable and environmentally friendly to produce concrete , the alkali-activated slag concrete produced by the method according to the present invention has the advantage that it is possible to exhibit strength early .

1st Main Claim

[MT] 1. Preparing an alkali-active slag concrete, comprising the following steps:(S1) bubbling carbon dioxide into an aqueous alkali hydroxide solution to produce blended water; (S2) adding slag and aggregate to the blended water and mixing.

**Assignees:** KOREA ADVANCED INST OF SCIENCE AND TECH; KOREA ADVANCED INST SCI AND TECH; KOREA ADVANCED INST OF SCIENCE AND TECHNOLOGY



## 272. Family 99896587 (CN117069444 A)

[View in PatBase](#)

### Title

[EN] CARBONIZED PHASE CHANGE CONCRETE AND PREPARATION METHOD THEREOF

### Abstract

[EN] The invention relates to carbonized phase change concrete and a preparation method thereof. The carbonized phase change concrete is prepared from the following components in parts by mass: 30-60 parts of low-carbon silicate clinker, 45-100 parts of coarse aggregate, 55-110 parts of fine aggregate, 14-18 parts of mixing water, 0.4-1 part of a phase change triggering agent, 2-4 parts of a phase change regulator and 0.2-0.5 part of a water reducing agent. The low-carbon silicate clinker is used as a cementing material, less limestone and energy are consumed in the production process, less carbon dioxide is discharged, the concrete is prepared by a carbon dioxide curing process, and a large amount of carbon dioxide is absorbed through carbonization reaction in the curing process, so that carbon sequestration is realized. Meanwhile, the pore structure is optimized, the compactness is improved, the defect that carbon dioxide channels and a large number of communicated pores still exist after conventional carbonized concrete is prepared is overcome, and the water resistance and frost resistance of concrete products in the watery and humid environment in the application process are further improved; the application scene of the carbonized concrete is expanded.

### 1st Main Claim

[MT] 1. A carbonized phase change concrete, characterized by comprising the following components in mass parts: Low carbon silicate clinker 30 to 60 parts, coarse aggregate 45 to 100 parts, fine aggregate 55 to 110 parts, mixed water 14 to 18 parts, phase change trigger 0.4 to 1 part, phase change regulator 2 to 4 parts, Water reducing agent 0.2 to 0.5 parts.

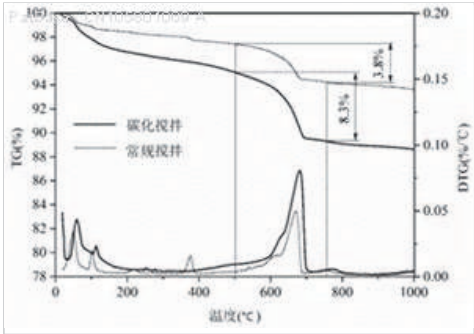
**Assignees:** HUAXIN CEMENT CO LTD

273. Family 63000726 (CN105801069 A)

[View in PatBase](#)

**Title**  
[EN] METHOD FOR PREPARING HIGH-FIXED-CARBON-CONTENT CONSTRUCTION MATERIAL PRODUCT

**Abstract**  
[EN] The invention provides a method for preparing a high-fixed-carbon-content construction material product. The method comprises the following steps of: mixing a cementing material which is prepared from dicalcium silicate, tricalcium silicate, calcium hydroxide and other ingredients with water in a certain water-cement ratio; mixing and stirring in a CO<sub>2</sub> atmosphere in a certain procedure to absorb a certain amount of CO<sub>2</sub> to prepare a construction product blank; and then, performing carbonated curing to absorb CO<sub>2</sub> once again to produce the construction material product. According to the method, CO<sub>2</sub> is absorbed in the whole process of producing a construction product, so that CO<sub>2</sub> can be effectively utilized, the fixed carbon content is improved by 70 percent in comparison with that of single carbonized curing, the traditional mode which has high CO<sub>2</sub> emission in construction material product production is broken through, and the product performance can be improved. The method has remarkable effects in relieving the weather problem caused by CO<sub>2</sub> emission, shortening production cycle of construction material products and improving production efficiency.



**1st Main Claim**

[MT] 1 of a high amount of carbon materials prepared products, characterized in that: the following steps

After (1) containing a dicalcium silicate, tricalcium silicate, calcium hydroxide cementitious material by mixing cement ratio of 0.1 to 0.15 and the proportion of water, stir in the atmosphere of carbon dioxide 1-1.5 minutes give carbonized stirring after mixing thereof;

(2) obtained in the step Mixture 8MPa pressure forming, too rough;

(3) obtained on a blank step the standard curing for 2 hours to obtain.

**Assignees:** UNIV WUHAN; WUHAN UNIV

## 274. Family 94334941 (CN115321861 A)

[View in PatBase](#)

### Title

[EN] METHOD FOR ABSORBING AND FIXING CARBON BY USING CONCRETE POROUS AGGREGATE AND CONCRETE

### Abstract

[EN] The invention provides a method for absorbing and fixing carbon by using a concrete porous aggregate, which comprises the following steps: soaking the porous aggregate in a suspension containing non-corrosive ions of  $\text{Ca}^{2+}$  and/or  $\text{Mg}^{2+}$ , fully stirring and drying to obtain a pretreated aggregate; the porous aggregate is selected from one or more of coral aggregate, ceramsite aggregate and recycled brick aggregate; the porosity of the porous aggregate is 40-60 percent; and placing the pretreated aggregate in a closed environment, introducing  $\text{CO}_2$  gas for carbonization, and drying again to obtain the modified porous aggregate. According to the method,  $\text{CO}_2$  can be effectively stored in pores of the porous aggregate (accounting for about 20 percent of  $1\text{m}^3$  of concrete), and the situation that the pH value of a cement matrix is reduced due to carbon absorption and carbon sequestration in a conventional method is avoided, so that the adverse effect on concrete reinforcements is reduced. When the modified porous aggregate is applied to concrete, the carbon absorption amount of the concrete can be increased; the physical properties, such as the water absorption rate, are improved.



### 1st Main Claim

[MT] 1. A method of carbon fixation with concrete porous aggregates comprising the steps of:

Soaking porous aggregate in a suspension containing non-corrosive ions of  $\text{Ca}^{2+}$  and/or  $\text{Mg}^{2+}$ , thoroughly stirred and then oven-dried to obtain pretreated aggregate; said porous aggregate is selected from one or more of coral aggregate, grain aggregate and regenerated brick aggregate; said porous aggregate has a porosity of 40~ 60%;

The pretreated aggregates were placed in a sealed environment and carbonized by  $\text{CO}_2$  gas and oven dried again to obtain modified porous aggregates.

**Assignees:** HONG KONG POLYTECHNIC UNIV; UNIV HONG KONG POLYTECHNIC

275. Family 46814474 (WO10048457 A1)

[View in PatBase](#)

Extended Family Number: 42613795

Title (EP2352706 A1)

[EN] REDUCED-CARBON FOOTPRINT CONCRETE COMPOSITIONS

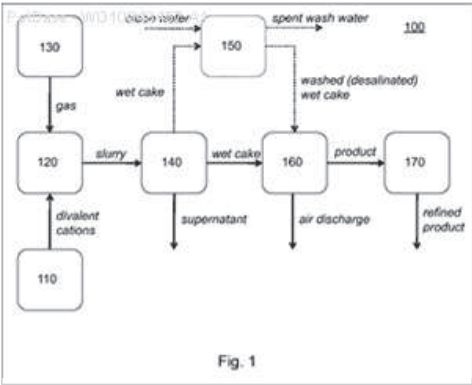
Abstract (EP2352706 A1)

[EN] Reduced-carbon footprint concrete compositions, and methods for making and using the same, are provided. Aspects of the reduced-carbon footprint concrete compositions include CO<sub>2</sub>-sequestering carbonate compounds, which may be present in the hydraulic cement and/or aggregate components of the concrete. The reduced-carbon footprint concrete compositions find use in a variety of applications, including use in a variety of building materials and building applications.

1st Main Claim (EP2352706 A1)

[EN] 1. A method comprising: a) producing a synthetic carbonate component from a divalent cation- containing solution and an industrial waste gas comprising CO<sub>2</sub> and b) incorporating the synthetic carbonate component into a reduced-carbon footprint concrete composition, wherein the reduced-carbon footprint concrete composition has a reduced carbon footprint relative to an ordinary concrete composition.

Assignees: CALERA CORP; ARELAC INC; YOUNGS ANDREW; CONSTANTZ BRENT R; HOLLAND TERENCE



276. Family 96165231 (CN115745450 A)

[View in PatBase](#)

Title

[EN] METHOD FOR ENHANCING BUILDING SOLID WASTE ADHESIVENESS AND INTERFACE WATER STABILITY AND APPLICATION

Abstract

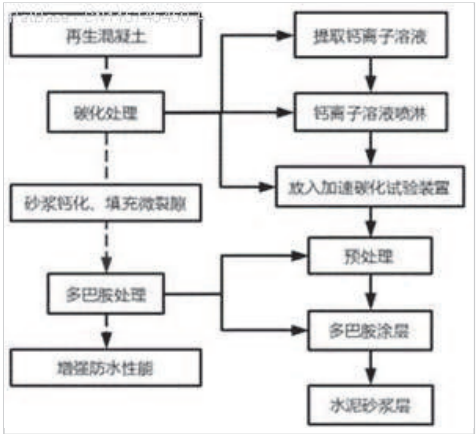
[EN] The invention discloses a method for enhancing building solid waste adhesiveness and interface water stability, which comprises the following steps of: cleaning building solid waste concrete aggregate to remove surface dust, spraying a  $\text{Ca}^{2+}$  solution with the concentration of 0.04 percent  $\pm$  0.01 percent by using spraying equipment until the building solid waste concrete aggregate absorbs water to reach an infiltration state, and carbonizing to obtain the building solid waste concrete aggregate. And naturally airing, carrying out hydroxylation treatment in a nitrogen environment, and carrying out ultrasonic dispersion in a dopamine solution, so that dopamine is fully dried and firmly attached to the surface of the building solid waste concrete aggregate to form a layer of polydopamine. The building solid waste recycled concrete aggregate with high adhesiveness and interface water stability is obtained through accelerated carbonization and dopamine cooperative control, the mortar calcification degree can be improved, the chemical bonding performance of the recycled aggregate/waterproof SBS modified asphalt can be enhanced, the interface stability of the recycled aggregate/water/asphalt can be improved, the application field is wide, energy is saved, carbon is reduced, and the application prospect is wide. Various defects in the prior art are effectively overcome, and high industrial utilization value is achieved.

1st Main Claim

[MT] 1. A method for enhancing building waste adhesion and interfacial water stability, comprising the following specific steps:

- Step 1: Cleaning the building waste concrete aggregate to remove surface dust, spraying  $\text{Ca}^{2+}$  solution with a concentration of 0.04 plus or minus 0.01 units by spraying equipment until the building waste concrete aggregate absorbs water to a wet state;
- Step 2: Carbonizing the infiltrated building waste concrete aggregate;
- Step 3: After the carbonization treated building waste concrete aggregate is cleaned and dried by natural air, hydroxylation is carried out by subjecting it to a nitrogen atmosphere;
- Step 4: Ultrasonically disperse 1.5 h plus or minus 0.5 h in a dopamine solution;
- Step 5: The ultrasonically dispersed building waste concrete aggregate is taken out of natural air-dried, the dopamine is sufficiently dried and firmly attached to the surface of the building waste concrete aggregate to form a layer of polydopamine, resulting in a building waste regenerated concrete aggregate having high adhesion and interfacial water stability.

**Assignees:** HENAN UNIV OF TECHNOLOGY; UNIV HENAN TECHNOLOGY



277. Family 54784088 (US2013243674 AA)

[View in PatBase](#)

Extended Family Number: 42613795

Title

[EN] METHODS AND SYSTEMS FOR UTILIZING WASTE SOURCES OF METAL OXIDES

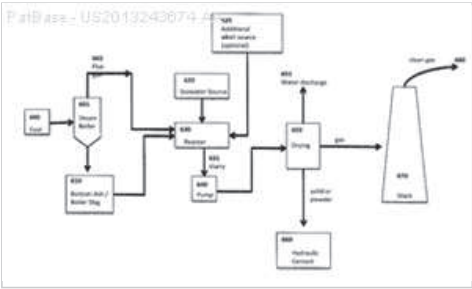
Abstract

[EN] Methods are provided for producing a composition comprising carbonates, wherein the methods comprise utilizing waste sources of metal oxides. An aqueous solution of divalent cations, some or all of which are derived from a waste source of metal oxides, may be contacted with CO<sub>2</sub> and subjected to precipitation conditions to provide compositions comprising carbonates. In some embodiments, a combustion ash is the waste source of metal oxides for the aqueous solution containing divalent cations. In some embodiments, a combustion ash is used to provide a source of proton-removing agents, divalent cations, silica, metal oxides, or other desired constituents or a combination thereof.

1st Main Claim

[EN] **80.** A method comprising: a) contacting an aqueous solution with metal oxides comprising slag; b) charging the aqueous solution with carbon dioxide from an industrial process; and c) subjecting the aqueous solution to precipitation conditions favoring precipitation of precipitation material comprising aragonite, vaterite, or mixture thereof.

Assignees: CALERA CORP



## 278. Family 92098341 (CN114671649 A)

[View in PatBase](#)

### Title

[EN] HIGH-STRENGTH CONCRETE PREPARED FROM CONSTRUCTION WASTE AND PREPARATION METHOD OF HIGH-STRENGTH CONCRETE

### Abstract

[EN] The invention discloses high-strength concrete prepared from construction waste and a preparation method of the high-strength concrete. The method comprises the following steps: screening out impurities from recycled aggregate, soaking recycled aggregate particles in a low-concentration soaking solution and a high-concentration soaking solution prepared from an active admixture and a water reducing agent, adjusting the pH value of the soaking solution by using sodium hydroxide, and performing alkali excitation on the active admixture, thereby obtaining the recycled aggregate particles. A calcium silicate hydrate phase substance is generated through a pozzolanic reaction to fill tiny gaps in the recycled aggregate to make up the strength, mortar holes in the surface of the recycled aggregate are filled and covered to reduce the water absorption rate of the recycled aggregate, and then carbon dioxide gas is used for accelerating the reaction with the calcium silicate hydrate phase substance at a high temperature to generate calcium carbonate; compacting the surface of the recycled aggregate. After treatment, the strength of the recycled aggregate is compensated, and the water absorption rate of the recycled aggregate is reduced, so that the water cement ratio of the concrete is reduced, and the construction performance and strength of the concrete are enhanced.

### 1st Main Claim

[MT] 1. A preparation method of high strength concrete prepared using building garbage, characterized by comprising the following steps:

S1. Preparation of regenerated aggregates:

S11. Disintegrating building garbage into continuously graded regenerated aggregate particles having a particle size of 10-25 mm, removing ferrous material, wood material and plastic from the regenerated aggregate particles after magnetic and flotation, and leaving to dry;

S12. Silica ash, fly ash, slag, water reducing agent based on naphthalene and water are mixed with stirring to prepare a low concentration soaking solution, soaking the regenerated aggregate particles after drying in the low concentration soaking solution, slowly adding sodium hydroxide to adjust the pH value to 10.5-11.5, and then soaking by vacuum soaking for 15-30 min, removing the air drying;

S13. Silica ash, fly ash, slag, water reducing agent based on naphthalene and water are mixed with stirring to prepare a high-concentration soaking solution, and regenerated aggregate particles are soaked again, sodium hydroxide is slowly added to adjust the pH value to 10.5-11.5, and the soaking time is 20-40 min, and after the end of soaking, the soaking time is 20-40 min; and after the end of soaking, the soaking is taken out to dry; and

S14. moving the particles of regenerated aggregate left to dry into a closed container, heating by passing through a CO<sub>2</sub> cycle, and heating by 2-3 h, obtaining regenerated aggregate;

S2. After mixing the cement, the active alloy, the reinforcing fiber and the fine aggregate uniformly, adding natural coarse aggregate, and after mixing uniformly, adding regenerated coarse aggregate and mixing to obtain concrete aggregates;

S3. After dissolving the water reducing agent in the blending water, one piece is added to a blender, uniformly stirred with concrete aggregates, and then formed by pouring and curing to obtain high-strength concrete.

**Assignees:** JIANGSU ZHONGDING BUILDING MAT GROUP CO LTD

## 279. Family 108553263 (CN120208621 A)

[View in PatBase](#)

### Title

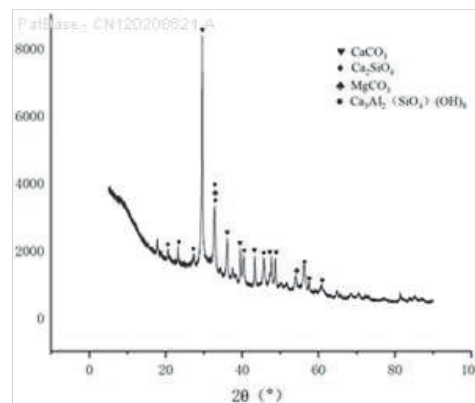
[MT] CONCRETE COMPOSITION, AUTOCLAVED SAND AERATED CONCRETE BLOCK AND APPLICATION THEREOF

### Abstract

[MT] [0001] The present invention provides a concrete composition, an autoclaved sand aerated concrete block and an application thereof. The concrete composition of the present invention comprises quartzite rock powder, a cementing component A and a calcium component B, wherein the cementing component A comprises calcium silicate slag, mineral powder and desulfurized gypsum, and the calcium component B comprises quicklime and optional calcium carbide slag. The concrete cementing composition of the present invention can be used to prepare autoclaved sand aerated concrete blocks, which greatly reduces the amount of silicate cement and lime while ensuring the mechanical properties of the blocks, improves the utilization rate of solid waste and can also reduce the emission of carbon dioxide.

### 1st Main Claim

[MT] 1. A concrete composition comprising quartzite rock powder, a cementitious component A and a calcareous component B, wherein the cementitious component A comprises calcium-silicon slag, mineral powder and desulfurized gypsum, and the calcareous component B comprises quicklime and optionally carbide slag.



## 280. Family 51779733 (US2012213688 AA)

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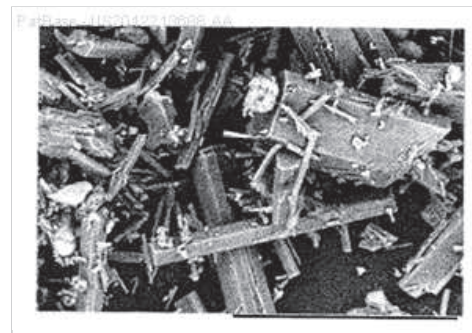
**Extended Family Number:** 42613795

### Title

[EN] METHODS OF SEQUESTERING CO<sub>2</sub>

### Abstract

[EN] Methods of sequestering carbon dioxide (CO<sub>2</sub>) are provided. Aspects of the methods include precipitating a storage stable carbon dioxide sequestering product from an alkaline-earth-metal-containing water and then disposing of the product, e.g., by placing the product in a disposal location or using the product as a component of a manufactured composition. Also provided are systems for practicing methods of the invention.



### 1st Main Claim

[EN] **21.** A method of making artificial reef structure, comprising: treating at least a portion of flue gas from an industrial plant, wherein said flue gas comprises carbon dioxide, with a proton removing agent to produce a solution comprising carbonate ions; treating said solution with alkaline-earth-metal-ions to produce a precipitate comprising carbonate wherein said carbonate comprises metastable carbonate; and using said precipitate to make artificial reef structure.

**Assignees:** KIRK DONALD W; GILLIAM RYAN J; CONSTANTZ BRENT R; DANZIGER ROBERT; FARSAD KASRA; OMELON SIDNEY; DECKER VALENTIN; TUET PHILIP BRIAN; FERNANDEZ MIGUEL; BARD ALLEN J; RYAN CECILY; YOUNGS ANDREW; WAY J DOUGLAS

281. Family 99774555 (CN117023618 A)

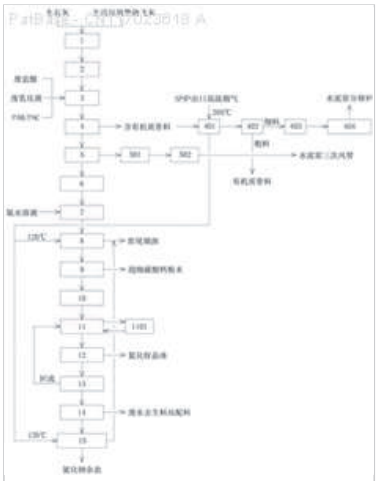
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Title

[EN] SYSTEM AND METHOD FOR CO-PROCESSING WASTE LIQUID AND HOUSEHOLD GARBAGE INCINERATION FLY ASH IN CEMENT KILN

Abstract

[EN] The invention provides a system and a method for co-processing waste liquid and household garbage incineration fly ash in a cement kiln. The method comprises the following steps: modifying the household garbage incineration fly ash by using a small amount of quick lime, mixing with waste hydrochloric acid, waste emulsion and the like, reacting, and separating to obtain high-added-value materials such as organic aggregate, fine powder, high-calorific-value waste oil, superfine calcium carbonate, ammonium chloride crystals, carnallite and the like. Meanwhile, the process is coupled with a cement clinker production line, and partial material absorption is realized by utilizing the characteristics that a flue gas system of the cement production line contains waste heat, a sintering system needs to supplement heat and a raw material batching station system needs to supplement water. The system and the method have the characteristics that the industrial solid waste is treated in a manner of treating waste with waste, various products with additional values are produced in the whole process, the waste heat of the cement kiln is recycled, carbon dioxide supplementation of a cement line can be realized, and the system and the method have a wide prospect in the hazardous waste utilization and treatment industry.



1st Main Claim

[MT] 1. A system for co-disposal of waste liquid and domestic waste incineration fly ash in a cement kiln, characterized in that the system comprises a solid material mixer (1), a crusher (2), a reactor (3), a first stage solid liquid separator (4), a water separator (5), a first stage clarifier tank (6), A liquid mixer (7), a bubbling reactor (8), a second stage solid-liquid separator (9), a second stage clarified liquid storage tank (10), a temperature reduction system (11), a frozen salting system (12), a mother liquor storage tank (13), a flash concentration system (14), A bubble bed dryer (15), a dryer (401), a sifter (402), a bin (403), a pneumatic conveying pump (404), an oil storage tank (501), a conveying pump (502), A refrigerator (1101); a small quantity of quicklime mixed uniformly with domestic waste incinerated fly ash is fed through a feeder to a solid material mixer (1) for mixing; a solid material mixer (1) outlet is connected to an inlet of a crusher (2); The outlet of the crusher (2) is connected to the inlet of the reactor (3), and the mixed solid material is crushed by the crusher (2) and then put into the reactor (3); The outlet of the reactor (3) is connected to the inlet of the first stage solid-liquid separator (4), the outlet of the first stage solid-liquid separator (4) is connected to the inlet of the water separator (5), and the outlet of the water separator (5) is connected to the inlet of the first stage clarifier tank (6). The outlet of the first stage clarifier tank (6) is connected to a liquid mixer (7), and the first stage solid-liquid separator (4) separates the solid phase from the liquid phase of the water mixture from the reactor. The liquid phase enters an oil-water separator (5) for oil-water separation, and the resulting aqueous phase is fed as a separated clarified liquid to a first stage clarified liquid storage tank (6) for temporary storage and then to a liquid mixer (7), the outlet of the liquid mixer (7) being connected to the inlet of the bubbling reactor (8), The air inlet of the bubble reactor (8) is connected to the air outlet of the dryer (401), and an aqueous ammonia solution of a certain concentration is fed into the liquid mixer (7) and mixed with the separated clarified liquid of water from the first stage clarified liquid storage tank (6). Then a bubble reactor (8) is fed to react sufficiently with the dryer (401) outlet, the bubble reactor (8) outlet is connected to the inlet of a second stage solid-liquid separator (9), the outlet of the second stage solid-liquid separator (9) is connected to the inlet of a second stage clarifier tank (10), After separation of the solid phase from the liquid phase of the water mixture from the bubbling reactor (8) by the second stage solid-liquid separator (9), the liquid phase enters a second stage clarifier tank (10) for temporary storage, and the outlet of the second stage clarifier tank (10) is connected to the inlet of the temperature reduction system (11). The cooling system (11) outlet is connected to the inlet of the refrigerated salting system (12), the freezing salting system (12) outlet is connected to the inlet of the mother liquor storage tank (13), and the clarified liquid of the second stage clarifying liquid storage tank (10) is sent to the cooling system (11) after cooling, to the freezing salting system (12). The chlorinate remaining mother liquor enters the mother liquor storage tank (13) for a temporary period, and a portion of the temporary mother liquor is refluxed to the temperature reduction system (11). The mother liquor tank (13) outlet is connected to the inlet of the flash concentration system (14) and the flash concentration system (14) outlet is connected to the inlet of the bubble bed dryer (15) to produce wastewater to be sent to the cement line raw ingredient station, The air inlet of the bubble bed dryer (15) is connected to the air outlet of the dryer (401), and the missalt solution in the flash concentration system (14) enters the bubble bed dryer (15), and is dried by the air outlet of the dryer (401) to obtain chlorinate sodium missalt.

Assignees: JIANGSU ENVIRONMENTAL ENGINEERING TECH CO LTD

282. Family 79468738 (US2021395102 AA)

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Title

[EN] METHOD FOR MANUFACTURING COMPOSITE CARBONATE BY USING COMBUSTION ASH

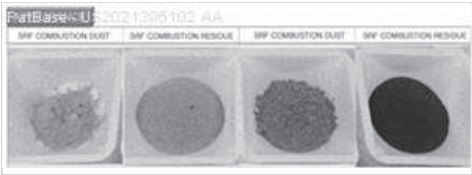
Abstract

[EN] The present invention provides a method for manufacturing a composite carbonate in a semi-dry manner by using combustion ash and, more specifically, provides a method for manufacturing a composite carbonate in a semi-dry manner by using combustion ash, the method comprising a step of adding a small amount of water to combustion ash containing calcium ions in an atmosphere of carbon dioxide. According to the present invention, carbon mineralization is carried out in a semi-dry manner by the manufacturing method, so that the composite carbonate can be efficiently produced. In addition, the composite carbonate can be utilized as a component for a concrete composition.

1st Main Claim

[EN] 1. A semi-dry method for manufacturing a composite carbonate from combustion ash, the method comprising a step of adding water to calcium ion-containing combustion ash in a carbon dioxide atmosphere.

Assignees: KOREA INST CERAMIC ENG AND TECH



283. Family 52557577 (CN102809145 A)

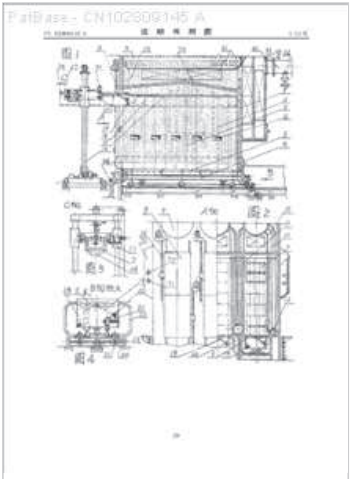
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Title

[EN] HYBRID INDEPENDENT OR GAS-LIQUID CONNECTION HIGH-STRENGTH MULTI-CARBON-CAPTURE INTEGRATED FURNACE WITH EXPONENTIALLY REDUCED INVESTMENT AND HIGH BENEFITS

Abstract

[EN] A hybrid independent or gas-liquid connection high-strength multi-carbon-capture integrated furnace with exponentially reduced investment and high benefits is distinguished from a furnace with high discharge and high investment for carbon capture of clean coal. By a method, cost cannot be increased, flying particles and leakage are avoided, carbon capture seal ('CCS') is guided and multiple break-through points of ultra-high multiple liquid-gas captures are stacked by low investment and high benefits, combustion efficiency is increased by ultra-expansion during automatic running, and the strength of the clean coal can be equal to that of high-blast clean coal owing to high heat efficiency; thermal power is taken as an example, oxygen and liquid gas are used together, so that thermoelectricity is increased twice; carbon rock can be added in hundred millions of tons of fuel slag, the mixture can be converted into cement, and dual carbon capture and the most industry closing state are realized; oil and gas is increased by using carbon dioxide (CO2), the investment is low, and benefits are high, so that CCS can be realized quickly or can be used for a scale or main-stream industry, and independent property rights can be obtained by high-quality solid pure oxygen CCS; and the integrated furnace can also be used as an exhaust heat source for cement and chemical fertilizers, and various thermal power type boilers and household stoves such as single-hearth pre-smoking and bituminous coal combustion stoves can be updated.



1st Main Claim

[MT] 1. Fold hybrid body cast a giant drop of liquid to gas have both independently or in combination of multiple strong carbon flapping giant sets and stoves, the difference between coal carbon flutter set way high-ranked investment giant, which is not a hybrid body backwards Law, by no incremental cost no fly tablets each leak-free, easy times can cause the drop-only implementations have both cast high 'CCS' a carbon cycle that is oxygen combustion carbon sequestration flutter set, and empathy can be superimposed conventional or liquid-gas-fired CCS multi-multi-set union bashing, the situation just ride out the storm and innovative series of breakthrough, but unfortunately changes will improve special return line must be characterized by the method of this Law specific hybrid body can meet these giant strong independent or associated liquid gas or conventional application methods and structures oversized and following boiler furnaces and household characteristics involving the constitution of each breakthrough, as follows; ① method described hybrid body; it is characterized by a coal as the main including non-fuel versatility added to the device may be prepared consistent with the furnace or a portion of the lumen, the surface has no edge or edge a continuous surface, or large geometric hybrid body, the body type mold is made at the same time, both ends of the face and body tables, and is eligible for concave or convex grooves or ribs, it is on the center tank or tendons, divided by the body in the same direction or staggered to the through or non-through-hole, can also be used instead of the Depression as the porous body, which in Adding and molding and baking processes of both its own strength, so that it may, by symmetrical surfaces including cement slurry or adhesive substance and a stacked or piled features, including a spherical surface of the continuous, stand covered in this law boilers and boiler horizontal one, after the example embodiment arbitrary bit track feeder shop materials, you can scroll and basic pave their own, while the latter can be fed from the scroll and complete combustion, the other body is required by the on feeder stack code placed in an oven, or pre-completed by the embodiment of the pile after the appropriate settings into the furnace, the size of the hybrid combustion body molding facilities and a full charge capacity of the flue gas sufficiently self-evacuating selected; above has take into account the difficulty of equipment and tooling may hybrid surface gluten ducts can improve the influence of the coal hole when positive bias on mechanical material, so as to ensure this law with special self-evacuating smoke and from precipitation, which include the following non-combustible multicomponent add, except to make it meet the national standard indicators of physical and chemical stability requirements for hot briquette strength, and given to another super functional components as follows; a, because sulfur nitrate must go on after fine grinding calcium rock such as limestone and clay is added (this add just after having reacted with coal combustion ash and slag cement clinker output function), b, after the introduction of oxygen control to prevent overheating and burning velocity, is still above content add objects that both add add cement skeleton silicate and strength, C, can withstand high-level stacked, heat drying and combustion required to add their own strength, it will still be the same and both a thus it can be added, d, lower oxygen consumption and easy to get the oxygen-rich materials and other inexpensive add include biomass zero carbon emissions and so on; now above both coal and all the super functions conferred added, including claims from the resources given to human evolution, or may simply Super hybrid block that the body of this Act, the super block by specific power blast furnace including the removal of the following series of changes, that is, when the consequent weakening of flue gas thermal efficiency, the method can also be eligible for equal or higher heat and construction guarantee; a, press the large expansion in multiples lower, including the average load density convection bank, and thereby ensure full combustion furnace busy, so by the extensive collection of oversized furnace flue gas intensity of the original volume of burnout chamber, and no less than control of coal, coal b, large furnace volume, the full-bore overflowing Red hot super block hole burning inside and outside surfaces of the total area, far more so far for all furnaces, C, said full-bore overflowing red super hot super block heat radiation, combined with the large furnace flue gas from evacuating double superimposed thermal efficiency, full indemnity non-power flue heat loss, d, the home heating efficiency, combined with the following 'CCS' oxygen on the super promotion, should be able to meet and exceed include thermal power and other needs of firepower, e, and following more burning superimposed structure, will make include thermal power and capacity for electric, jumped breakthrough re new situation; ② can meet the above and conventional Dual involving large and the following household boiler furnace, characterized in that all of the loose coal burning furnace distinction of vertical or horizontal combination of independent or serial expansion chamber, from the top closure of the furnace grate and no communication under or After the furnace composition, after opening lower or boreside for burnout chamber communicating with the flue, this order never pre-carbonization burning furnace includes all oversized and minimum household

furnace smoke set, the first eligible for the above-described non-water-cooled grate 'single bore' Pre-carbonization burning coal smoke and thereby dramatically REDD and Minimalist breakthrough between large expansion after the aforementioned tandem lined hearth interworking between parallel lines, the water-cooled wall and convection bank intervals, as each type furnace automatic Cycle run and expansion premise, hybrid body series slagging bottleneck breakthrough technology to make simple, so must be obtained from each furnace in addition to a grate and slag hopper evolution, which cost as little as possible and common to all series of automatic furnace slag smooth outer, super block automatic cycle runs and on-demand expansion caused it to break, because they bring large amounts of the following strong oxygen furnace fuel, combined heat total of the following multi-fuel third superimposed strong, allowing to make a large proportion Add the aforementioned non-combustible calcium rocks, and lead have both high following a breakthrough, because the non-fuel component of the hybrid taboo excess air coefficient, by means of its self-pumping lead into the furnace and thus from slightly negative pressure, coupled if necessary for the guarantee, does not exceed the fuel control and smoke transport needs of the wind set, the power to exclude from evacuating blast slightly negative pressure, thereby eliminating the oxygen into the pressurized external leakage worries, because there was no power into the wind No combustible micro fly grain, combined with this Act the following set of non-combustible material circulating CO<sub>2</sub> flutter back to the furnace protection, caused by the above method of the present invention eliminates the micro fuel tablets, oxygen concentration of the three elements plus burst trigger, so it can be simple CD Hypoxia High have both introduced 'CCS' carbon sequestration flutter collection, empathy without fuel tablets worry no explosion, but also at the same time no flying particles superimposed introduced to CCS and the following return of oxygen furnace tail of smoke mixed, to be developed include a carbon-based clean coal bed methane, carbon-based thirty-four associated gas and liquefied petroleum gas, as well as other conventional heavy oil and other liquid-gas, combined with the burning of conventional overlay or 'CCS' double carbon flutter set, and is eligible for this superposition more energy and more effective set of multiple CCS carbon flutter, should be on 'CCS' new expansion and breakthroughs, for the simple 'CCS', its corresponding settings that will be mixed with purified CO<sub>2</sub> and smoke back end residual oxygen furnace, in order to achieve oxygen security conditions on the tail of smoke residual oxygen cycle flutter set back the smoke pipe, located at the bottom of the furnace grate under the grate on the wall or, provided in parallel to the channel under the grate, one connection back to the smoke pipe, and oxygen into the furnace When another parallel pipe connection, in order to avoid corrosion grate oxygen, oxygen nozzle disposed above the grate furnace wall, furnace wall can be used with or without the corresponding outstanding, but it is the nozzle of each series of the furnace water wall between columns and convection bank, should be let out so that oxygen flow through the respective interrupted, to make it dispersed in the whole furnace transparent outer and inner surfaces comprehensive self-pumping cited hybrid body double for superimposed burning conventional or 'CCS' multiple flutter set way to thermal power train and oversized furnace example, in the middle of the bore wall on both sides of the vertical and horizontal furnace flue opening above, but can exceed bore high burnout chamber with walls separated by a range outside the furnace wall to highlight the portion surrounded by a space communicating with the chamber United conventional liquid constituting the superimposed gas or 'CCS' of the combustion chamber, or pressurized gas and oxygen back through the tail of smoke mixed burner, or pressurized atomizer tail back through the smoke and the burning liquid, including divided when Oxygen mouth, with its jet cross and points toward the front and rear direction of the furnace, the fire-hole provided in the furnace wall, facing the water wall tubes and convection furnace combustion chamber in series between each column are let out to make the above-mentioned By intermittent combustion fire smoke, to make it transparent dispersed in all directions from the inner and outer surfaces of evacuating all hybrid body, exhaust the reverse downward, classified by the flue opening burnout chamber, above the nearest oxygen dispersion coupled with corresponding control of combustion also meet the safety requirements of the liquid-gas burn instantly full, multi-burning residual oxygen than carbon, with its extension of the aforementioned import whole furnace or 'CCS' circulation was rushed to do the best fuel for thermal power industry is the use of Pulverized Coal or roaster, such as the face and therefore abandoned, to play a benefit terms, it can also be simply transformed into the reformer on the small burn liquid gas, much of this Act or dual fuel combined with a conventional set of super-furnace carbon flutter part of the application of non-high-purity oxygen-rich or slightly enriched conduct 'CCS' carbon flutter set, in particular due to dense film of non-through-hole of coal refuse nitrogen and oxygen enriched nitrogen retention chamber under the grate can be set up simple membrane or pressure swing adsorption unit or class of this fan can be switched, so that part of the nitrogen in the air is discharged, thereby lowering the cost of part of the oxygen, the superposition of multi-fuel, and can be used in this Act furnace Stokes started, its summary start and stop can be used for large furnace with a substantial adjustment of output load, when not having 'CCS' condition, said a large expansion, dual thermal efficiency coupled with substantial coal emissions and the following high both, is this law can replace coal stove The reason furnace applications, while conventional multi-fuel applications superimposed more natural, with a corresponding amount of various types of industrial furnace size or commodity settings, make oxygen and completion of CO<sub>2</sub> and other solid or liquid distillation recovery, superposition liquid fuel gas required also this, burn burnout chamber portion owed to the tail of smoke, smoke tube back into the cycle, has been part of the tail cigarette burn, the super block drying heat output and energy-saving cool pool cool further dehydration after use, and access to CO<sub>2</sub> pipeline connection recycling facilities; ③ Law and eligible to vote down times have both structure and method giant multi breakthrough assurance; wherein said smoke from evacuating ensure precipitated hybrid bodies strut groove structure, and the non-fuel component taboo coefficient of excess air, when necessary, with the burning of tobacco control except through the wind matches, excluding the conventional air intake force after the blast, to get than the current coal particles 6 ~ 8 to REDD better rate, substantially residual gas after combustion nitrogen oxides and heat discharge as little as possible, so the carbon-oxygen cycle at full flutter set, by the self-pumping and micro-negative, the hybrid structure in an amount of self-adaptation, acceptance by the breech portion under reflux Tail smoke duct and oxygen nozzle, by appropriate when oxygen through combustion control provided outside to the inside, because the control of oxygen and said return residual oxygen circulating smoke flutter set, so that the convergence to the upper chamber of the furnace burning ember of high-strength smoke The product not only eliminates the waste heat outside 78 percent of nitrogen oxide, and is mainly CO<sub>2</sub> flutter set basic purification obtained, which ranked first eligible by the mixing temperature exhaust purification so simple, this is now the same technology for simple and convenient recycling or storage, provided a rare premise and inevitable, more wind power for additional gas giant or super reactive oxygen matching, or CO<sub>2</sub> air purifying waste nitrogen will cost an additional increase, combined with oxygen and positive pressure gas leak Giant Under micro fuel particle anti-oxygen explosion and other problems, comparing the two, this law was a huge advantage to exclude CO<sub>2</sub> recovery and oxygen consumption of the additional costs and said difficult to exclude oxygen burst of the method, therefore it is not only the only simple and safe, and by early Operator, can be doubled down the introduction of oxygen down costs 'CCS' and multi-fired combined carbon sequestration flutter set (due to the calculation of non for the rights or limited and technical programs and some simple examples cited, here it is be omitted) This Act may be applied to any one of multiple structures and methods have both high returns, characterized in that the only body of the hybrid multi-component and thus self-evacuating structure, method is to obtain high return guarantee, corresponding The structure, various types of furnace slag bottleneck breakthrough series make

simple, high-powered large expansion caused eligible for self-running, self-evacuating the firepower combined with wind power can be canceled, thus no fly grain leak-free, easy-induced CD's Low investment and the introduction of more fuel and oxygen fuel superposition, by the upper end to the non-availability of CD burning calcium rocks of the super-hot intensity that allowed the best big added, which constitutes the structure to ensure more have both a breakthrough in thermal power Case, as the largest source of greenhouse set up to large furnace, thus most of the CCS demonstration significance of the thermal power industry as a whole, and thereby eligible for the massive multi returns yes, all multi-billion tons of fuel residue to the strict sense of the whole composition and the basic composition having, so the performance of cement clinker with higher overall conversion and output of massive returns, the conversion and output, as this hybrid method and corresponding furnace body structure deliberate discovery and innovation, which method is characterized in that; the total accounted into the furnace the amount of double-digit, although large rocks  $\text{CaCO}_3$  calcium component, accounting for 56 percent of  $\text{CaO}$ , with the removal of about 70 percent fixed carbon and volatile matter remaining after approximately 30 percent of coal ash - accounted for five percent of the ash  $\text{SiO}_2$ , three percent of  $\text{Al}_2\text{O}_3$ , Semis of  $\text{Fe}_2\text{O}_3$ , combined with clay this individual items supplement, said  $\text{CaO}$  with coal ash and the composition of each supplement, after this law class cement shaft kiln furnace, iron available calcium aluminosilicate all four Portland cement clinker and other oxide aggregates or solid solution, as the difference between the excess cement kiln coal, because the post-combustion of coal ash remaining 30 percent, while the corresponding amount in most of the ash, but also for the account of the total calcium rock above the double-digit calcined polymerization, so that the few remaining surplus ash gray, compare the total amount of double-digit sum accounted for newborn cement clinker, which is only a fraction of relatively more a small amount, that is the case, the amount is more than the ash has been defined exactly constitutes pozzolana cement and fly ash cement, said Ingredients cement residuals (which by definition; burnt clay and power plant fly ash containing  $\text{SiO}_2\text{AL}_2\text{O}_3\text{A}_2\text{O}_3$  etc. is called artificial pozzolan cement composition can be used as the active material, and they added lime rigid gas, air and water can be hardened in the relay, the composition is called fly ash cement and artificial pozzolana known as no cement clinker), thus, which have both of the aforementioned giant returns, it is the strict sense of the skeleton silicate with a body having a high output performance the whole composition of the cement, the overall conversion and output, enabling the thermal power industry and create no waste burning Large industrial large closed the most, accounting for calcium rock  $\text{CaCO}_3$  As 44 percent of the remaining components of  $\text{CO}_2$ ,  $\text{CO}_2$  regardless of division or heat absorption during calcination, and finally are no additional oxygen and free to join 'CCS' flapping tail of smoke set is the system recovery, therefore, the recovery is also part of the cement production sharing temperature carbon double row flutter set recovery to the next one billion tons of coal, 30 percent ash and double-digit add calculations, multi-billion after the aforementioned combustion slag cement clinker overall transformation, after the phase-out of electrical idle add pulverized coal mill (gypsum, etc.) commodities cement grinding obtained, that is downgraded for masonry, walls, brick panels and other special cement, also Only this method it may be and is eligible for several no-cost pure huge returns, wide with  $\text{CO}_2$  force mouth of itself and increase oil and gas often huge profits, cause of huge costs, difficult complicated processes like 鑄 hesitate the 'CCS' to that line or with Express scale or for the mainstream, and even as a solid 'CCS' expectations country still missing as the way, with its extensive use of low investment and high yield advantage, with independent intellectual property rights should be promising, as other various types of furnace output and return dispersion of the above, paid after collection and disposal, also continue to benefit or sequestration, the present invention various types of furnaces in the regular intake temporarily with conditions and when combined with multi-fuel, remain much above both, substantial energy savings and thus can replace coal corresponding Advantages furnace, and said 'CCS' furnace of the present method can also be used following the heat discharge large cement calcination temperature gasification and fertilizers, etc., for the benefit of the same time, so that large power generation and the following various types of boilers and furnaces of all involved in the family furnace, including the above-mentioned changes in the system is eligible for a new generation.

**Assignees:** WANG QIANSHENG

## 284. Family 11939040 (US5135664 A)

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### Title

[EN] METHOD FOR TREATING WASTEWATER SLUDGE

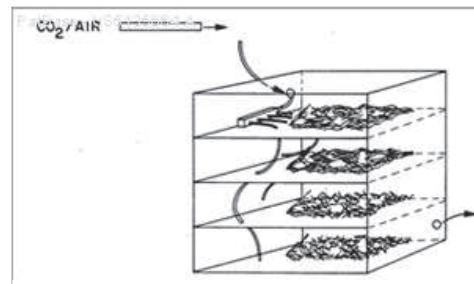
### Abstract

[EN] A method for treating wastewater sludge which comprises the steps of further treating the sludges after they have been mixed with alkaline materials and are still in a wet condition with carbon dioxide containing gases wherein the carbon dioxide is a significant constituent for a time sufficient to reduce the pH below 10 and to prevent the emission of the ammonia nitrogen. Preferably heat is added to the mixture to accelerate the reaction and facilitate drying. The product is useful as an agricultural product. In a preferred process, the amount of alkaline materials being sufficient to raise the pH of the mixture to 12 or above and to heat the mixture by an exothermic reaction to a range of about 52 DEG C. to about 62 DEG C. and maintain the pH above 12 and the temperature range for a minimum of 12 hours to reduce significantly offensive odor of the sludge to a level that is tolerable; to reduce animal viruses therein to less than one plaque forming unit per 5 grams dry weight of said sludge; to reduce pathogenic bacteria therein no less than three colony forming units per 5 grams dry weight of said sludge; to reduce parasites therein to less than one viable egg per 5 grams dry weight of said sludge; to retain a soil-like indigenous microflora; to reduce vector attraction to said sludge; and to prevent significant regrowth of the pathogenic microorganism; and thereafter subjecting the mixture to carbon dioxide containing gas wherein carbon dioxide is a significant constituent for a time sufficient to reduce the pH below 10 and to prevent the emission of the ammonia nitrogen.

### 1st Main Claim

[EN] 1. In the method of treating wastewater sludges with alkaline materials wherein the method comprises the steps of mixing said sludge with alkaline materials to form a mixture wherein the amount of added materials mixed with said sludge are sufficient to raise the pH of said mixture to 12 and above for at least two hours and sufficient to emit ammonia nitrogen from said sludge; the improvement comprising, thereafter subjecting the mixture of sludge and alkaline material to carbon dioxide containing gas for a time sufficient to reduce the pH below 10 and to prevent the emission nitrogen from said sludge.

**Assignees:** N VIRO ENERGY SYSTEMS LTD; VIRO INT CORP N; N VIRO INT CORP; VIRO INTERNEHSHNL CORP N



285. Family 47922710 (AU2010246393 AA)

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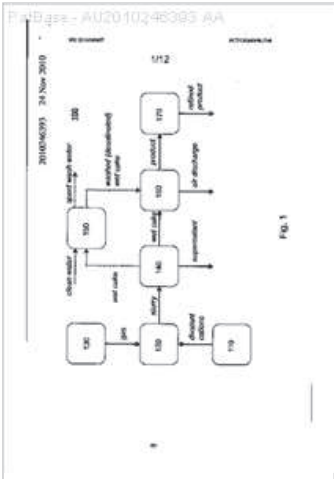
Extended Family Number: 42613795

Title  
[EN] REDUCED-CARBON FOOTPRINT CONCRETE COMPOSITIONS

Abstract  
[EN] Reduced-carbon footprint concrete compositions, and methods for making and using the same, are provided. Aspects of the reduced-carbon footprint concrete compositions include CO-sequestering carbonate compounds, which may be present in the hydraulic cement and/or aggregate components of the concrete. The reduced-carbon footprint concrete compositions find use in a variety of applications, including use in a variety of building materials and building applications.

1st Main Claim  
[EN] 1. A method comprising: a) producing a synthetic carbonate component from a divalent cation containing solution and an industrial waste gas comprising CO<sub>2</sub> and b) incorporating the synthetic carbonate component into a reduced-carbon footprint concrete composition, wherein the reduced-carbon footprint concrete composition has a reduced carbon footprint relative to an ordinary concrete composition.

Assignees: CALERA CORP



## 286. Family 102848347 (CN118079631 A)

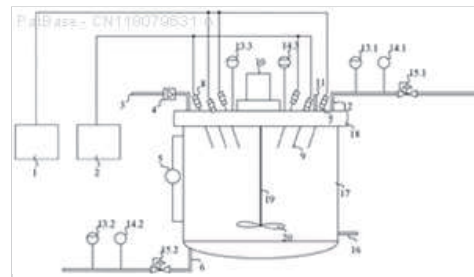
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### Title

[EN] DEVICE FOR SEALING AND STORING CARBON DIOXIDE AND METHOD FOR SEALING AND STORING CARBON DIOXIDE

### Abstract

[EN] The invention discloses a device for sealing and storing carbon dioxide and a method for sealing and storing carbon dioxide. A cavity is formed in a three-phase reaction kettle, and a carbon dioxide gas inlet is formed in the lower portion of the left side of the cavity; a slurry outlet is formed in the lower part of the right side of the cavity; a gland is detachably connected to an opening in the upper end of the cavity, and a slurry inlet, an exhaust port and a sampling port are formed in the gland; a liquid level sensor is arranged on the side wall of the three-phase reaction kettle; a stirring device is arranged in the center of the upper end of the gland; the main frequency ultrasonic transducers and the auxiliary frequency ultrasonic transducers are arranged on the gland in a circumferential array mode, and the main frequency ultrasonic transducers and the auxiliary frequency ultrasonic transducers are arranged alternately. The ultrasonic transducer is connected with an ultrasonic probe, the ultrasonic probe penetrates through the gland and extends into the cavity, and the ultrasonic transducer is connected with an ultrasonic generator through a circuit. According to the method, after the coal ash is synergistically enhanced by the ultrasonic waves with two frequencies, the cavitation effect can be obviously enhanced, and mineralization and storage of carbon dioxide on the basis of no additional additive and no excessive energy consumption are realized.



### 1st Main Claim

[MT] 1. An apparatus for sequestration of carbon dioxide, comprising a three-phase reactor, a main frequency ultrasonic generator (1), an auxiliary frequency ultrasonic generator (2), a main frequency ultrasonic transducer (7), an auxiliary frequency ultrasonic transducer (8), and a thermal insulation layer on the outside of the reactor. Characterized in that a chamber (17) is provided in the three-phase reactor, The chamber (17) is provided with a carbon dioxide inlet at the lower left side thereof, and the carbon dioxide inlet pipe (6) is connected to the chamber (17) via the carbon dioxide inlet, and the slurry outlet is provided at the lower right side of the chamber (17). A slurry discharge pipe (16) is connected to the chamber (17) through a slurry discharge opening, and a gland (18) is detachably connected at the upper end opening of the chamber (17), and the gland (18) is provided with a slurry inlet, a gas outlet, a sampling port, and a sample port. The inlet pipe (3) is connected to the chamber (17) via the inlet port; the exhaust pipe (12) is connected to the chamber (17) via the outlet port; the sampling pipe (11) is connected to the chamber (17) via the sampling port; the three-phase reactor has a level sensor (5) on the side wall; and the stirring electric is provided at the center of the upper end of the gland (18) A machine (10), an output of a stirring motor (10) connected to a stirring shaft (19), A stirring shaft (19) extends through the gland (18) and into the interior of the chamber (17), the stirring shaft (19) being fixedly attached at its bottom end to the stirring blade (20), a primary frequency ultrasonic transducer (7), an auxiliary frequency ultrasonic transducer (8) being arranged in a circumferential array at the gland (18), And the main frequency ultrasonic transducers (7), the auxiliary frequency ultrasonic transducers (8) are arranged alternately, the ultrasonic transducers being connected to an ultrasonic probe (9), the ultrasonic probe (9) extending through the gland (18) and into the interior of the cavity (17), A primary frequency ultrasonic transducer (7) and an auxiliary frequency ultrasonic transducer (8) are respectively connected to the primary frequency ultrasonic generator (1) via lines, Auxiliary frequency ultrasonic generator (2).

**Assignees:** CHINA UNIV OF MINING AND TECHNOLOGY; UNIV CHINA MINING

## 287. Family 101574078 (CN117658554 A)

[View in PatBase](#)

### Title

[EN] METHOD FOR PREPARING MULTI-SCALE FIBER-TOUGHENED JET UHPC (ULTRA HIGH PERFORMANCE CONCRETE) BY UTILIZING CARBON MINERALIZATION REACTION

### Abstract

[EN] The invention discloses a method for preparing multi-scale fiber-toughened jet UHPC (Ultra High Performance Concrete) by utilizing a carbon mineralization reaction. The method comprises the following steps: S1, weighing cement, fly ash floating beads, silica fume, superfine limestone powder, microfilament steel fibers, mixing water, nano aragonite and porous aggregate; s2, soaking the porous aggregate in a magnesium chloride solution, fishing out and draining to obtain pre-wetted porous aggregate, and mixing the pre-wetted porous aggregate with other raw materials to prepare spraying ultra-high performance concrete; s3, industrial waste gas with the temperature of 60-80 degrees centigrade and the carbon dioxide concentration of 50-70 vt percent is adopted, the sprayed UHPC obtained in the step S2 is pumped, and a sprayed UHPC test piece is obtained and cured. According to the invention, high-temperature carbon dioxide is used for spraying UHPC, porous aggregate is used for pre-adsorbing magnesium chloride, and nano crystal nucleus is used for inducing, so that a multi-scale toughening effect is achieved, and meanwhile, a large amount of carbon dioxide industrial waste gas is consumed.

### 1st Main Claim

[MT] 1. A method of making a multi-scale fiber toughened jet UHPC using a carbon mineralization reaction, comprising the steps of: Providing a carbon mineralization reaction;

Step S1 : Weigh out the following raw materials by mass, 300 to 400 parts of cement, 40 to 100 parts of fly ash, 50 to 100 parts of silica ash, 40 to 70 parts of ultra fine limestone powder, 30 to 70 parts of micro-wire steel fiber, 90 to 120 parts of mixed water, 5 to 20 parts of nano-artifact, 300 to 400 parts of porous aggregate;

Step S2: Soaking the porous aggregate weighed in Step S1 in the chlorinate magnesium solution to thoroughly absorb the chlorinate magnesium solution, draining and draining to obtain a pre-wet porous aggregate, and then mixing the pre-wet porous aggregate with the cement weighed in Step S1, fly ash bleached beads, silica fume, ultra fine limestone powder, microfilamentary steel fibers, and water mixture. Nanaraurite, mixing to prepare jetted ultra-high performance concrete;

Step S3: Pumping the sprayed ultra-high performance concrete obtained in Step S2 using industrial exhaust gas with a temperature of 60 degrees centigrade to 80 degrees centigrade and a carbon dioxide concentration of 50 to 70 vt. The spray UHPC coupons are obtained and maintained.

**Assignees:** CCCC SECOND HARBOUR ENG CO LTD; CCCC SECOND HARBOR ENGINEERING CO LTD

288. Family 97779553 (US2025051538 AA)

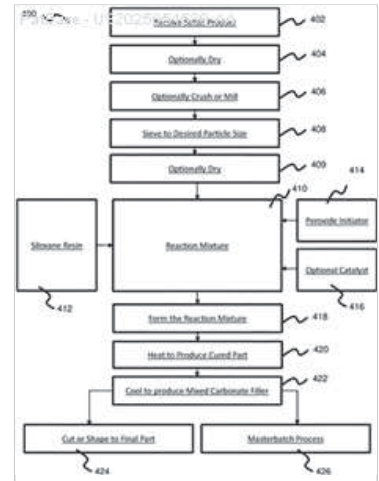
[View in PatBase](#)

**Title**  
[EN] PROCESS FOR PRODUCING A MIXED FILLER

**Abstract**  
[EN] Various embodiments provide an integrated carbon capture, utilization and storage (CCUS) process that can convert CO<sub>2</sub> to Group 2 carbonates and subsequent encapsulation and sequestration process to convert the carbonates to commercially useful aggregate, useful in plastics, building materials, mineral boards, concrete and road materials and make a feedstock of water useful for carbon neutral or carbon negative chloralkali and green hydrogen manufacture.

**1st Main Claim**  
[EN] 1. A method comprising:  
obtaining a solids product from produced water, the solids product comprising at least one carbonate of a Group 2 alkaline earth metal;  
mixing the solids product with a siloxane resin to produce a reaction mixture;  
forming the reaction mixture to produce a preform; and  
heating the preform to cure the siloxane resin.

**Assignees:** SEMPLASTICS LLC



289. Family 72341187 (CN108975815 A)

[View in PatBase](#)

**Title**  
[EN] REGENERATED CONCRETE PRODUCTION TECHNOLOGY

**Abstract**

[EN] The invention discloses a regenerated concrete production technology. The regenerated concrete production technology comprises the following steps: crushing waste concrete, carrying out primary sieving and washing to obtain regenerated coarse aggregate and regenerated fine aggregate; heating the regenerated coarse aggregate and the regenerated fine aggregate to 300 to 400 DEG C; crushing again; carrying out secondary sieving after crushing, so as to obtain refined coarse aggregate and regenerated fine aggregate; putting the refined coarse aggregate and the regenerated fine aggregate into a sealed container and carbonizing; controlling the relative humidity to be 40 to 85 percent and the CO2 concentration to be 30 to 75 percent until the weight of non-carbonized regenerated aggregate is less than or equal to 5 percent; S4, preparing regenerated concrete; stirring and mixing the regenerated aggregate treated by S3 with raw aggregate, an adhering material, filler and an additive, so as to obtain a finished product. With the adoption of the regenerated concrete production technology, waste concrete is subjected to multi-level treatment to obtain relatively qualified regenerated aggregate, and mechanical properties are also greatly improved; meanwhile, the effect of slowly releasing carbon dioxide is realized after the concrete is carbonized, drying shrinkage and creep in the later period can be relieved and the stress and anti-permeability capability of the regenerated aggregate are improved and the service life of the regenerated aggregate is prolonged.



**1st Main Claim**

[MT] 1. A recycled concrete production process, characterized in that it comprises the following steps:

S1, making recycled aggregate, the waste concrete crushing, screening, cleaning, get recycled coarse aggregate and fine bone regeneration materials;

S2, pre-treatment, after S1 treated recycled aggregate resulting recycled coarse aggregate and fine aggregate heated to 300-400 degrees centigrade, again broken, and broken after secondary screening to obtain refined coarse aggregate and fine aggregate;

S3, recycled aggregate secondary processing, after the processing S1 and S2 to obtain purified coarse aggregate and fine aggregate placed in a closed container, control the relative humidity of 40-85 percent carbonization, CO2 concentration of 30 to 75 percent until the uncharred recycled aggregate weight?5 percent;

S4, preparing recycled concrete, after S3 treated with native recycled aggregate aggregate, adhesive materials, fillers, additives mixed with stirring to obtain the finished product.

**Assignees:** WUHAN HUAQIANG NEW BUILDING MAT CO LTD

## 290. Family 100202514 (CN117185334 A)

[View in PatBase](#)

### Title

[EN] METHOD FOR PREPARING NANO CALCIUM CARBONATE THROUGH CARBON DIOXIDE ADSORPTION BY USING STEEL SLAG

### Abstract

[EN] The invention discloses a method for preparing nano calcium carbonate through carbon dioxide adsorption by using steel slag, and relates to the technical field of solid waste/fixed carbon utilization. Leaching and extracting Ca < 2 +> in the residual components by using ammonium salt for adsorbing and curing carbon dioxide to prepare nano calcium carbonate; and finally, the residual residues, slag, desulfurized fly ash and other bulk solid wastes are used for preparing a cementing material for manufacturing floor tiles or roadway filling. The comprehensive utilization value of the steel slag is effectively improved, the problem that a large number of land resources are occupied due to the fact that the steel slag cannot be effectively utilized is solved, the influence of carbon dioxide on the environment is also solved, and the national strategic goal of reaching carbon peak/carbon neutralization is facilitated; meanwhile, high-value nano calcium carbonate is produced. The method has great economic benefits and social benefits, and has a good application prospect.



### 1st Main Claim

[MT] 1. A method for producing nano calcium carbonate by carbon dioxide adsorption using steel slag, comprising the steps of:

- 1) after drying steel slag, mechanical fine grinding to obtain high-activity steel slag powder; pre-magnetic separation of the powdered steel slag powder to obtain high-iron steel slag powder and low-iron steel slag powder; high-iron steel slag powder, return to the steel plant to recover iron resources, low-iron steel slag powder is used for carbon dioxide curing;
- 2) To the low-iron steel slag powder obtained in step 1), add ammonium salt solution, leach Ca in the low-iron steel slag powder using ammonium salt<sup>2+</sup> To obtain an enriched Ca<sup>2+</sup> Of alkaline leachate and leachate residues;
- 3) The leachate is subjected to carbon fixing reaction by passing carbon dioxide gas under water bath heating conditions, and ammonia water is added to improve the alkalinity of the solution, promote the reaction, until the solution reaches neutrality, indicating that the reaction is complete, and high purity high whiteness nano calcium carbonate is obtained by filtration. The reaction solution is recycled to leach steel slag;
- 4) The leaching residue obtained in step 2) is mixed with slag and sulfur ash to prepare a full solid waste gelling material.

**Assignees:** YANGZHOU YICHUAN NICKEL IND CO LTD

291. Family 98834796 (KR20230128666 A)

[View in PatBase](#)

Title

[EN] - - 3 METHOD FOR EVALUATION OF PROPERTIES OF LIMESTONE-CALCINED CLAYCEMENT TERNARY BLENDS USING KINETIC HYDRATION MODEL AND RECORDING MEDIUM THEREOF

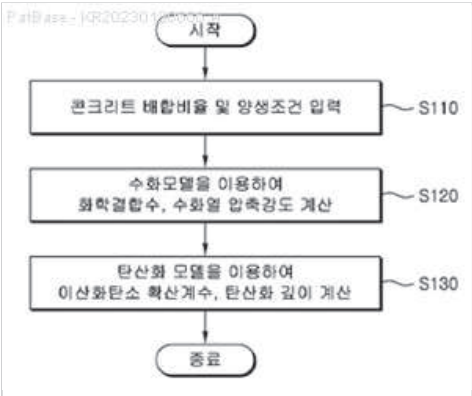
Abstract

[EN] The present invention relates to a method for predicting the performance of limestone fine powder-calcined clay-cement three-component concrete. The method includes the steps of: once the concrete mixing ratio and curing conditions are entered, calculating the number of chemical bonds, heat of hydration, and compressive strength using a hydration model; and calculating the carbon dioxide diffusion coefficient and carbonation depth using a carbonation model. According to the present invention, it is possible to easily predict the performance of limestone fine powder-calcined clay-cement three-component concrete using the hydration model.

1st Main Claim

[MT] 1. A method for predicting performance of limestone fine powder-calcined clay-cement three-component concrete based on concrete performance comprising the steps of : using a hydration model to calculate chemical bond water, hydrated heat and compressive strength when concrete compounding ratio and curing conditions are input; and using a carbonation model to calculate a carbon dioxide diffusion coefficient and a carbonation depth.

**Assignees:** KNU IND COOPERATION FOUNDATION; KNU IND COOPERATION FOUND



## 292. Family 102473629 (CN117962095 A)

[View in PatBase](#)

### Title

[EN] PREPARATION AND MAINTENANCE METHOD OF LOW-CARBON RECYCLED CONCRETE PREFABRICATED PART

### Abstract

[EN] The invention belongs to the field of concrete buildings, and particularly relates to a preparation and maintenance method of a low-carbon recycled concrete prefabricated part. The recycled aggregate is used for replacing natural aggregate, the low-carbon recycled concrete prefabricated part is prepared, the use amount of the natural aggregate of the low-carbon recycled concrete is remarkably reduced, CO<sub>2</sub> curing is conducted in the forming process, and the device meeting CO<sub>2</sub> curing of the concrete prefabricated part is designed. The plastic film which can be changed according to the shape of the prefabricated part covers the concrete prefabricated part in CO<sub>2</sub> curing, a gas sealing system is formed, the reasonable CO<sub>2</sub> gas concentration is guaranteed, and efficient curing of the concrete prefabricated part is achieved. The curing time of the low-carbon recycled concrete prefabricated part is shortened, the purposes of time saving and low carbon are achieved, remarkable economic benefits and environmental benefits are achieved, and contribution is made to sustainable development of the building industry. The CO<sub>2</sub> curing concrete not only can store CO<sub>2</sub> gas in a curing form, but also can improve the performance of the concrete.

### 1st Main Claim

[MT] 1. A method of preparing and retaining a low carbon regenerated concrete preform, comprising the steps of: Providing a concrete preform having a first surface and a second surface, the first surface having a first surface and a second surface;

(1) Mixing and forming of low-carbon recycled concrete: According to the design requirements, prepare new mixed concrete mix, the mixed new mixed concrete mix into the prefabricated component mold, vibration or compaction of the mold, so that the concrete fully fills the gap in the mold;

( 2 ) CO<sub>2</sub>Gas maintenance: Industrial waste of CO<sub>2</sub>Gas is injected into CO<sub>2</sub>Gas maintenance equipment, to CO<sub>2</sub>Greater than or equal to 20 percent;

(3) Add the prefabricated component mold of the new mixed concrete mixture in step (1), and put the prefabricated component mold in step (2) with CO<sub>2</sub>Gas maintenance devices are used for maintenance, and different maintenance temperatures, humidity and time are set as required; CO<sub>2</sub>After the gas conservation is completed, the CO of the plant will be maintained<sub>2</sub>Gases are collected centrally for subsequent dry maintenance or other treatment.

**Assignees:** GUIZHOU HIGHWAY ENG GROUP CO LTD

293. Family 42634172 (CN101284668 A)

[View in PatBase](#)

Title

[EN] Process for abstracting earth silicon, oxide of alumina and gallium oxide from high-alumina flying ash

Abstract

[EN] A method for extracting silicon dioxide, alumina and gallium oxide from high-alumina fly ash relates to the technology fields of environmental mineralogy and material, chemical industry and metallurgy. The method comprises the main steps as follows: causing the high-alumina fly ash to react with sodium hydroxide solution; filtering the solution; introducing CO<sub>2</sub> to the filtrate for full gelation; cleaning, purifying, drying, grinding and calcining the silica gel after gel filtration to obtain finished white carbon black; adding limestone and a sodium carbonate solution into the filter mass after the reaction and filtration of the high-alumina fly ash and the sodium hydroxide solution; ball grinding the mixture into raw slurry; dissolving out the clinker obtained by baking the raw slurry; subjecting the filtrate to deep desiliconization to obtain sodium aluminate extraction liquid; filtrating the sodium aluminate extraction liquid after subjecting the sodium aluminate extraction liquid to carbon dioxide decomposition; baking the aluminum hydroxide after washing the filter mass to form the aluminum hydroxide product; and extracting the gallium oxide from the carbon dioxide decomposition mother solution and desiliconized solution. The method has the advantages of low material price, simple operating procedures, low investment, low production cost, low energy consumption and less slag.

1st Main Claim

[MT] 1, an extract from fly ash in silica, alumina and gallium oxide, the main steps of: a) fly ash and sodium hydroxide solution in a high pressure after the reaction in the reactor was filtered, and the filtrate was prepared to generate silica and fly ash desilication cake; b) to the filtrate into CO<sub>2</sub> gas through the reaction, when the PH value dropped to 13, the ventilation stops, and the filtrate was allowed to stand after removal of the precipitate at the same temperature to continue to pass into the filtrate until the filtrate sufficient CO<sub>2</sub> gel; c) sodium carbonate solution for gel filtration using a mixed solution, after filtering off the silicon and silica liquor, according to the mother liquor and desilication Na<sub>2</sub>O of 1: 1 molar ratio of caustic lime is added, to form caustic NaOH solution was concentrated solid caustic soda added is returned to step a) using sodium hydroxide solution as cycle; d) dilute hydrochloric acid was added to the silica gel, the reaction was stirred after the reaction was filtered, washed with water and silica, silica gel drying cleaning impurity after grinding, the finished product was calcined silica; e) was added to the cake was fine limestone and concentrated sodium carbonate solution, mixture milled in a ball mill made of raw slurry; f) the raw slurry into the rotary kiln firing, firing produced by recycling solvent CO<sub>2</sub>, CO<sub>2</sub> and concentrated for the preparation of silica and sodium aluminate solution refinement carbonation; g) raw slurry calcined clinker water dissolution, and the filtrate was rough sodium aluminate solution, the filter cake is calcium silicon slag; h) with two desilication method of rough sodium aluminate solution depth desilication give refined sodium aluminate solution; i) the refinement of sodium aluminate solution in the carbon separation column group carbonation; j) When carbonation filtered, the filter cake washed aluminum hydroxide, calcined alumina products are formed, washed was added to step i) the mixed liquor carbonation, concentrated and added solid sodium carbonate is returned to step e) recycling; k) carbon stars and liquor desilication liquor recycled many times, becoming a Ga-rich solution, the use of carbon precipitation points - sodium gallium oxide dissolution method further enriched and then extracted using resin adsorption gallium oxide.

Assignees: UNIV TSINGHUA; TONGFANG ENVIRONMENT CO LTD; TSINGHUA UNIV



294. Family 103498899 (CN118307278 A)

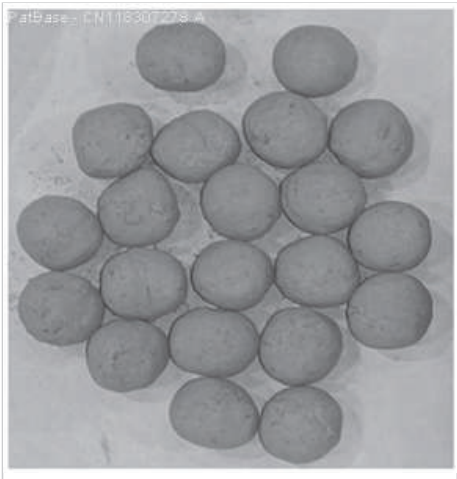
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Title

[EN] COARSE-GRAINED AGGREGATE PREPARED BY CARBON SEQUESTRATION OF HIGH-WATER-CONTENT SLUDGE SOIL AND PREPARATION METHOD OF COARSE-GRAINED AGGREGATE

Abstract

[EN] The invention discloses a coarse-grained aggregate prepared by carbon sequestration of high-water-content sludge soil and a method thereof. The method comprises the steps that the high-water-content sludge soil and quick lime are mixed in proportion, and after the quick lime is fully cured, the quick lime is in a plastic state; the malleable sludge soil is put into an extrusion type pelletizer to be extruded and compacted, and coarse-grained blanks in corresponding shapes are prepared; and curing the coarse-grained blank in an environment containing CO<sub>2</sub> gas, so that the cured lime in the coarse-grained blank fully reacts with the CO<sub>2</sub> gas to obtain the coarse-grained aggregate after carbon sequestration. The sludge soil with high water content is taken as the main raw material, so that the cost is low, and energy consumption and carbon emission generated in the dehydration process as well as land occupation and ecological environment pollution caused by filling treatment are avoided; carbon emission in the whole production and preparation process can be remarkably reduced, the greenhouse effect of the earth is relieved, and the prepared coarse-grained aggregate can be applied to the fields of roadbed filler, abutment back filler, lightweight concrete aggregate and the like.



1st Main Claim

[MT] 1. A method of carbon sequestration of a high moisture silt to produce coarse aggregate comprising: Providing a slurry comprising a high moisture content silt and a high moisture content silt;

Mixing quicklime with the sludge thoroughly, so that part of the water in the sludge reacts with the quicklime and exotherms, thereby distilling off part of the moisture in the sludge and aging the quicklime, while bringing the sludge into a plastic state after mixing;

Granulating the mud after mixing and in a moldable state to obtain a coarse granular blank;

The resulting coarse granular billet is uniformly spread out and fed to an environment containing carbon dioxide gas for conservation, the hydrated lime in the coarse granular billet is carbonized with the carbon dioxide gas in the conservation environment to form calcium carbonate, and the sludge in the coarse granular billet is cemented, solidified and reinforced, This results in a coarse aggregate after carbon consolidation.

**Assignees:** ZHEJIANG JIAOGONG JINZHU TRAFFIC CONSTRUCTION CO LTD

## 295. Family 85684082 (CN113024174 A)

[View in PatBase](#)

### Title

[EN] PROCESS FOR RAPIDLY IMPROVING EARLY STRENGTH OF PREFABRICATED CEMENT-BASED PRODUCT

### Abstract

[EN] The invention discloses a process for rapidly improving the early strength of a prefabricated cement-based product, which comprises the following steps of: firstly, uniformly mixing a cementing material, sandstone, water and an additive by weight, injecting into a mold for molding, and dismantling the mold after standard curing for 20-24 hours; then carrying out carbon dioxide curing; and after the carbon dioxide curing is finished, changing the curing of the finished product into irregular water spraying curing. The process can quickly and effectively improve the early strength of the prefabricated cement-based product, has the advantages of low energy consumption and simplicity and convenience in operation, can remarkably improve the mineralization absorption rate of CO<sub>2</sub>, and is beneficial to carbon emission reduction.

### 1st Main Claim

[MT] 1. A rapid increase in the early strength of precast cement-based products, characterized by comprising the steps of:

(A) by weight of the cementitious material, gravel 2900-3200 parts, 800-1000 parts water 500-600 copies, admixtures mixed, poured into a mold molding, standard curing 20-24h after removal of the mold, the admixture of water reducer, early strength agent and calcium nitrate, added in an amount of not more than 1 percent by weight of the cementitious material, the gelling material including cement 500-800 parts of slag or fly ash 250-300 parts;

(B) carbon dioxide conservation; Carbon dioxide purity?99 percent, pressure 0.1-0.4Mpa, curing time is 8-24h;

(C) a carbon dioxide after curing, the manufactures turn instead to occasional watering curing can be.

**Assignees:** UNIV TANGSHAN; TANGSHAN COLLEGE

## 296. Family 92775656 (CN114873979 A)

[View in PatBase](#)

### Title

[EN] LOW-CARBON CEMENT CONCRETE AND PREPARATION METHOD THEREOF

### Abstract

[EN] The invention discloses low-carbon cement concrete, which is prepared from the following ingredients in parts by weight: 200 to 500 parts of low-calcium cement, 20 to 200 parts of hydration active cementing materials, 600 to 1000 parts of fine aggregates, 800 to 1200 parts of coarse aggregates, 100 to 240 parts of water, 4 to 12 parts of regulation and control additives and 4 to 16 parts of fibers. Putting the low-calcium cement, the hydrated active cementing material, the fine aggregate, the coarse aggregate and the fiber into a stirrer, uniformly mixing, adding the water and the regulating additive, and stirring to obtain a concrete mixture; the mixture is poured into a mold, vibration forming is conducted, and the maximum thickness of a formed concrete product is not larger than 200 mm; naturally curing in a dry environment for 6-24 hours, and then removing the mold; and removing the mold, putting into a carbonization reaction kettle, vacuumizing, introducing CO<sub>2</sub> with the concentration of 20-100 percent, controlling the pressure in the reaction kettle to be 0-1.5 MPa and the temperature to be 20-100 DEG C, and performing carbonization maintenance for 6-48 hours to obtain the low-carbon cement concrete.

### 1st Main Claim

[MT] 1. A low-carbon cementitious concrete characterized in that the composition in parts by weight is as follows:

Low-calcium cement 200~ 500 parts, hydrating active cement 20~ 200 parts, fine aggregate 600~ 1000 parts, coarse aggregate 800~ 1200 parts, water 100~ 240 parts, conditioning additive 4~ 12 parts, fiber 4~ 16 parts.

**Assignees:** HUAXIN CEMENT CO LTD

297. Family 49048177 (KR20110061546 A)

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Extended Family Number: 42613795

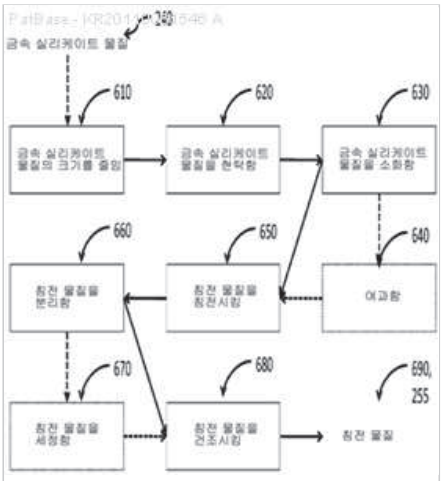
Title

[EN] PRODUCTION OF CARBONATE-CONTAINING COMPOSITIONS FROM MATERIAL COMPRISING METAL SILICATES

Abstract

[MT]

The carbon dioxide supply source, a divalent cation-containing solution, and a silicon-based material from the source of the scavenger material) (for example, the carbonate-containing composition comprising a there is provided a method for producing. In this method, a divalent cation-containing solution comprises divalent cations, the material of the metal silicate is provided by digestion. In addition, the silicone-based material that does not substantially contain carbonate which does not contain at all or a method for producing a salt-containing composition is provided. In this way, the silicon-based material (e.g., silica, non-reacted or fluorinated, silicate, aluminosilicate, etc.) separated from carbonate-containing composition can be processed separately. And carbonate-containing material, a silicon-based material blended at a later stage, further processed to, for example, Portland cement and pozzolanic materials, which can be formulated it can produce.



1st Main Claim

[MT] 1. According to the method,

- a) can be a material including a metal silicate solution cation, and the hydridecomprises  $\text{SiO}_2$ ,
- b) comprising the steps of preparing a material the dissolved carbon dioxide dissolved carbon dioxide by reaction with the material comprising the steps of: producing a precipitate precipitated material, c) the method comprising the step of drying.

Assignees: CALERA CORP

## 298. Family 62486200 (CA2872212 AA)

[View in PatBase](#)

### Title

[EN] METHOD OF MAKING A SUPPLEMENTARY CEMENTING MATERIAL FOR CONCRETE CONSTRUCTION FROM BASE METAL SMELTER SLAGS

### Abstract

[EN] A general method of producing a compound identified as synthetic obsidian from base metal smelter slags which can be used as a supplementary cementing material for manufacturing concrete that meets all CSA and ASTM requirements for construction of all buildings, roads, bridges, etc., and as a side benefit recovers any base metals such as Copper, Nickel, Cobalt and precious metals, if present, together with a major reduction of CO<sub>2</sub> to the atmosphere when combined with Portland cement. In the manufacture of Portland cement one ton of CO<sub>2</sub> is produced whereas one ton of synthetic obsidian only produces one-sixth of a ton of CO<sub>2</sub>.

### 1st Main Claim

[EN] 1. A method of treating and converting typical base metal slags into supplementary cementing material suitable to manufacture commercial grades of concrete which meet all requirements of CSA and ASTM standards for residential, institutional, commercial, industrial transportation (roads and bridges) and specialized grades (such as CN Tower). (The prior art describes making "mortar cubes" from untreated ground up base metal slags " which is not acceptable as concrete.) The new material is made by the addition of from 3 percent Al to a maximum of 7 percent Al (above this figure the process becomes uneconomic due to the cost of Al), and 6 percent to 14 percent Calcium Oxide in the form of lime or limestone (CaCO<sub>3</sub>). Any metals recovered report to the bottom of the furnace and is tapped off to be further refined by persons skilled in the art. The new slag is also tapped off in such a way as it can be granulated by pressing it through jets of water or high pressure air. The cooled granulated slag appears black and on close examination the particles have conchoidal fractures similar to obsidian found in volcanic ash. For this reason it has been named "Obsidian".

**Assignees:** KROFCHAK DAVID

299. Family 106875013 (CN119528529 A)

[View in PatBase](#)

**Title**  
[EN] SELF-HEALING MICROBIAL FULL-RECYCLED CONCRETE AND PREPARATION METHOD THEREOF

**Abstract**  
[EN] The invention discloses self-healing microorganism full-recycled concrete and a preparation method thereof, and belongs to the technical field of concrete materials. Modified microorganism-loaded ceramsite is adopted to load different microorganisms through a vacuum adsorption method and a soaking method; the concrete is composed of the high-alumina fly ash-slag cement, the microbe reinforced recycled fine aggregate, the microbe reinforced recycled coarse aggregate, water and the modified supported microbe ceramsite. When tiny damage is generated in the concrete, metabolism can be carried out through microorganisms attached to the recycled aggregate, then calcium carbonate is generated for damage repair, and when the concrete is greatly damaged, the modified microorganism-loaded ceramsite is damaged, and the microorganisms loaded in the ceramsite play a role to repair the concrete damage. Therefore, full-stage self-repairing of concrete damage is realized. Meanwhile, the materials adopt high-alumina fly ash, slag and recycled aggregate, so that the comprehensive utilization rate of industrial solid wastes and building solid wastes can be increased, and the environmental problems caused by the industrial solid wastes and the building solid wastes are relieved.



**1st Main Claim**

[MT] 1. A method for preparing self-healing microbial fully regenerated concrete, characterized by comprising the following steps:

Step S101: adding culture solution to a first container containing modified microorganism-loaded porous lightweight aggregate, so that the surface of the porous lightweight aggregate is soaked with the culture solution;

Step S102: adding water into the first container until the liquid in the first container completely covers the modified microorganism-loaded porous lightweight aggregate, and preparing the liquid into a modified microorganism-loaded porous lightweight aggregate suspension;

Step S103: adding aluminum fly ash-slag cement, microbial enhanced waste concrete recycled aggregate and water into a second container and stirring evenly;

Step S104: adding the suspension into the second container, and gradually adding water, measuring the slump of concrete by the slump method per unit time, and stopping adding when the slump of concrete reaches a threshold value, thereby obtaining a mixed material;

Step S105: Curing and shaping the mixed material to obtain self-healing microbial fully regenerated concrete.

**Assignees:** CHINA STATE INSPECTION AND TEST HOLDINGS GROUP ZHEJIANG CO LTD

300. Family 87422990 (JP2021155271 A2)

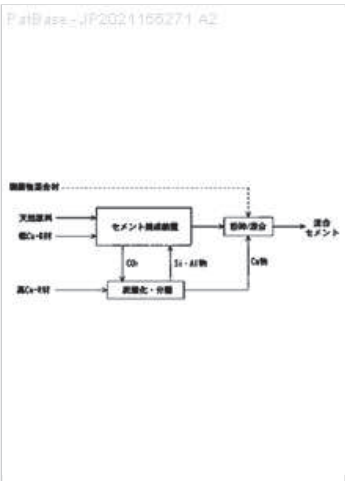
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**Title**  
[EN] MANUFACTURING METHOD OF CEMENT

**Abstract**  
[EN] To provide a manufacturing method of cement which reduces CO2 discharge amount while using a large amount of waste and can flexibly deal according to a kind and an amount of the waste to be treated.SOLUTION: A method for manufacturing cement by reacting a waste containing 5 mass percent or larger of CaO with CO2, and using a part or all of the resulting carbonate as a cement mixture. While the waste material containing 5 mass percent or larger of CaO is reacted with CO2, followed by separating into a material containing calcium carbonate and a material containing aluminosilicate, and a part of at least any one or all can be used as the cement mixture. Furthermore, blast furnace slag or/and fly ash may be used as a cement mixture. Among the material containing calcium carbonate and the material containing aluminosilicate, the material that was not used as the cement mixture can be used as a cement clinker raw material.SELECTED DRAWING: Figure 1

**1st Main Claim**  
[MT] 1 to 5 percent by weight or greater waste containing Cao and carbon dioxide, resulting carbonate by reacting a part or all of the to be used as a cement admixture cement manufacturing method characterized.

**Assignees:** TAIHEIYO CEMENT CORP



301. Family 95179483 (CN115504638 A)

[View in PatBase](#)

**Title**  
[EN] CARBON DIOXIDE MINERALIZATION MAINTENANCE METHOD FOR DREDGING SEDIMENT OF RIVERS AND LAKES

**Abstract**  
[EN] The invention provides a carbon dioxide mineralization maintenance method for river and lake dredging bottom mud. The method comprises the following steps: preparing a curing agent; preparing solidified sludge; permeable template cloth is laid on the outer side of the first mold template; pouring solidified sludge with the moisture content of more than 60 percent into the first mold; a plurality of first molds loaded with solidified sludge with the moisture content larger than 60 percent are sequentially installed in the support from bottom to top at intervals; the support is placed in a closed curing space for carbon dioxide mineralization curing; pouring the solidified sludge with the water content of less than or equal to 60 percent into a second mold, and compacting the solidified sludge in the second mold through a press machine to form a porous sludge building block; and the second mold is conveyed into a closed curing space for carbon dioxide mineralization curing. The pH value of the sludge can be effectively neutralized, the early strength and hardness of the sludge are rapidly improved, the compactness of the sludge structure is further enhanced, and the solidified sludge has a wide application prospect; carbon dioxide can be consumed, and the greenhouse effect is reduced.

**1st Main Claim**

[MT] 1. A method for the mineralization of carbon dioxide in riverlake sludge, comprising the steps of:

The method comprises the steps of: 1) dry agitating a large amount of waste material, a small amount of gel material, and thoroughly mixing to form a curing agent for use;

Step 2) mixing the curing agent, the river lake sludge in a blender, adding mixing water to obtain a solidified sludge. The cured sludge having a moisture level less than or equal to 60 goes to step 3), the cured sludge having a moisture level less than or equal to 60 goes to step 7), the cured sludge having a moisture level less than or equal to 60 goes to step 8);

Step 3) of closely fitting a water-permeable stencil cloth (5) to which a water-absorbent resin is attached to the outside of the stencil wall of the first mold (1), the bottom stencil wall of the first mold (1) and the peripheral stencil wall having first through holes (1-1) extending through the inside of the first mold (1), Thereby forming a porous structure inside the first mold (1);

A step 4) of pouring a solidified sludge having a moisture level of 60:1 to the inside of the first mold (1), and absorbing the moisture remaining in the surface of the solidified sludge by means of a water-permeable template cloth (5) outside of the walls of the first mold (1) to reduce the moisture content of the solidified sludge;

Step 5), then a plurality of first molds (1) loaded with the water-borne curing sludge of 60-interval water-borne by the waterborne curing sludge are sequentially installed in the frame (2) from the bottom to the top, with gap passages (2-1) being provided between adjacent first molds (1);

A step 6) of placing a holder (2) loaded with a plurality of first molds (1) in a closed preservation space (6) into which industrial waste carbon dioxide gas is introduced, Carbon dioxide gas enters the water permeable stencil cloth (5) outside the stencil wall of the first mold (1) through the gap passage (2-1), and then continues into the porous structure inside the solidified sludge through the first through hole (1-1), The carbon dioxide gas absorbed by the steel slag around the porous structure is carbonated to form stable calcium carbonate, magnesium carbonate, rapidly mineralizing large quantities of solidified sludge in a short period of time and reducing the mineralization and maintenance time of the solidified sludge, Reducing the strong alkalinity of the solidified sludge to adjust the soil pH for low alkaline neutralization;

Step 7) pouring the solidified sludge having a water content less than or equal to 60 into a second mold (3) having a second through hole (3-1) formed in the bottom template wall, The solidified sludge in the second mold (3) is then compacted by a press (4) provided with a pressure rod (4-1) in one-to-one correspondence with the second through hole (3-1), so that the solidified sludge after extrusion is formed into porous sludge blocks;

Step 8) transporting the second mold (3) containing the porous sludge blocks into the enclosed preservation space (6), passing industrial waste carbon dioxide gas through the second through hole (3-1) into the porous structure inside the porous sludge block, and passing the carbon dioxide gas through the second through hole (3-1). The carbon dioxide gas absorbed by the steel slag around the porous structure to undergo a carbonation reaction, Stable calcium carbonate, magnesium carbonate is produced, increasing the structural strength and the compactness of the interior of the solidified sludge.

**Assignees:** CCCC SECOND HARBOUR ENG CO LTD; CCCC SECOND HARBOR ENGINEERING CO LTD



## 302. Family 46814476 (AU2010200225 AA)

[View in PatBase](#)

**Extended Family Number:** 42613795

### Title

[EN] METHODS OF SEQUESTERING CO<sub>2</sub>

### Abstract

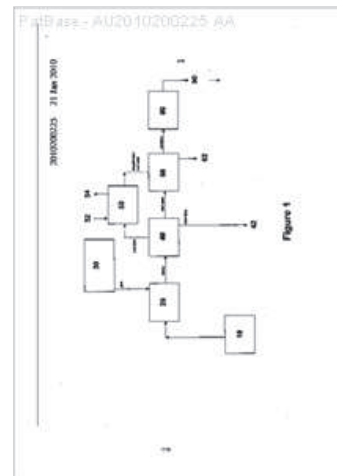
[EN] OF THE DISCLOSURE 5 Methods of sequestering carbon dioxide (CO<sub>2</sub>) are provided. Aspects of the methods include precipitating a storage stable carbon dioxide sequestering product from an alkaline-earth-metal-containing water and then disposing of the product, e.g., by placing the product in a disposal location or using the product as a component of a manufactured composition. Also provided are systems for practicing 10 methods of the invention.

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### 1st Main Claim

[EN] 1. A method of sequestering gaseous CO<sub>2</sub> from an industrial source comprising 5 precipitating a portion or substantially all of the CO<sub>2</sub> in the form of a stable solid precipitate from aqueous solution, wherein the precipitation occurs with a yield of 10 g/L or more of stable solids in a single precipitation step.

**Assignees:** CALERA CORP



303. Family 71434552 (CN108623266 A)

[View in PatBase](#)

**Title**  
[EN] REGENERATED CONCRETE AND PRODUCTION PROCESS THEREOF

**Abstract**  
[EN] The invention discloses a process for collecting and production of regenerated concrete. The regenerated concrete includes, by weight, 965-1328 parts of primary aggregate, 659-1123 parts of recycled aggregate, 566-720 parts of cement; 231-322 parts of fly ash, 118-266 parts of blast furnace slag, 25-55 parts of a water reducing agent, 221-308 parts of water, and 18-45 parts of a pore space regulator. The water reducing agent consists of sodium methylene dimethyl bisnaphthalenesulfonate polymer and a beta naphthalene sulfonate-formaldehyde condensate in a weight ratio of 1:1.5-3.5. The pore space regulator includes a sustained release agent and a swelling agent, in a weight ratio of 1:0.5-0.8, which are capable of releasing carbon dioxide. Through the arrangement, the recycled aggregate reasonably replaces a part of the primary aggregate, the fly ash and the blast furnace slag are adopted for improving concrete workability, water is reduced through the water reducing agent so as to reduce pores generated after water evaporation, and most pore space can be filled or sealed with the pore space regulator, thus improving inner structure of concrete, enhancing stress strength of concreteand improving the grade of impermeability.

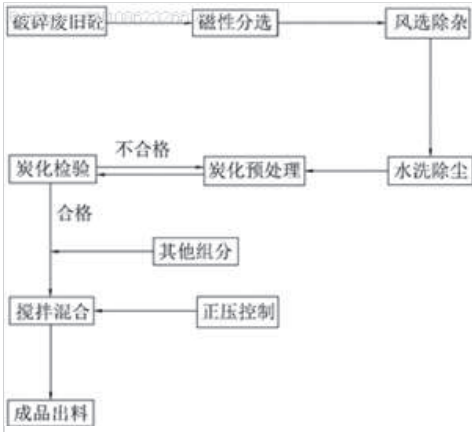
**1st Main Claim**

[MT] 1. A recycled concrete, characterized in that comprises the following components in parts by weight:

- Native aggregate 965-1328 parts;
- 659-1123 parts recycled aggregate;
- Cement 566-720 parts;
- 231-322 parts of fly ash;
- Blast furnace slag 118-266 parts;
- Superplasticizer 25-55 parts;
- Water 221-308 parts;
- Porosity adjusting agent 18-45 parts;

Wherein the reducing agent by weight ratio of 1: 1.5-3.5 methylene dimethyl naphthalene sulfonate polymer and beta-naphthalene sulfonic acid salt-formaldehyde condensates composition; The porosity modifiers include weight ratio of 1:0.5-0.8 can release carbon dioxide release agents and bulking agents.

**Assignees:** WUHAN HUAQIANG NEW BUILDING MAT CO LTD



304. Family 51991325 (US2014010743 AA)

[View in PatBase](#)

Title

[EN] SULFATE-BASED ELECTROLYSIS PROCESSING WITH FLEXIBLE FEED CONTROL, AND USE TO CAPTURE CARBON DIOXIDE

Abstract

[EN] A method including electrolysis processing using sulfate-based electrolytes includes precipitating sodium sulfate decahydrate from a salt solution and then redissolving sodium sulfate decahydrate to prepare feed of electrolyte solution for the electrolysis processing. Front-end processing may be used to treat mixed salt solutions, including brine solutions. Calcium sulfate reagent may provide a sulfate source to regenerate electrolyte solution following carbon capture, and with carbon dioxide being sequestered in the form of calcium carbonate.

1st Main Claim

[EN] 1. A method for chemical manufacture, the method comprising: electrolysis processing of an aqueous electrolyte solution, the electrolysis processing comprising electrolyzing water of the aqueous electrolyte solution to generate hydronium ions at an anode and hydroxide ions at a cathode; preparing feed solids of sodium sulfate decahydrate, the preparing feed solids of sodium sulfate decahydrate comprising precipitating sodium sulfate decahydrate from an aqueous salt solution; preparing a feed of the aqueous electrolyte solution, the preparing the feed of the aqueous electrolyte solution comprising dissolving in water at least a portion of the feed solids of the sodium sulfate decahydrate; and providing the feed of the aqueous electrolyte solution to the electrolysis processing.

**Assignees:** NEW SKY ENERGY INC; LITTLE C DEANE; CARLON NABILAH RONTU; KOSMOSKI JOSEPH VICTOR; NEW SKY ENERGY LLC; LITTLE DEANE C



305. Family 59647529 (CN104743979 A)

[View in PatBase](#)

Extended Family Number: 42613795

Title

[EN] CO2-SEQUESTERING FORMED BUILDING MATERIALS

Abstract

[EN] CO2-sequestering formed building materials are provided. The building materials of the invention include a composition comprising a carbonate/bicarbonate component. Additional aspects of the invention include methods of making and using the CO2-sequestering formed building material.

1st Main Claim

[MT] 1 A method for producing a formed building material, the method comprising:.

A) divalent cations from solution and contains CO<sub>2</sub> waste stream production CO<sub>2</sub> - sequestering component, wherein the CO<sub>2</sub> - sequestering component comprises metastable carbonate compounds, the metastable carbonate compounds include amorphous calcium carbonate, vaterite, or combinations thereof; b) the metastable carbonate compounds comprising CO<sub>2</sub> - sequestering components are dissolved and re-precipitated into a stable form; and c) is formed comprising 50 percent (w / w) or more CO<sub>2</sub> - sequestering component forming materials.

Assignees: CALERA CORP



## 306. Family 55977249 (US2014234946 AA)

[View in PatBase](#)

### Title (EP2892635 A1)

[EN] CARBON SEQUESTRATION METHODS AND SYSTEMS, AND COMPOSITIONS PRODUCED THEREBY

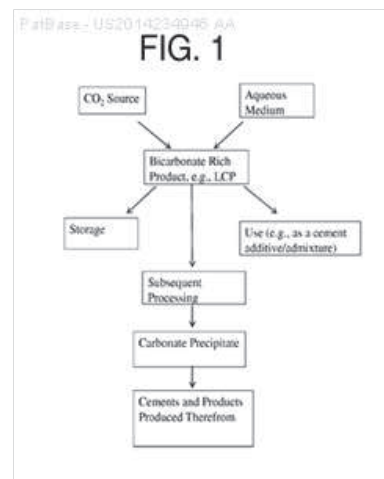
### Abstract (EP2892635 A1)

[EN] Aspects of the invention include methods of removing carbon dioxide (CO<sub>2</sub>) from a CO<sub>2</sub> containing gas. In some instances, the methods include contacting CO<sub>2</sub> containing gas with a bicarbonate buffered aqueous medium under conditions sufficient to produce a bicarbonate rich product. Where desired, the resultant bicarbonate rich product or a component thereof may then be stored or further processed, e.g., combined with a divalent alkaline earth metal cation, under conditions sufficient to produce a solid carbonate composition. Aspects of the invention further include systems for practicing the methods, as well as products produced by the methods.

### 1st Main Claim (EP2892635 A1)

[EN] 1. A method of removing carbon dioxide (CO<sub>2</sub>) from a CO<sub>2</sub> containing gas, the method comprising: contacting the gas with an aqueous medium under conditions sufficient to produce a bicarbonate rich product; to remove CO<sub>2</sub> from the CO<sub>2</sub> containing gas.

**Assignees:** BLUE PLANET LTD; CONSTANTZ BRENT RICHARD; CAMIRE CHRIS; SCHNEIDER JACOB; BEWERNITZ MARK; BLUE PLANET SYSTEMS CORP



## 307. Family 82637493 (CN112125625 A)

[View in PatBase](#)

### Title

[EN] PREPARATION METHOD OF ANHYDROUS PHOSPHOGYPSUM-BASED PRODUCT CURED BY CARBON DIOXIDE

### Abstract

[EN] The invention discloses a preparation method of an anhydrous phosphogypsum-based product cured by carbon dioxide, which comprises the steps of proportionally mixing and uniformly stirring anhydrous phosphogypsum, an excitation reagent, cement clinker, an active admixture and gypsum whiskers to obtain a mixture; slowly adding water into the obtained mixture, adding a water reducing agent at the same time, and stirring until the mixture is uniformly dispersed to obtain flowing slurry; and finally, rapidly injecting the obtained slurry into a mold, putting the mold into a carbon dioxide curing box for curing, curing to a specified age, and removing the mold to obtain the anhydrous phosphogypsum-based product cured by carbon dioxide. The anhydrous phosphogypsum-based product prepared by the invention has good mechanical properties, high surface hardness and good water resistance, and the water resistance coefficient can reach 0.8 or above. Industrial waste is effectively utilized, the cost is low, high-added-value utilization of the waste is achieved, waste greenhouse effect gas, namely, carbon dioxide, is utilized, the greenhouse gas emission amount is reduced, the environment can be protected, and the greenhouse effect is restrained.

### 1st Main Claim

[MT] 1. A conservation of carbon dioxide, anhydrous gypsum-based products preparation, characterized in that the preparation of the raw material components according to weight as follows:

Anhydrous gypsum 70 ~ 100 parts, excitation agent 5 to 20 parts, cement clinker 2 ~ 14 parts, 5 to 15 parts of active admixtures, gypsum whisker 2 ~ 6 parts, superplasticizer 0.1 to 0.95 parts, water in an amount of anhydrous gypsum weight of 0.25 to 0.65;

The preparation method comprises the following steps:

Step 1, the raw material components of anhydrous phosphogypsum, Reagents excited, active admixtures, cement clinker and gypsum whisker mixed in proportion, stir, to obtain a mixed material;

Step 2, the resulting mix was slowly added to the water, while adding water reducer, stirring until evenly dispersed, to obtain a flowable slurry;

Step 3, the resulting slurry was quickly poured into a mold, into carbon dioxide conservation tank maintenance, conservation to a predetermined age, Chaimo conservation of carbon dioxide obtained anhydrous gypsum-based products.

**Assignees:** UNIV HUBEI TECHNOLOGY; HUBEI UNIV OF TECHNOLOGY

308. Family 50267438 (WO13034049 A1)

[View in PatBase](#)

Title (EP2682487 B1)

[EN] COMPREHENSIVE RECOVERY METHOD FOR COMPLEX MATERIAL CONTAINING ARSENIC AND VALUABLE METAL SLAGS

Abstract

[EN] Disclosed is a comprehensive recovery method for a complex material containing arsenic and valuable metal slags, comprising passing the materials containing arsenic through a primary rotating kiln to volatilize the arsenic, and through a secondary rotating kiln to purify the arsenic, so that an arsenic product containing 99.5 percent  $As_2O_3$  is produced; reduction smelting slags from the primary and secondary rotating kilns in a blowing volatilization furnace, with the resultant highly arsenious dust being returned to the primary rotating kiln for treatment, and the slags being used as a raw material in a cement manufactory and a raw material for zinc after undergoing strongly reductive dearsenization and volatilization of zinc in a fuming furnace; the resultant alloy containing arsenic being subjected to basic oxidizing refinement, and the oxidized/refined alloy after dearsenizations containing  $Pb > 72$  percent,  $Sb > 12$  percent,  $As_2O_3 < 0.02$  percent, being sold as a lead-antimony alloy; the basic slags from the refinement, containing  $As_2O_3$  10 percent -20 percent, being subjected to crushing, dissolution in base, and filtration, with the slags thereof being returned to a blowing volatilization furnace for treatment; precipitating tin from the basic solution containing tin and arsenic by blowing in  $CO_2$ , with the filtered tin oxide being sold as a raw material for tin; adding  $Ca(OH)_2$  into the basic filtrate containing arsenic to precipitate arsenic, returning the filtered slags of calcium arsenate to the primary rotating kiln for treatment, and evaporating the remaining basic solution to concentrate and recover the base.

1st Main Claim (EP2682487 B1)

[EN] 1. A comprehensive recovery method of a complex material containing arsenic and valuable metal slags, comprising the following steps:

- (1) volatilizing and enriching arsenic through a primary rotating kiln: sending 95-97 parts of various slags containing arsenic and 3-5 parts of reducing coal powder to the primary rotating kiln, controlling the lumpiness of the slag containing arsenic to be less than F20mm, the average arsenic content to be larger than 25 percent and the furnace temperature of the primary rotating kiln at 600-800 degrees centigrade, with the resultant dust from the primary rotating kiln containing  $As_2O_3$  60-70 percent, and collecting the dust from the primary rotating kiln by a bag; and sending the resultant slag from the primary rotating kiln containing  $As_2O_3$  5-8 percent, to a blowing volatilization furnace to recover valuable metals;
- (2) purifying arsenic through a secondary rotating kiln: sending 95-97 parts of the dust from the primary rotating kiln, which is obtained in the primary rotating kiln and 3-5 parts of reducing coal powder to a secondary rotating kiln, controlling the temperature of the secondary rotating kiln in sections, with the resultant dust from the secondary rotating kiln containing  $As_2O_3$  above 99.5 percent, subjecting the dust from the secondary rotating kiln to bag collection to be packaged and sold as an arsenic product, and sending the resultant slag from the secondary rotating kiln into the blowing volatilization furnace together with the slag from the primary rotating kiln to recover the valuable metals;
- (3) reduction smelting the slags from the primary and secondary rotating kilns in a blowing volatilization furnace: mixing the slags from the primary and secondary rotating kilns according to a ferro-silicon calcium slag type, briquetting, and then sending the briquette into the blowing volatilization furnace, with the resultant dust from the blowing furnace being returned to the primary rotating kiln in step (1) for treatment; sending the resultant slag from the blowing furnace to a fuming volatilization furnace for treatment; and sending a resultant alloy containing arsenic being sent a basic oxidizing refinement furnace for treatment;
- (4) performing strongly reductive dearsenization on residual arsenic in the slag from the blowing furnace and volatilizing valuable metal zinc in a fuming volatilization furnace:
  - sending 70-74 parts of the slag from the blowing furnace and 26-30 parts of reducing coal powder to the fuming volatilization furnace, and controlling the furnace temperature of the fuming volatilization furnace at 1200-1350 degrees centigrade, with the resultant dust from the fuming furnace containing  $As_2O_3$  3-6 percent and Zn above 40 percent, being sold as a raw material for zinc, and the resultant slag from the fuming furnace containing  $As_2O_3 < 0.04$  percent, being sold as a raw material in a cement manufactory;
- (5) performing basic oxidizing refinement on a resultant alloy containing arsenic from the blowing volatilization furnace: sequentially sending 68-72 parts of the alloy containing arsenic from the blowing volatilization furnace, 23-27 parts of NaOH and 3-7 parts of  $NaNO_3$  to a smelting reverberatory furnace and a blowing reverberatory furnace, with the resultant oxidized/refined alloy containing  $Pb > 72$  percent and  $Sb > 12$  percent, being sold as an alloy of antimony and lead, and the resultant oxidized/refined slag containing  $As_2O_3$  10-20 percent; and sending the slag from the oxidizing refinement furnace to a basic arsenic slag process for treatment; and
- (6) performing basic arsenic slag treatment: performing crushing and water immersion on the basic arsenic slags to dissolve arsenic as soluble sodium arsenate into a water solution and also dissolve valuable metal tin as soluble sodium stannate into the water solution, filtering, and then returning the water immersion slag to step (3) to recover the valuable metal; precipitating tin from basic solution containing arsenic and tin by blowing in  $CO_2$ , with filtered slags of tin oxide being sold as a raw material for tin; and adding  $Ca(OH)_2$  into the basic solution containing arsenic for dearsenization, returning the filtered slags of calcium arsenate to step (1) for treatment, and heating and evaporating the basic solution to recover sodium carbonate or sodium hydroxide.



[MT] Claims

1. A complex slag dust containing arsenic and valuable metals comprehensive recovery method, characterized in that the material comprises the following steps:

(1) a rotary kiln volatile enrichment of arsenic: The various slag dust containing arsenic 95-97 parts, 3-5 parts of further coal powder after the ingredients into a rotary kiln furnace and control the slag containing arsenic dust blocks of less than  $\Phi 20\text{mm}$ , greater than 25 percent of the average arsenic, control a rotary kiln furnace temperature was 600~800 degrees C: produce containing as<sub>203</sub>60~70 percent, with a rotary kiln dust bag collection the next transfer kiln dust; Yield of kiln slag containing as<sub>2035</sub>~ 8 percent, the primary transfer feed blast furnace volatile kiln slag recovery of valuable metals;

(2) rotary kiln secondary purification: Arsenic The 95-97 parts of a rotary kiln, resulting primary rotary kiln dust, 3-5 parts also coal powder fed into the secondary rotary kiln furnace, zoning control the secondary rotary kiln furnace temperature, as<sub>20399.5</sub> percent above the secondary rotary kiln rotary kiln dust, the secondary dust collecting bag after packaging for sale as arsenic products, the output of the primary transfer, secondary transfer of kiln slag furnace slag together sent drum wind volatilization furnace recovery of valuable metals;

(3) blast furnace smelting reduction volatilization kiln slag primary and secondary transfer: The primary and secondary rotary kiln slag by the slag ash calcium silicon iron type ingredients, prepared pellet feed blast volatilization furnace: Yield blast furnace dust returns to the step (1) of the kiln processing; Production of blast furnace slag fuming evaporation furnace feeding process; Output arsenic-containing alloy oxidation refining furnace served alkaline treatment;

(4) strong reducing fuming evaporation furnace blast-furnace slag removal of residual volatile arsenic and valuable metals zinc: Take 70-74 parts, 26-30 parts also coal powder fed into the blast furnace slag fuming evaporation furnace, the furnace temperature control is 1200 fuming volatile degrees C to 1350 degrees C, the output of smoke furnace dust containing as<sub>2033</sub>~ 6 percent, zn<sub>40</sub> percent and zinc as a raw material for sale; Output of fuming furnace slag as cement raw materials contain as<sub>203</sub> <0.04 percent sold;

(5) blast volatile alkaline oxidation refining furnace output of arsenic-containing alloy: take 68-72 parts by volatilization blast furnace output of arsenic-containing alloys, 23-27 parts 3\_7 parts naoh, nan<sub>03</sub>sequence into the smelting furnace and a blowing refining furnace oxidation refining, oxidation refining alloy containing, sb>12 pb>72 percent percent, as<sub>203</sub><0.02 percent of lead-antimony alloy as sold; output of as<sub>20310</sub>~ 20 percent, oxidation refining slag containing arsenic soda residue feed treatment processes;

(6) arsenic soda residue treatment: the arsenic base slag crushed to flooding in soluble arsenic arsenic acid sodium dissolved into an aqueous solution, the valuable metals, tin also showed a soluble sodium stannate is dissolved in the aqueous solution, after filtration, water leaching residue is returned to step (3) recovery of valuable metals; containing arsenic, tin lye, after filtration through the c<sub>02</sub> gas shen tin tin tin oxide slag as raw material for sale; in addition to arsenic arsenic-containing lye plus ca (oh) <sub>2</sub>, filtered to obtain calcium arsenate slag returns to step (1), the lye is heated evaporation, the recovery of sodium carbonate or sodium hydroxide.

**Assignees:** LEIYANG YANXIN NON FERROUS METALS CO LTD; LEIYANG YANXIN NON FER ROUS METALS CO LTD; MOYANG YANXIN NON FERROUS METAL CO LTD; SHI HONGJIAO; LIANG JINFENG; SHI RENZHANG

## 309. Family 103494455 (CN118307224 A)

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### Title

[EN] COMPOSITE ADMIXTURE FOR HIGH-STRENGTH AND HIGH-PERFORMANCE CONCRETE AND PREPARATION METHOD OF COMPOSITE ADMIXTURE

### Abstract

[EN] The invention provides a composite admixture for high-strength and high-performance concrete and a preparation method of the composite admixture, and belongs to the technical field of concrete. The material is prepared from the following raw materials in parts by weight: 20-40 parts of a composite material, 5-7 parts of coated silica fume and 2-4 parts of nanocrystalline seeds, the prepared composite admixture for the high-strength and high-performance concrete can improve the workability of the concrete, improve the later strength of the concrete, improve the internal pore structure of the concrete, and improve the compactness, crack resistance and durability of the concrete, and has a certain inhibition effect on an alkali-aggregate reaction, so that the comprehensive performance of the concrete is improved, and the service life of the concrete is prolonged. The raw materials are wide in source, the resource utilization degree of waste raw materials can be improved, the addition amount of the fly ash is reduced, and the method is more suitable for sustainable development.

### 1st Main Claim

[MT] 1. A composite blend for high-strength high-performance concrete, characterized in that From 20 to 40 parts by weight of a composite, 5 to 7 parts by weight of coated silica fume, 2 to 4 parts by weight of nanocrystals, said composite comprising limestone, ore powder, converter slag, blast furnace slag, said coated silica fume being coated by adding silica fume to a Ca and Mg doped silica-alumina sol, Dry, calcined, ball milled; the nanocrystals are calcium carbonate blended silica nanospheres.

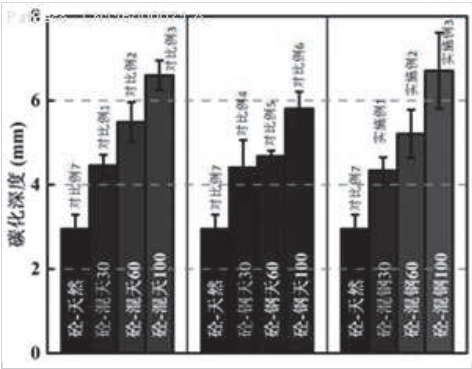
**Assignees:** HUNAN GAOXIANG NEW MAT CO LTD

310. Family 98093515 (CN116409971 A)

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**Title**  
[EN] ACTIVE CARBON SEQUESTRATION CONCRETE AND PREPARATION METHOD THEREOF

**Abstract**  
[EN] The invention discloses active carbon sequestration concrete and a preparation method thereof. The active carbon sequestration concrete is prepared from, by mass, 1-1.2 parts of cement, 0.4-0.5 part of water, 1.5-1.6 parts of fine aggregate, 0-1.96 parts of natural coarse aggregate and 0.6-2.8 parts of artificial coarse aggregate; the raw materials of the artificial coarse aggregate comprise the following components in parts by mass: 7-7.5 parts of waste incineration bottom ash, 1-2 parts of concrete waste powder and 1-2 parts of industrial residues. The waste incineration bottom ash is alkaline and can absorb CO<sub>2</sub>, the content of calcium oxide in the concrete waste powder and the industrial residues is high, more calcium hydroxide can be generated through hydration to react with CO<sub>2</sub>, the activated concrete waste powder has high volcanic ash activity and is combined with the incineration bottom ash, and the carbon dioxide content is high. The artificial coarse aggregate, the cement, the water, the fine aggregate and the artificial coarse aggregate are jointly used as raw materials of the active carbon sequestration concrete, so that the active carbon sequestration concrete can effectively absorb CO<sub>2</sub> under natural conditions, and solid calcium carbonate can be generated after carbonization to realize permanent storage of CO<sub>2</sub>.



**1st Main Claim**  
[MT] 1. An active carbon concrete, characterized in that the raw material of the active carbon concrete comprises, in parts by mass, the following components:  
  
1 to 1.2 parts of cement, 0.4 to 0.5 parts of water, 1.5 to 1.6 parts of fine aggregate, 0 to 1.96 parts of natural coarse aggregate, 0.6 to 2.8 parts of artificial coarse aggregate;  
  
The raw material of the artificial coarse aggregate comprises the following parts by mass of components:  
  
Waste incineration bottom ash 7 to 7.5 parts, concrete waste powder 1 to 2 parts, industrial residue 1 to 2 parts.

**Assignees:** SHENZHEN UNIV; CCCC SHEC DONG MENG ENG CO LTD; UNIV SHENZHEN

311. Family 91769405 (CN114575519 A)

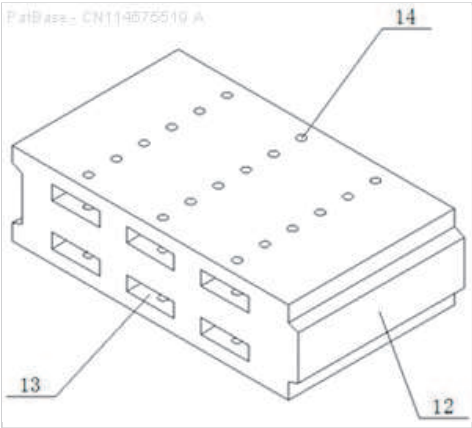
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Title

[EN] NOVEL ENVIRONMENT-FRIENDLY CONCRETE BRICK AND PREPARATION METHOD THEREOF

Abstract

[EN] The invention discloses a novel environment-friendly concrete brick and a preparation method thereof. The novel environment-friendly concrete brick comprises a brick body, the whole brick body is of a cuboid structure, a concave groove is formed in the left side of the brick body, a convex block is further arranged on the right side of the brick body, and the convex block and the brick body are integrally formed; when a user needs to use the brick, the brick can be spliced and used through the concave grooves and the convex blocks on the two sides of the brick, so that when a wall needs to be built, a plurality of bricks are connected more tightly, the overall connecting effect of the wall is further achieved, and even if cement falls off after long-time outdoor use, the brick can not fall off. The hollow grooves are formed in the middles of the bricks, so that the good ventilation effect of the two sides of the bricks in the using process is guaranteed, the situation that a wall is extruded by wind in the using process is avoided, and then it is guaranteed that the wall is safer in the using process.



1st Main Claim

[MT] 1. A new type of environmentally friendly concrete brick comprising brick (1), characterized in that the entirety of said brick (1) is cuboid like structure, and the left side of the brick (1) is provided with concave grooves (11), and the right side of said brick (1) is also provided with convex blocks (12), said convex blocks (12) being integrally formed with the brick (1).

**Assignees:** NOVEL ENVIRONMENT FRIENDLY BUILDING MAT CO FOR YUANLONG IN HYUAN CITY LTD

312. Family 47108042 (IN02429CN2010 A)

[View in PatBase](#)

Extended Family Number: 42613795

Title

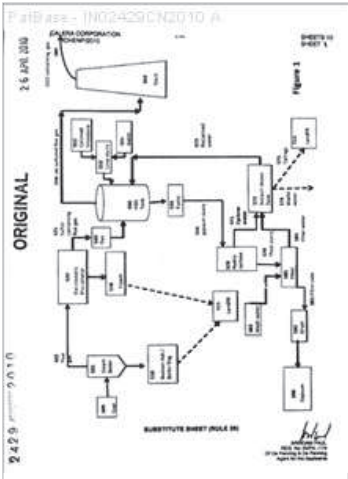
[EN] METHODS AND SYSTEMS FOR UTILIZING WASTE SOURCES OF METAL OXIDES

Abstract

[EN] Methods are provided for producing a composition comprising carbonates, wherein the methods comprise utilizing waste sources of metal oxides. An aqueous solution of divalent cations, some or all of which are derived from a waste source of metal oxides, may be contacted with CO<sub>2</sub> and subjected to precipitation conditions to provide compositions comprising carbonates. In some embodiments, a combustion ash is the waste source of metal oxides for the aqueous solution containing divalent cations. In some embodiments, a combustion ash is used to provide a source of proton-removing agents, divalent cations, silica, metal oxides, or other desired constituents or a combination thereof.

1st Main Claim

[EN] 1. A method comprising: a) contacting an aqueous solution with a source of metal oxides from a first industrial process; b) charging the aqueous solution with carbon dioxide from a source of carbon dioxide from a second industrial process; and c) subjecting the aqueous solution to precipitation conditions under atmospheric pressure to produce a carbonate-containing precipitation material, wherein the precipitation material comprises calcium carbonate, magnesium carbonate, or a combination thereof, wherein the calcium carbonate is selected from the group consisting of aragonite, vaterite, and mixtures thereof.



313. Family 83541959 (US2021053871 AA)

[View in PatBase](#)

Title (EP4329514 A1)

[EN] PROCESS FOR THE PRODUCTION OF METAL OXIDES OR CITRIC ACID

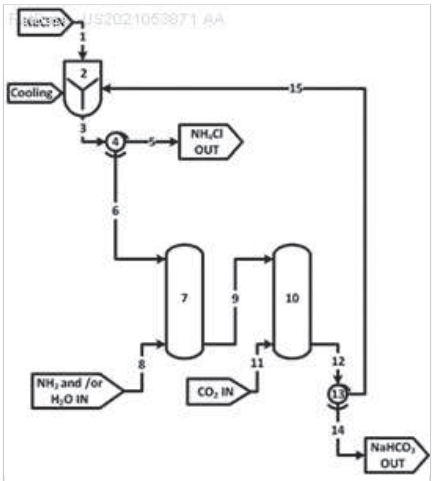
Abstract (EP4329514 A1)

[EN] The present application pertains to methods for making metal oxides and/or citric acid and / or capturing carbon dioxide. In one embodiment, the application pertains to a process for producing calcium oxide, magnesium oxide, or both from a material comprising calcium and magnesium. The process may include reacting a material comprising calcium carbonate and magnesium carbonate. Separating, concentrating, and calcining may lead to the production of oxides such as calcium oxide or magnesium oxide. In other embodiments the application pertains to methods for producing an alkaline-earth oxide and a carboxylic acid from an alkaline earth cation - carboxylic acid anion salt. Such processes may include, for example, reacting an alkaline-earth cation - carboxylic acid anion salt with aqueous sulfur dioxide to produce aqueous alkaline-earth sulfite or bisulfite and an aqueous carboxylic acid solution. Other useful steps may include desorbing, separating, and/or calcining.

1st Main Claim (EP4329514 A1)

[EN] 1. A process for producing calcium oxide and citric acid from a calcium - citrate anion salt wherein the process comprises: reacting a calcium cation - citrate anion salt with aqueous sulfur dioxide to produce a solid calcium sulfite and an aqueous citric acid solution; separating said solid calcium sulfite from said aqueous citric acid solution; and calcining said solid calcium sulfite to produce a calcium oxide, a cement, or a combination thereof.

**Assignees:** INNOVATOR ENERGY LLC; NOVEK ETHAN J; CREATIVE ENERGY LLC



## 314. Family 13469841 (JP8131990 A2)

[View in PatBase](#)

### Title

[EN] INCINERATION ASH SOLIDIFYING APPARATUS

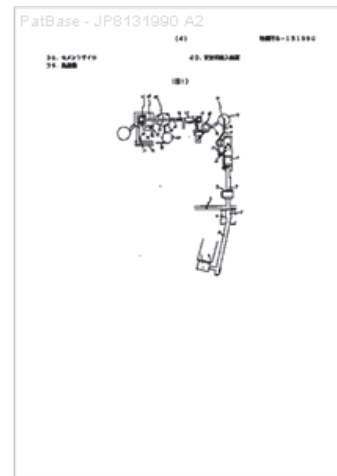
### Abstract

[EN] PURPOSE: To prevent the elution of a harmful substance to environment by subjecting incineration ash to which cement is added to heat-treatment in a rotary kiln and subsequently adding a stabilizer to the heat-treated ash to solidify the ash. CONSTITUTION: As a harmful substance stabilizing treatment agent, a reaction product of a carbon dioxide and sodium silicate is used. That is, the decomposition of sodium silicate is promoted by carbon dioxide generated from sodium carbonate or the like to form colloidal silica in a system and this silica is used. As the stabilizing treatment agent, one containing a solidifying components of glass such as SiO<sub>2</sub>, Na<sub>2</sub>SiO<sub>3</sub>, NaCO<sub>3</sub>, CaCO<sub>3</sub> or the like and a carbon dioxide supply component and utilizing urethane forming reaction such as polyisocyanate or polyol as a carbon dioxide supply component is designated. The stabilizing treatment agent and cement are added to incineration ash in a predetermined amt. to enhance the function of rock forming work still more to certainly prevent the elution of a harmful metal.

### 1st Main Claim

[MT] 1. With the addition of incineration ash, cement Lee kiln opening comparator, after heat treatment in the step of solidifying by adding a stabilizer composed mainly of incineration ash cement solidification equipment

**Assignees:** KIKUCHI TAKESHI; TECHNO JAPAN KK



## 315. Family 57932234 (JP2014218415 A2)

[View in PatBase](#)

### Title

[EN] QUICK-HARDENING POLYMER CEMENT MORTAR COMPOSITION

### Abstract

[EN] PROBLEM TO BE SOLVED: To provide a quick-hardening polymer cement mortar composition which can secure a sufficient pot life even after a product is stored for a long term. SOLUTION: Provided are: (1) a quick-hardening polymer cement mortar composition comprising cement, a polymer, fine aggregate, a super quick-hardening clinker, gypsum, a coagulation regulator, where the super quick-hardening clinker is a CaO-AlO<sub>3</sub>-based super quick-hardening clinker including a carbonic acid component; (2) the quick-hardening polymer cement mortar composition according to (1) where the super quick-hardening clinker contains 29.9 to 65 percent of CaO, 29.9 to 70 percent of AlO<sub>3</sub>, and 0.1 to 5 percent of a carbonic acid component as CO<sub>2</sub>; (3) the quick-hardening polymer cement mortar composition according to (1) or (2) containing a shrinkage-reducing agent; and (4) the quick-hardening polymer cement mortar composition according to any of (1) to (3) containing fibers.

### 1st Main Claim

[MT] 1. Cement and polymer, fine aggregate, ultra-fast curing clinker, gypsum, it becomes contain coagulation modifiers, CaO-Al ultra fast curing clinker containing carbonate component  $2\text{O}_3$  System than speed Kyukata polymer cement mortar composition is hard clinker.

**Assignees:** DENKI KAGAKU KOGYO KK; DENKA GROUP

## 316. Family 102472349 (CN117964285 A)

[View in PatBase](#)

### Title

[EN] COLD REGION RECYCLED ASPHALT CONCRETE COMPOSITE PAVEMENT MATERIAL AS WELL AS PREPARATION METHOD AND USE METHOD THEREOF

### Abstract

[EN] The invention provides a cold region recycled asphalt concrete composite pavement material as well as a preparation method and a use method thereof. The pavement material is prepared from the following components in parts by weight: 40 to 60 parts of waste asphalt pavement milling material, 20 to 30 parts of crushed waste ceramic fine aggregate, 30 to 45 parts of carbon dioxide carbonized recycled concrete coarse aggregate, 5 to 30 parts of CTAB-HAP zeolite molecule ultrahigh-activity powder, 4 to 20 parts of phenylenediamine type cationic asphalt emulsifier, 2 to 10 parts of N-alkyl biquaternary ammonium salt type asphalt emulsifier and 60 parts of N-alkyl biquaternary ammonium salt type asphalt emulsifier. And 90 parts of regenerated rubber powder. The pavement material is suitable for the cold region climate, has excellent compressive strength, durability, compactness and construction performance, is an ideal material for repairing the pavement in the cold region, can reduce the diseases (cracks, pit slots, subsidence and the like) of the pavement material influenced by the low-temperature climate in the cold region, and is not easy to fall off or crack again.

### 1st Main Claim

[MT] 1. A cold zone recycled asphalt concrete composite road surface material, characterized in that it comprises 40 to 60 parts by weight of waste asphalt road milling material, 20 to 30 parts by weight of crushed waste ceramic fine aggregate, 30 to 45 parts by weight of carbon dioxide carbonized recycled concrete coarse aggregate. 5 to 30 parts CTAB-HAP zeolite molecular ultra-high active powder, 4 to 20 parts phenylenediamine-type cationic asphalt emulsifier, 2 to 10 parts N-alkyl diquatarnary ammonium salt-type asphalt emulsifier and 60 to 90 parts recycled rubber powder.

**Assignees:** HARBIN UNIV OF SCIENCE AND TECHNOLOGY; UNIV HARBIN SCIENCE AND TECH



317. Family 66203037 (KR101748351 B1)

[View in PatBase](#)

Title

[EN] GROUND SOLIDIFIER COMPOSITION AND METHOD FOR SILIDIFYING SIOL USING THE SAME

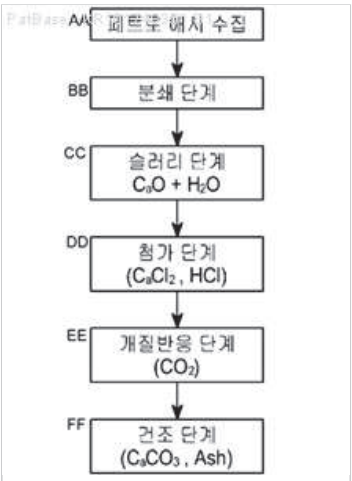
Abstract

[EN] A composition for improving soft ground of the present invention comprises: 15-20 wt percent of carbonation-modified petroleum coke ash; 15-20 wt percent of slag; 10-15 wt percent of fly ash; 10-20 wt percent of paper ash; 10-15 wt percent of natural gypsum; 10-15 wt percent of desulfurized gypsum; and 15-25 wt percent of cement. Since the composition for improving soft ground of the present invention uses the modified petroleum coke ash, which is an improved petroleum coke ash that is a by-product of the oil refining industry, early strength can be easily secured, and watertightness is improved. Fly ash is the ash that is produced after combusting pulverized coal in a boiler, and collected in a lower hopper after capturing fine particles dispersed through the chimney by using an electric dust collector, and has a particle diameter of 0.3-1.0 mm. Also, paper ash means a spare of the limestone micro powder (filler) used in increasing the quality of paper in the papermaking process. Finally, the use of the paper ash is limited to 10-20 wt percent because when used in more than 20 wt percent, it absorbs even the water needed for hydration.

1st Main Claim

[MT] 1. The carbonation reforming petroleum Co., ash 15 to 20% by weight slag 15 to 20% by weight, 10 to 15% by weight of fly ash, 10 to 20% by weight paper ash 10-15% by weight of natural gypsum desulfurization gypsum 10 to 15% by weight, including 15 to 25% by weight of cement reforming petroleum co., the by-product of petroleum refining industry ash is collected in ash using a grinding step of grinding the grinding apparatus (10), the reaction vessel 20and the petroleum Co., ash and water (H2O mixture slurry, the slurry was added to the reaction chamber 20, the step of adding the additive to the reactor 20, thereforming reaction step for injecting a carbon dioxide (CO2), wherein the reforming reaction after the slurry of step a drying step for drying in the dryer (30); and, at the same time produced by a process comprising, the petri dishes in the grinding step to ash 280 ~ 320 mesh grinding, said adding step of additive is calcium chloride (cac12)or hydrogen chloride (HCL) is added to at least one of the modification reaction step, thegas collected at the factory and the plant carbon dioxide (CO2), the drying step, the slurry was dried for 35-40 minutes at a temperature of 600 to 800 °C, the calcium oxide (Cao) and Petro ash of magnesium oxide (MGO) of the petri dishes, ash 2.0 parts by weight, 55 to 65 parts by weight, based on the weight of the soft soil improving composition characterized in that.

Assignees: SINCHANG ENC

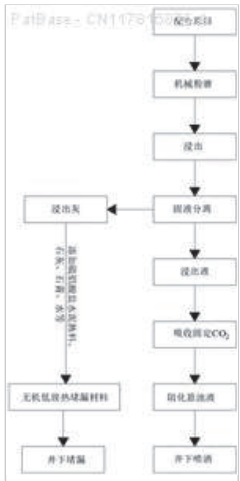


318. Family 102007961 (CN117815875 A)

[View in PatBase](#)

**Title**  
[EN] INTEGRATED UTILIZATION METHOD FOR ABSORBING AND FIXING CO<sub>2</sub> AND PREVENTING COAL SPONTANEOUS COMBUSTION BY ALKALINE SOLID WASTE

**Abstract**  
[EN] The invention discloses an integrated utilization method for absorbing and fixing CO<sub>2</sub> and preventing coal spontaneous combustion by alkaline solid waste. The method comprises the following steps: by taking two alkaline industrial solid wastes as raw materials and hill sand as a grinding aid, mechanically grinding and exciting activity to obtain pre-fixed carbon powder; after the powder is mixed with water and a chlorine salt leaching agent and stands still, alkaline leaching liquid, solid waste and mountain sand leaching ash are obtained through solid-liquid separation, the alkaline leaching liquid is used for absorbing and fixing carbon dioxide greenhouse gas discharged by a coal-fired power plant, and mixed turbid liquid of nano carbonate particles, the leaching agent and water is obtained; as an inhibitor, the inhibitor is sprayed on the surface of residual coal in an underground coal mine easy-to-oxidize spontaneous combustion area; the leaching ash is used as a raw material to prepare the inorganic low-heat-release plugging material, and the material is poured and filled to an underground coal mine air leakage area. According to the method, the alkaline industrial solid waste is utilized, carbon dioxide in flue gas can be absorbed and fixed, the purpose of reducing carbon is achieved, meanwhile, the mining inhibitor and the inorganic low-heat-release plugging material are produced, and dual high-value utilization of the alkaline industrial solid waste is achieved.



**1st Main Claim**  
[MT] 1.An alkaline solid waste absorption fixed CO<sub>2</sub>And an integrated utilization method for controlling coal spontaneous combustion, characterized in that it comprises the following steps:

- Step 1, mechanical pulverization: The basic solid waste complex material and the sandy grinding aid into the ball mill for 30 to 60 minutes, increase the specific surface area of the material, improve the reactivity, obtain the prefixed carbon powder;
- Step 2, Leaching Ions: The pre-solid carbon powder of Step 1 was mixed with water, a chloride salt leaching agent to form a composite slurry, and left to leach for 12 hours;
- Step 3, solid-liquid separation: The composite slurry in Step 2 is filtered to obtain an alkaline leach solution, solid waste, and sand leach ash, respectively;
- Step 4, the alkaline leach solution absorbs fixed CO<sub>2</sub>The carbon dioxide gas from the coal-fired power plant is passed into the alkaline leach solution described in step 3, which is leached by alkaline solid waste materials and sand grinding aids for calcium, magnesium and CO in the solution<sub>2</sub>Reaction to form nanocarbonate particles, mixed with chloride leaching agent and water to form a blocking suspension;
- Step 5. Preparation of inorganic low exotherm blocking material: Collect the solid waste and the sand leach ash described in Step 3, add sulfur aluminate cement clinker, lime, gypsum and water, mix and mix to obtain inorganic low exotherm blocking material.

**Assignees:** UNIV CHINA MINING; CHINA UNIV OF MINING AND TECHNOLOGY

319. Family 106670641 (CN119430766 A)

[View in PatBase](#)

Title

[EN] METHOD FOR EFFICIENTLY SOLIDIFYING CARBON DIOXIDE WITH LOW COST AND LARGE QUANTITY BY USING TAILING FILLING BODY

Abstract

[EN] The invention discloses a low-cost, large-quantity and efficient carbon dioxide curing method for a tailing filling body, which adopts a two-step carbon sequestration method and comprises the following steps of: firstly, grinding and screening a tailing raw material, and chemically exciting and activating; secondly, the activated tailings are subjected to first-step carbon sequestration through cooperation of a wet method and ultrasonic, and carbon sequestration tailings are prepared; then preparing a mine filling body by using the carbon sequestration tailings and cementing materials such as cement; and finally, through second-step carbon sequestration maintenance, the carbon sequestration filling body with the high carbon sequestration amount is obtained. The carbon sequestration in the first step can stimulate the carbonization and gelation activity of the tailings and increase the carbon sequestration amount on one hand, and nano calcium carbonate and silica gel formed in the prepared carbon sequestration tailings optimize the structural compactness of the filling body and improve various properties on the other hand. According to the carbon sequestration filling body prepared through the second step of carbon sequestration, the compressive strength of 3 days can reach 3 MPa or above, the compressive strength of 28 days can reach 5 MPa or above, the carbon sequestration amount can reach 13 weight percent or above, and the carbon sequestration filling body has the advantages of being simple in process, good in performance and low in cost.

1st Main Claim

- [MT] 1. A method for high-efficiency solidification of carbon dioxide in large quantities at low cost in tailings filling, characterized in that it comprises the following steps:
- (1) Grinding and screening the tailings raw materials, activating the tailings, and then adjusting the pH;
  - (2) directly introducing carbon dioxide gas into the slurry formed in (1) under wet conditions to achieve the first step of carbon fixation of the tailings and obtain carbon-fixed tailings;
  - (3) mixing the carbon-fixing tailings obtained in step (2) with the gelling material and the additive solution, adjusting the fluidity of the slurry, mixing and stirring the slurry evenly, and filling the slurry into the goaf of the mine to form the mine filling material;
  - (4) After the filling material obtained in step (3) has been cured or hydrated for 3 to 28 days, carbon dioxide gas is introduced again so that the filling material is cured in an environment where carbon dioxide exists, thereby achieving the second step of carbon fixation and obtaining a carbon-fixed filling material with satisfactory mechanical properties and a high carbon fixation amount.

Assignees: NANJING TECH UNIV; NANJING UNIV OF TECHNOLOGY



320. Family 15947125 (JP2001316150 A2)

[View in PatBase](#)

**Title**  
[EN] QUICK SETTING AGENT, CEMENT COMPOSITION AND SPRAYING MATERIAL USING IT

**Abstract**  
[EN] PROBLEM TO BE SOLVED: To provide a quick-setting agent for a cement in which properties such as setting property, development of strength and durability are improved, thickness of a sprayed coat is decreased, spraying time is decreased, and a watertight concrete structure is realized, a composition of the agent and a spraying material using the composition. SOLUTION: The agent contains a calcium aluminate, a sulfate and an alkaline metal aluminate containing a carbonate. The cement quick-setting agent composition comprises the agent and an admixture. The cement composition comprises the cement and the cement quick-setting agent or its composition. The spraying material comprises the cement composition and an aggregate.

**1st Main Claim**  
[MT] 1. calcium aluminate sulfate, cement set accelerating agent by blending the alkali metal aluminate component comprising a carbonate.

**Assignees:** DENKI KAGAKU KOGYO KK; DENKA GROUP

水ガラス 比	CaO 比	平均 粒径 ( $\mu$ m)	硫酸 成分 (%)	結合 水の 有無
SA 1	0.9	60	5.0	無
SA 2	1.0	60	5.0	無
SA 3	1.1	60	5.0	無
SA 4	1.2	60	5.0	無
SA 5	1.25	60	5.0	無
SA 6	1.5	60	5.0	無
SA 7	1.1	60	0.01	無
SA 8	1.1	60	0.5	無
SA 9	1.1	60	1.0	無
SA10	1.1	60	3.0	無
SA11	1.1	60	10	無
SA12	1.1	60	20	無
SA13	1.1	60	30	無
SA14	1.1	40	5.0	無
SA15	1.1	100	5.0	無
SA16	1.1	150	5.0	無
SA17	1.1	300	5.0	有
SA18	1.1	60	5.0	有
* 1	1.1	60	0.0	無
* 2	1.1	60	0.0	有
* 3	1.1	60	2.2	無
* 4	1.1	60	2.2	有

\* 1と\* 2は市販アルミン酸ナトリウム、\* 3と\* 4は市販アルミン酸ナトリウムと硫酸ナトリウムの混合物

## 321. Family 101758963 (WO24057134 A1)

[View in PatBase](#)

### Title

[EN] METHOD FOR MANUFACTURING A PANEL

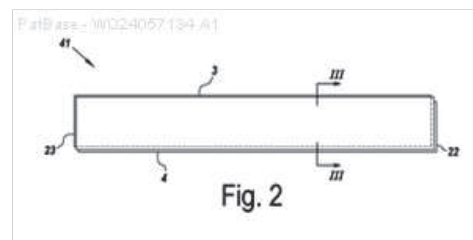
### Abstract

[EN] The method comprises the steps of: providing a mass which comprises a carbonatable powder, bringing this mass into a sheet form and compacting into a sheet form, carbonating this mass that has been brought into a sheet form and compacted, so that a panel is obtained with a thickness of less than 60 mm.

### 1st Main Claim

[EN] 1. Method for manufacturing a panel, preferably a decorative panel, wherein the method comprises the steps of: - providing a mass which comprises a carbonatable powder, - bringing this mass into a sheet form; and compacting into a sheet form; - carbonating this mass that has been brought into a sheet form and compacted, so that a panel is obtained with a thickness of less than 60 mm; preferably with a thickness of less than 30 mm, more preferably with a thickness less than 20 mm, more preferably with a thickness less than 14 mm, more preferably with a thickness less than 10 mm, more preferably with a thickness less than 8 mm, more preferably less than 5 mm; and preferably higher than 3 mm.

**Assignees:** FLOORING IND LTD SARL; UNILIN BV



## 322. Family 103406584 (CN118290115 A)

[View in PatBase](#)

### Title

[EN] METHOD FOR MANUFACTURING BUILDING MATERIAL BY CARBONIZING SILICON-CALCIUM SLAG

### Abstract

[EN] The invention discloses a method for manufacturing a building material by carbonizing silicon-calcium slag, which comprises the following steps of: in the process of extracting aluminum oxide from fly ash, washing the dissolved silicon-calcium slag, drying the silicon-calcium slag by high-temperature flue gas at a kiln head, cooling the dried silicon-calcium slag to normal temperature, adding water, blending, uniformly stirring, and feeding into a pressurizing forming machine to manufacture various building profiles. The building profile is subjected to carbonization treatment after being manufactured and formed. The content of gamma-dicalcium silicate in the tailings-calcium silicate slag obtained in the process of extracting aluminum oxide from fly ash by using a limestone sintering method is high, and meanwhile, the gamma-dicalcium silicate has the characteristic of good air hardness, so that the strength of the finished product can be greatly improved after the product is cured by carbon dioxide under a certain condition. When the silicon-calcium slag is carbonized and made into various building materials, high-temperature firing is not needed, the characteristics of low production cost and high product strength are achieved, the utilization value of tailings can be greatly improved, carbon dioxide emission of a limestone sintering method is reduced, and huge market application value is achieved.

### 1st Main Claim

[MT] 1. A method of carbonization of lime-silica slag to produce a building material, characterized in that during the extraction of alumina from fly ash, the dissolved lime-silica slag is washed, then dried by high temperature flue gas at the kiln head, and the dried lime-silica slag is cooled to normal temperature. Add water and mix to water 10 percent - 15 percent, stir and uniformly send pressure molding machine, make various building profiles, after the building profiles are formed, carry out carbonization treatment;

During the drying, The moisture content of the dried lime slag is less than or equal to 10 percent ; the temperature of the drying smoke: 150 degrees centigrade -300 degrees centigrade Drying time: 20 minutes to 50 minutes;

The pressure control of the press molding machine was: 4.0-40.0 MPa;

During the carbonization process, the shaped embryos are placed in a carbonization reactor, spaced apart, leaving a certain gap between the embryos, the carbonization reactor is a sealing device, the bottom of the carbonization reactor contains a portion of water, and the carbonization reactor is closed after the carbonization reactor is filled with embryos. The carbonization operation is started; carbon dioxide gas is introduced from one end of the carbonization reactor, and the other end is vented, and the internal air is vented with carbon dioxide gas, and after 5-10 minutes of venting, the venting valve is closed; Carbonization time: 1.0-24 hours; Carbonization reactor carbon dioxide concentration: 25 percent -99 percent; Carbonization reactor pressure: 0.01MPa-0.30MPa.

**Assignees:** INNER MONGOLIA MENGXI ERDOS ALUMINUM CO LTD

323. Family 54141064 (US2013164198 AA)

[View in PatBase](#)

Title (EP2794942 A1)

[EN] RECOVERY METHOD FOR A CONTINUOUS CALCIUM EXTRACTION AND PCC PRODUCTION

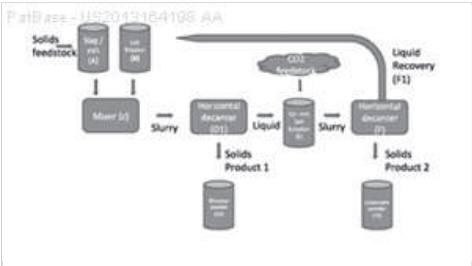
Abstract (EP2794942 A1)

[EN] A method of mineralizing calcium from industrial waste comprising extracting calcium ions from a suspension of calcium rich granular particles and aqueous ammonium nitrate to form a calcium-rich first fraction and a heavy second fraction. The heavy second fraction is separated from the first fraction and the calcium-rich first fraction is carbonated with a gas comprising carbon dioxide to form a suspension of precipitated calcium carbonate and aqueous ammonium nitrate. The precipitate is separated from the aqueous ammonium nitrate by centrifugal means and the separated heavy second fraction comprises an enriched weight percent of iron.

1st Main Claim (EP2794942 A1)

[EN] 1. A method of mineralizing calcium from industrial waste comprising: a. extracting calcium ions from a suspension of calcium rich particles and aqueous ammonium nitrate, forming a calcium-rich first fraction and a heavy second fraction; wherein said heavy second fraction is separated from said first fraction by centrifugal means; b. carbonating the calcium-rich first fraction with a gas comprising carbon dioxide, forming a suspension of precipitated calcium carbonate, and aqueous ammonium nitrate, wherein said precipitate is separated from said aqueous ammonium nitrate by centrifugal means; and wherein said heavy second fraction comprises an enriched weight percent of iron.

Assignees: COREX MAT INC; COREX MATERIALS INC; KARBARZ FRANK A

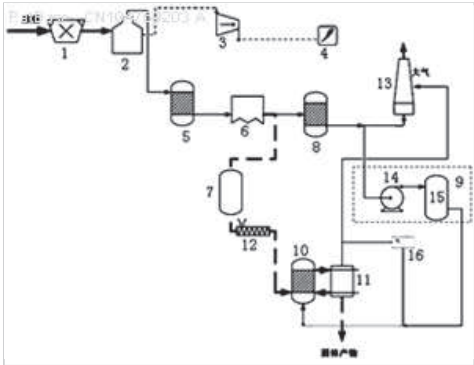


324. Family 59704288 (CN104759203 A)

[View in PatBase](#)

**Title**  
[EN] FLUIDIZED BED TECHNOLOGY AND FLUIDIZED BED SYSTEM FOR DIRECTLY CAPTURING CO2 IN MINERALIZED FLUE GAS

**Abstract**  
[EN] The invention discloses a fluidized bed technology for directly capturing CO2 in mineralized flue gas. In the technology, a high-calcium waste, such as fly ash, carbide slag, steel slag, waste cement and the like, as a raw material. A by-pass is formed on a flue gas discharge pipeline to feed a flue gas flow of which the humidity and the temperature are regulated by a temperature and humidity regulator. In a fluidized bed reactor, the flue gas flow, of which the humidity and the temperature are regulated, is contacted with the high-calcium waste in a co-current flow manner to generate calcium carbonate. After the reaction, a dust-containing gas flow discharged out from the fluidized bed reactor is fed into a cyclone separator for gas-solid separation to obtain a gas flow, wherein the gas flow is fed into the original flue gas discharge pipeline and then is fed into the chimney for being discharged. The invention also provides a fluidized bed system for directly capturing CO2 in the mineralized flue gas. The technology can not only effectively increase the utilization rate of fly ash but also reduce CO2 emission of a power plant, is simple in processes, is convenient to continuously operate, is high in device processing capacity, is small in size and less in occupied area and can be combined with the existing system conveniently. Meanwhile, the decarbonized fly ash does not influence the original use approach of the fly ash from the power plant, thereby achieving a lower decarbonization cost.



**1st Main Claim**  
[MT] 1 a direct capture of carbon dioxide in the flue gas fluidized bed process of mineralization, characterized in that it comprises the following steps:

- First, grinding waste collection calcium stand;
- The second step, open the flue gas discharge flue bypass cited an flue gas temperature and humidity regulator regulate temperature and humidity, the temperature adjustment range of 40-90 degrees centigrade, the adjustment range of 5 to 60 percent humidity;
- The third step in the flue gas in the fluidized bed reactor temperature and humidity adjusted to the calcium waste to contact reaction;
- The fourth step is the reaction of the fluidized bed reactor gas into the cyclone dust-solid separation, and the resulting flue gas is discharged back into the original flue stack emissions.

**Assignees:** HUANENG POWER INT INC; HUANENG CLEAN ENERGY RES INST

## 325. Family 101806414 (CN117735877 A)

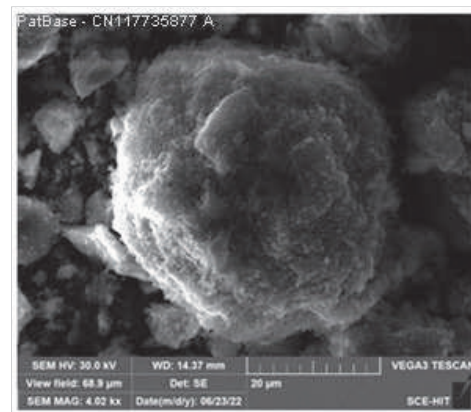
[View in PatBase](#)

### Title

[EN] PREPARATION METHOD OF HIGH-ACTIVITY MINERAL SLURRY OF WET-PROCESS CARBONIZED STEEL SLAG

### Abstract

[EN] The invention discloses a preparation method of high-activity mineral slurry of wet-process carbonized steel slag, relates to a preparation method of mineral slurry, and aims to solve the technical problems of low carbon sequestration efficiency and low volcanic ash activity of the existing wet-process carbonized steel slag. And adding the charcoal, the steel slag and the water into a high-pressure reaction kettle, introducing CO<sub>2</sub> gas into the reaction kettle, and continuously stirring to obtain the high-activity mineral slurry. The loose porous structure of the biochar enables solid CaCO<sub>3</sub> to be better precipitated, so that after the carbon sequestration efficiency is improved and an external compact CaCO<sub>3</sub> layer is peeled off, calcium silicate minerals with hydration activity in the steel slag can be better in contact with water in the slurry to generate hydration reaction, and the pozzolanic activity of the slurry can also be obviously improved. The prepared high-activity mineral slurry can partially replace cement and improve the early strength of a cement-based material. The method can be used in building field.



### 1st Main Claim

[MT] 1. A process for the preparation of a high-activity mineral slurry of wet carbonized steel slag, characterized in that the process is carried out by the following steps:

The present invention is further directed to a method of making a powder comprising the steps of: (I) drying and pulverizing steel slag and sieving to obtain steel slag fine powder having a particle size of 100 micro m or less, and pulverizing and sieving the biocarbon to obtain biocarbon particles having a particle size of 150 micro m or less;

Weigh 1 to 4 percent of biochar, 10 to 30 percent of steel slag and 66 to 89 percent of water in mass percentage and add to an autoclave with stirring device, First adjust the speed of the stirring device to 50 ~ 100 r/min, stir 60 plus or minus 2s at low speed, The mixture is initially mixed well; then the reactor is charged with CO in a volume percentage concentration of 20 to 99 percent<sub>2</sub>Gas, until the pressure gauge of the reactor indicates that the pressure inside the tank reaches 0.5 ~ 3 MPa, the aeration is stopped; then the stirring device speed is adjusted to 200 ~ 300 r/min and stirring is continued for 30 ~ 180 minutes, so that the slurry inside the tank and CO<sub>2</sub>The gases are mixed and reacted thoroughly, and then CO is released from the tank<sub>2</sub>Gases, resulting in highly active mineral slurries.

**Assignees:** HARBIN INST TECHNOLOGY; HARBIN INST OF TECHNOLOGY

326. Family 58032187 (CN104211094 A)

[View in PatBase](#)

**Title**  
[EN] NEW TECHNOLOGY USING POTASH FELDSPAR ORE FOR PRODUCTION OF POTASH, SODIUM CARBONATE AND ALUMINA

**Abstract**  
[EN] The invention discloses a new technology using potash feldspar ore for production of potash, sodium carbonate and alumina, and a method comprising pre-desiliconization, soda-lime sintering dissolution, aluminum extraction by carbon and evaporation crystallization for separation of potassium and sodium is used for comprehensive recovery of aluminum, potassium and sodium resources. The new technology has the following advantages: the technical scheme of the new technology is reasonable, and active calcium silicate, white carbon black, sodium carbonate potassium carbonate and alumina can be produced. In carbonation decomposition process of the new technology, CO2 gas produced by sintering is used, the raw material cost is very low, and the greenhouse gas emissions can be reduced. During the sintering, the amount of a pre-desiliconization raw material is reduced by about 35 percent, the amount of silicon calcium slag is reduced by about 30 percent; desilicification slag needs no addition of sodium carbonate for raw material proportioning; washing water for washing active calcium silicate can be used for desiliconization slag washing, the amount of process water and waste water can be reduced, the silica product form can be enriched, the white carbon black and activated calcium silicate with the high added value can be outputted; by causticization regeneration of the sodium carbonate, alkali self-sufficiency and equilibrium cycle of the whole process can be realized.



**1st Main Claim**  
[MT] 1 the use of K-feldspar ore production of potassium carbonate, sodium carbonate and alumina process, the method comprising the steps of: (1) K-feldspar ore crushing, milling; (2) Step (1) K-feldspar ore milled pre-desilication, get off the silicon cake and desilication filtrate obtained after washing off the silicon cake cake washing and silicon slag removal; (3) the step (2) desiliconizing slag and limestone by a certain percentage ratio milled and then sintered to obtain a sintered clinker; (4) the step (3) sintering clinker eluted with an alkaline solution, to give a crude residue of sodium aluminate solution and dissolution; (5) step (4) of crude sodium aluminate solution Desilication to give sodium and calcium silicon fine aluminum slag; (6) the step (5) of the fine carbonation decomposition of sodium aluminate solution to obtain hydroxide aluminum and carbon points liquor; (7) Step (6) to obtain an alumina calcination of aluminum hydroxide products; (8) the step (7) of the carbon sub liquor evaporation and crystallization to give sodium carbonate and potassium carbonate products.

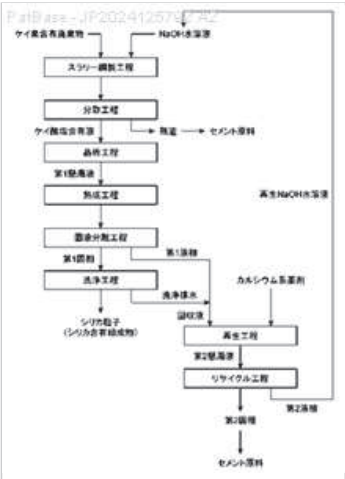
**Assignees:** BEIJING GEN RES INST MINING; BEIJING GENERAL RESEARCH INST OF MINING AND METALLURGY

327. Family 104476091 (JP2024125792 A2)

[View in PatBase](#)

**Title**  
[EN] METHOD FOR PRODUCING SILICA-CONTAINING COMPOSITION

**Abstract**  
[EN] To provide a method for producing silica-containing compositions with reduced NaOH consumption.SOLUTION: A method for producing a silica-containing composition includes: a slurry preparation step for mixing silicon-containing waste with an NaOH aqueous solution to prepare slurry; a step for separating an extract containing silicate and residues from the slurry; a step for reacting a silicate-containing liquid with a CO2-containing gas to provide a first suspension containing silica particles; a step for separating the first suspension into a first solid phase containing silica particles and a first liquid phase containing Na2CO3; a step for cleaning the first solid phase with water to provide a silica-containing composition containing silica particles; a step for adding a calcium-based agent to a recovery liquid containing wastewater resulting from cleaning the first liquid phase or first solid phase to achieve the Ca/Na molar ratio of 0.7-2.0, thereby providing a second suspension containing NaOH and CaCO3; and a step for separating the second suspension into a second liquid phase containing NaOH and a second solid phase containing CaCO3 and utilizing the regenerated NaOH aqueous solution from the second liquid phase for the slurry preparation step.SELECTED DRAWING: Figure 1



**1st Main Claim**  
[MT] 1. A slurry preparation step of mixing silicon-containing waste with aqueous NaOH to prepare a slurry containing silicate, a preparative step of preparative isolation of the silicate-containing extract and residue from the slurry, a silicate-containing liquid containing the extract, and Co.2A crystallization step of bringing the first solid phase containing the silica particles into contact with a gas containing the silica particles to obtain a first suspension containing the silica particles; and a second solid phase containing the silica particles and Na2CO3A washing step of washing the first solid phase with water to obtain a silica-containing composition containing the silica particles; and a calcium-based agent added to a recovery liquid containing at least one of the first liquid phase and washing waste water obtained by washing the first solid phase to obtain NaOH and CaCO3A regeneration step of obtaining a second suspension comprising NaOH and CaCO; and contacting the second suspension with a second liquid phase comprising NaOH3And a recycling step of using a regenerated aqueous NaOH solution obtained from the second liquid phase as at least a part of the aqueous NaOH solution in the slurry preparation step, wherein in the regeneration step, the calcium-based agent is added to the recovery liquid such that a ca/Na molar ratio is 0.7-2.0, A method for producing a silica-containing composition.

**Assignees:** MITSUBISHI UBE CEMENT CORP

## 328. Family 92929856 (CN114920523 A)

[View in PatBase](#)

### Title

[EN] COMPOSITE PARTICLE CAPABLE OF ADSORBING CARBON DIOXIDE AND PREPARATION METHOD THEREOF

### Abstract

[EN] The invention relates to composite particles capable of adsorbing carbon dioxide and a preparation method of the composite particles. The preparation method comprises the following steps: putting coal-fired power plant fly ash, bottom slag and desulfurized gypsum into a ball mill for fine grinding; putting the pulverized fuel ash, the bottom slag and the desulfurized gypsum which are finely ground as well as the cement, the alkaline activator and the binder into a stirrer, and fully and uniformly mixing; and putting the uniformly mixed materials into a pelletizer, and carrying out rolling or extrusion pelletizing to obtain the composite particles with the particle size range of 5-35mm. The obtained composite particles are subjected to industrial source flue gas curing and natural curing treatment, and low-cost capture of industrial source flue gas CO<sub>2</sub> is achieved while the particle strength is improved. The fly ash, the bottom slag and the desulfurized gypsum stacked in a large area in a coal-fired power plant are used as raw materials, the prepared composite particles can replace part of mineral raw materials such as quartz, clay and gravel, meanwhile, the industrial source CO<sub>2</sub> can be captured, and the purpose of treating pollution with waste is achieved.



### 1st Main Claim

[MT] 1. A composite particle adsorbable carbon dioxide, characterized by comprising the following components in parts by weight:

Silicate cement 35~ 40 parts, fly ash 20~ 35 parts, slag 15~ 25 parts, desulfur gypsum 2~ 3 parts, alkaline challenge agent 2~ 3 parts, binder 10~ 12 parts, water 20~ 30 parts.

**Assignees:** TAIYUAN UNIV OF TECHNOLOGY; UNIV TAIYUAN TECHNOLOGY

## 329. Family 104786555 (CN118754711 A)

[View in PatBase](#)

### Title

[EN] GREEN LIGHTWEIGHT FOAM CONCRETE AND PREPARATION METHOD THEREOF

### Abstract

[EN] The invention relates to green lightweight foam concrete and a preparation method thereof, the lightweight foam concrete comprises the following components by weight: 500-1000 parts of cement, 50-100 parts of a mineral admixture, 250-500 parts of water, 1500-2500 parts of fine aggregate, 50-150 parts of modified straw fiber, 4-6 parts of a foaming agent, 2-4 parts of a foam stabilizer, 25-50 parts of a compensating agent, 5-10 parts of a water reducer, and 1-2 parts of a coupling agent. The lightweight foam concrete prepared by the invention not only shows good heat preservation, heat insulation and sound insulation performance, but also can realize resource utilization of solid wastes, and has certain environmental protection advantage.

### 1st Main Claim

[MT] 1. A green lightweight foamed concrete, characterized in that it is composed of the following components in a weight fraction ratio: Cement 500 to 1000 parts, mineral blend 50 to 100 parts, water 250 to 500 parts, fine aggregate 1500 to 2500 parts, modified stover fiber 50 to 150 parts, Foaming agent 4-6 parts, stabilizing agent 2-4 parts, compensating agent 25-50 parts, water reducing agent 5-10 parts, coupling agent 1-2 parts.

**Assignees:** CHINA CONSTR 6TH ENG DIVISION; CHINA CONSTRUCTION SIXTH ENG DIVISION NORTH CHINA CONSTRUCTION CO LTD; CHINA CONSTRUCTION SIXTH ENG DIVISION SOUTH CHINA CONSTRUCTION CO LTD; CHINA CONSTRUCTION SIXTH ENGINEERING DIVISION CORP LTD

### 330. Family 105335450 (CN118949659 A)

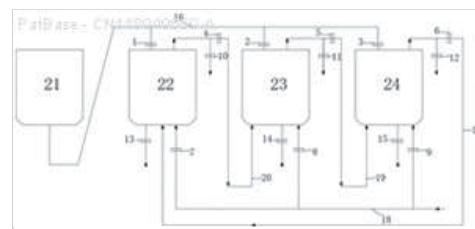
[View in PatBase](#)

#### Title

[EN] METHOD FOR DIRECTLY AND CIRCULARLY FIXING CARBON DIOXIDE IN FLUE GAS BY USING ALKALINE SOLID WASTE DRY METHOD

#### Abstract

[EN] The invention relates to a method for fixing carbon dioxide in flue gas, in particular to a method for directly and circularly fixing carbon dioxide in flue gas through an alkaline solid waste dry method. Alkaline solid waste is fed into a reaction tank, then an ammonium chloride solution serves as circulating liquid, the circulating liquid is mixed with the alkaline solid waste, ammonium chloride and water are decomposed and gasified after being heated to generate hydrogen chloride, ammonia gas and water vapor, the water vapor can wet the surface of the alkaline solid waste on the upper layer, and calcium ions in the alkaline solid waste can be extracted out to activate the alkaline solid waste; then introducing CO<sub>2</sub> into the reaction tank to activate calcium ions to generate calcium carbonate with CO<sub>2</sub>, and regenerating ammonia gas and chloride ions and ammonium in a humid environment to generate ammonium chloride; ammonium chloride is migrated and decomposed through phase change of ammonium chloride, alkaline solid waste is activated on the basis, CO<sub>2</sub> in flue gas is captured, and the problems that mass transfer is limited and energy consumption is high in a conventional direct dry method, and a large amount of waste liquid is generated due to the fact that an acid extraction agent, water consumption and an alkalizer cannot be recycled in an indirect method can be solved.



#### 1st Main Claim

[MT] 1. A method of directly recycling carbon dioxide in fixed flue gas using an alkaline solid waste drying method, characterized in that: The method of directly recycling carbon dioxide in fixed flue gas using an alkaline solid waste drying method is carried out according to the following steps:

##### Step 1:

(1) opening the second feed port (2), feeding the crushed alkaline solid waste into the second reaction tank (23), and then closing the second feed port (2);

(2) The first reaction tank (22) is a basic solid waste which has been fixed for carbon dioxide absorption, and the first reaction tank (22) is heated to a temperature of 105-450 degrees centigrade. The circulating liquid in the first reaction tank (22) decomposes the chlorinate hydrogen, ammonia and water vapor produced in the first reaction tank (22) to effect ammonium chlorinate separation in the first reaction tank (22), and then opens the gas valve #1 (4) to deliver the produced gas to the second reaction tank (23);

(3) the second reaction tank (23) is filled with basic solid waste and recycle liquid fed after crushing, and the gas supplied from the first reaction tank (22) continuously increases the temperature and pressure in the second reaction tank (23), When the temperature of the second reaction tank (23) reaches 105 to 450 degrees centigrade, metal ion extraction is carried out in the second reaction tank (23), and gas valve #2 (5) is opened, The gas produced in the second reaction tank (23) is passed into the third reaction tank (24); the second reaction tank (23) is heated if the temperature in the second reaction tank (23) is slow or the temperature is not sufficient to reach 105 to 450 degrees centigrade;

(4) For alkaline solid waste in the third reaction tank (24), which has completed extraction of metal ions, gas valve #6 (9) is opened and pre-trapped carbon dioxide is introduced, And close gas valve #3 (6) and gas valve #9 (12); control the temperature of the third reaction tank (24) below 100 degrees centigrade, Cooling the third reaction tank (24) above 100 degrees centigrade, and fixing carbon dioxide absorption in the third reaction tank (24);

(V) when the first reaction tank (22) is no longer generating gas, opening the #1 discharge valve (13) to discharge the alkaline solid waste from the first reaction tank (22);

##### Step Two:

(I) opening the first feed port (1), feeding the crushed alkaline solid waste into the first reaction tank (22), and subsequently closing the first feed port (1);

(2) The third reaction tank (24) is fixed for alkaline solid waste, and the temperature of the third reaction tank (24) is controlled to 105 to 400 degrees centigrade, The circulating liquid in the third reaction tank (24) decomposes chlorinate hydrogen, ammonia and water vapor produced, effectuates chlorinate ammonium separation in the third reaction tank (24), and opens gas valve #3 (6) to deliver gas produced in the third reaction tank (24) to the first reaction tank (22);

(3) The first reaction tank (22) is filled with basic solid waste and recycle liquid which is fed after crushing. When the temperature of the first reaction tank (22) reaches 105 to 450 degrees centigrade, Metal ion extraction is carried out in the first reaction tank (22), gas valve #1 (4) is opened and gas generated in the first reaction tank (22) is passed into the second reaction tank (23), and the gas generated in the first reaction tank (22) is passed into the second reaction tank (

(4) In the second reaction tank (23) is an alkaline solid waste which has completed the extraction of metal ions, and after the gas generated in the first reaction tank (22) starts to pass into the second reaction tank (23), the gas valve #5 (8) is opened to pass in the pre-trapped carbon dioxide, Closing gas valve #2 (5) and gas valve #8 (11) to achieve carbon dioxide absorption fixation in the second reaction tank (23); controlling the temperature of the second reaction tank (23) below 100 degrees centigrade, Cooling the

second reaction tank (23) above 100 degrees centigrade;

(V) after the third reaction tank (24) no longer generates gas, then the discharge valve #3 (15) is opened, and the alkaline solid waste of the third reaction tank (24) is discharged;

**Step Three:**

(I) opening the third feed port (3), feeding the pulverized alkaline solid waste into the third reaction tank (24), and subsequently closing the third feed port (3);

(2) The second reaction tank (23) is fixed for alkaline solid waste, and the temperature of the second reaction tank (23) is controlled to 105 to 400 degrees centigrade, The circulating liquid in the second reaction tank (23) decomposes chlorinate hydrogen, ammonia and water vapor produced, effectuates chlorinate ammonium separation in the second reaction tank (23), opens gas valve #2 (5), and passes the gas produced in the second reaction tank (23) to the third reaction tank (24);

(3) The third reaction tank (24) is the basic solid waste and recycle liquid which is fed after crushing. When the temperature of the third reaction tank (24) reaches 105 to 450 degrees centigrade, Metal ion extraction is carried out in a third reaction tank (24), gas valve #3 (6) is opened and gas generated in the third reaction tank (24) is passed into the first reaction tank (22), and the gas generated in the third reaction tank (24) is passed into the first reaction tank (

(4) an alkaline solid waste for metal ion extraction is carried out in the first reaction tank (22), and the gas produced in the third reaction tank (24) starts to pass into the first reaction tank (22), and the gas valve #4 (7) is opened to pass into the carbon dioxide gas which is trapped in advance, Closing gas valve #1 (4) and gas valve #7 (10) to achieve carbon dioxide absorption fixation in the first reaction tank (22); controlling the temperature of the first reaction tank (22) below 100 degrees centigrade, Cooling the first reaction tank (22) above 100 degrees centigrade;

(V) after the second reaction tank (23) no longer generates gas, opening the discharge valve #2 (14) to discharge the contents of the second reaction tank (23);

**Step four:** Repeating steps one to three to achieve direct recycle of carbon dioxide in the fixed flue gas using an alkaline solid waste dry process;

The method of direct recycle of carbon dioxide in fixed flue gas using the alkaline solid waste dry method is carried out in the alkaline solid waste recycle fixed carbon dioxide unit.

**Assignees:** HARBIN INST OF TECH ZHENGZHOU RESEARCH INST; HARBIN INST OF TECHNOLOGY

331. Family 42016809 (BRPI0606034 A)

[View in PatBase](#)

Title

[MT] Ecological compound for civil construction and pre-cast concrete artifacts in general

Abstract

[MT] 9 »9 99 49 • i \* \* •" • 09 '0' \* .... • «« «« l 9t «i •« »• e? • ".... • 0 0 \*« 0 0 9 09 99 9 9 1/1 SUMMARY ECOLOGICAL COMPOUND FOR CIVIL CONSTRUCTION AND PRE-CAST CONCRETE ARTIFACTS IN GENERAL and composed of calcium carbonate CaCO3 high and micro filler pulverized fly ash and Co2 common cement or Ari and a percentage of a core which is composed of cement CP5.

05 Calcium Hydroxide, Silica Enables or Escoria Basica, Flywheels Ash, Co2 mixed in a blender for dry, which ends the mixture of Nucleo and Ecological Compound.

Benefits Tecnicos the Ecological Composite: are composed not Magnesio pollutants below 5 percent, Ri 08/10 percent, pH 6.9

. 10 resistant sulfates, not burning hands and is not toxic not pass by burning the exchanges in mixtures in long shelf life of up to 36 months, it costs 30-40 percent cheaper than traditional ones, even with mixtures other binders, replacing the washed sand by artificial sand, increasing grit 0, 0 compound ecological comes in plastic packages or 15 paper, and ranges from 10 to 60 kg, and bulk and traces vary from 0 location application, being used more 0 dash composed of sand and gravel 30 percent 50 percent and 10 percent compound ecological and common cement 10 percent, and packages already bring in their rotulos variations of each trace.

1st Main Claim

[MT] , . . . . . \* • | . . . . ' . . . . . | # i / i' : . , A compound ECOLOGICO FOR CIVIL CONSTRUCTION AND PRE-CAST CONCRETE ARTIFACTS in general and characterized by constitute up of Calcium carbonate CaCo: "High and sprayed microfiller, Flywheels ashes, Co?. Common cement or Ari. and a percentage of the nucleus and which compound CP5 cement. Calcium hydroxide of 5, active silica or basic slag, fly ash and Co?, mixed pro route. dry through a mixer and consisting of: sand, gravel and cement, where rich ready for use in civil construction, pre-cast and concrete artifacts in general, the core of production process and made up 64-68 percent CP5, and -jo of 20 percent \* of calcium hydroxide: 8-12 percent of fly ash 10 01a 05 percent Co? mixed by dry process in a blender then launches 2-6 percent in the second mixture • The production process of ecological second compound 'measure and 64 to' 68 percent of high CaCoi calcium carbonate passed through the sieve 200. and 2 to 6 percent of the core is 1 to 5 percent, of microfiller. pulverized and from 10 to 14 percent 15 | ash wheel 1 to 5 percent Co? and 14-18 percent of common cement or CP5 by Ari mixed dry in a mixer where ends, mixtures and launches the civil construction market l compound comes with plastic packaging or paper 10 to OOKg or bulk. And to complete your resistance end-launches to the compound to each another half measure 20 common cement as chagando until a measure into conformity specifications of traits shown in bags or leaflets. Example 201 and It; g IOKg

Assignees: SANTOS JORGE ALEXANDRE DOS; DOS SANTOS JORGE ALEXANDRE

332. Family 48881016 (TW201033153 A)

[View in PatBase](#)

Extended Family Number: 42613795

Title

[EN] Reduced-carbon footprint concrete compositions

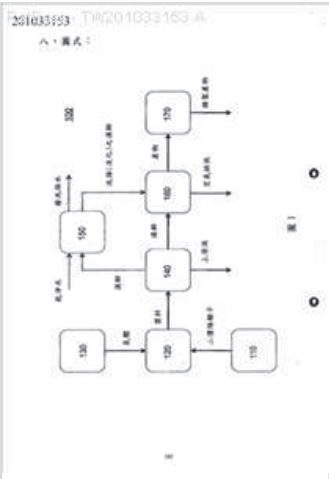
Abstract

[EN] Reduced-carbon footprint concrete compositions, and methods for making and using the same, are provided. Aspects of the reduced-carbon footprint concrete compositions include CO<sub>2</sub>-sequestering carbonate compounds, which may be present in the hydraulic cement and/or aggregate components of the concrete. The reduced-carbon footprint concrete compositions find use in a variety of applications, including use in a variety of building materials and building applications.

1st Main Claim

[MT] A way, which includes: a) composition incorporated into the manufacture of a synthetic carbonate composition and b) the synthesis of carbonate from industrial emissions containing the solution of divalent cations and containing CO<sub>2</sub> reduce the carbon footprint of concrete composition, the decrease of the carbon footprint of concrete composition for ordinary concrete composition to reduce their carbon footprint.

Assignees: CALERA CORP



### 333. Family 107812899 (IN202541031560 A)

[View in PatBase](#)

#### Title

[EN] A METHOD FOR EVALUATING THERMAL STABILITY OF CONCRETE USING THERMOGRAVIMETRIC ANALYSIS

#### Abstract

[EN] The present disclosure proposes a method that evaluates the thermal stability of concrete using a thermogravimetric analyser to assess phase changes, microstructural alterations, and mechanical properties for enhanced fire resistance and durability. The method for preparing first concrete specimens (112) and second concrete specimens (114) using a first composition (100) and a second composition (102), respectively. The first composition (100) is standard concrete (M30), and the second composition (102) is high-strength concrete (M90). The method studies microstructural alterations in concrete due to high temperatures, which include pore structure changes and cracking patterns, using thermogravimetric analyser. The method enhances the understanding of how supplementary cementitious materials (105), such as micro-silica, influence the thermal stability of high-strength concrete, leading to improved material formulations when exposed to thermal cycles ranges between 100 degrees centigrade and 400 degrees centigrade.

#### 1st Main Claim

[EN] 1. A method for evaluating the thermal stability of standard and high-strength concretes using thermogravimetric analysis, comprising: preparing first concrete specimens (112) and second concrete specimens (114) using a first composition (100) and a second composition (102), respectively, wherein the first composition (100) is standard concrete (M30), and the second composition (102) is high-strength concrete (M90); assessing mechanical properties that include compressive strength, split tensile strength, and flexural strength prior to thermal exposure. subjecting the first concrete specimens (112) and the second concrete specimens (114) to controlled thermal cycles ranges between 100C and 400C; analyzing phase transformations, microstructural changes, and weight loss using a thermogravimetric analyzer (TGA) (10); and

334. Family 104991088 (JP2024152191 A2)

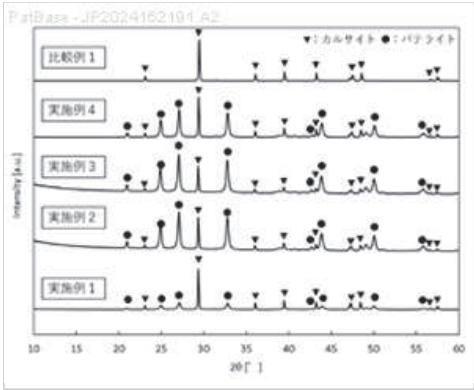
[View in PatBase](#)

**Title**  
[EN] METHOD FOR PRODUCING CALCIUM CARBONATE

**Abstract**  
[EN] To provide a method for producing calcium carbonate rich in vaterite.SOLUTION:  
A method for producing calcium carbonate rich in vaterite comprises the steps of:  
extracting calcium ions from a calcium-containing substance by bringing an aqueous  
solution containing a strong acid and a salt of a weak base into contact with the  
calcium-containing substance; and producing calcium carbonate by bringing a calcium  
ion extraction liquid into contact with a gas containing carbon dioxide gas at a ratio of  
the molar ratio of carbon dioxide gas to calcium ions (CO<sub>2</sub>/Ca<sup>2+</sup>) of 0.5 to  
9.SELECTED DRAWING: None

**1st Main Claim**  
[MT] 1. Contacting an aqueous solution containing a salt of a strong acid and a weak  
base with a calcium-containing substance to extract calcium ions from the calcium-containing substance, The molar ratio of calcium  
ions to carbon dioxide (CO<sub>2</sub>/ Ca<sup>2+</sup>) Of the calcium carbonate in the presence of a solvent (e.g. sodium hydroxide) at a ratio of 0.5-  
9vg9 to produce calcium carbonate.

**Assignees:** TAIHEIYO CEMENT CORP; RESEARCH INST OF INNOVATIVE TECH FOR EARTH



335. Family 73540070 (US10233116 BA)

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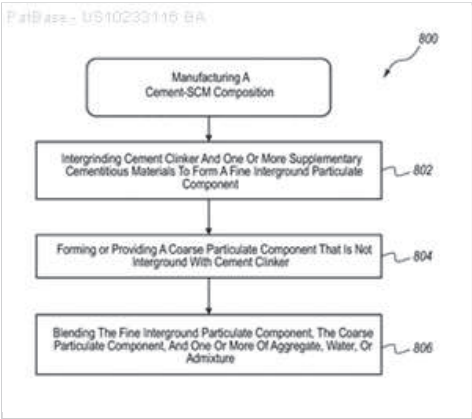
**Title**  
[EN] ACTIVATION OF NATURAL POZZOLANS

**Abstract**  
[EN] An activated pozzolan composition includes a fine interground particulate blend of an initially unactivated natural pozzolan and a supplementary cementitious material (SCM) different than the initially unactivated natural pozzolan. The initially unactivated natural pozzolan may include volcanic ash or other natural pozzolanic deposit having a moisture content of at least 3 percent, and the activated pozzolan composition can have a moisture content less than 0.5 percent. The initially unactivated natural pozzolan may have a particle size less than 1 mm before intergrinding with the SCM. The SCM used to activate the initially unactivated natural pozzolan can be initially coarse or granular with a size greater than 1-3 micro m and may include granulated blast furnace slag, steel slag, other metallurgical slag, pumice, limestone, fine aggregate, shale, tuff, trass, geologic material, waste glass, glass shards, basalt, sinters, ceramics, recycled bricks, recycled concrete, refractory materials, other waste industrial products, sand, or natural mineral.

**1st Main Claim**

[EN] 1. A method of activating a natural pozzolan, comprising:  
intergrinding limestone with an initially unactivated natural pozzolan to form an interground particulate material,  
wherein the initially unactivated natural pozzolan comprises volcanic ash with a moisture content of at least 3 percent, and  
wherein the interground particulate material has a moisture content of less than 0.5 percent.

**Assignees:** ROMAN CEMENT LLC



336. Family 52215766 (KR20120119485 A)

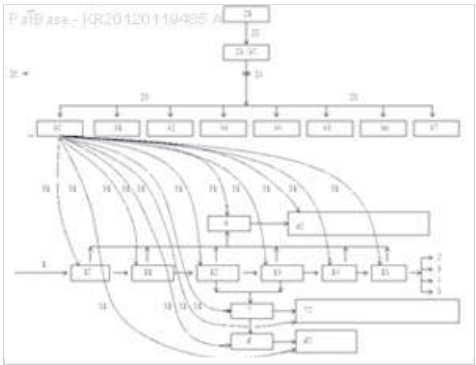
[View in PatBase](#)

Title

[EN] TREATMENT METHOD ON REUSING OF CONSTRUCTION WASTE FOR ACQUIRING OF HIGH QUALITY RECYCLING AGGREGATE AND COMBUSTIBLE MATERIAL

Abstract

[EN] PURPOSE: An environmentally-friendly construction waste recycling method is provided to treat one or more of dust containing air, washing water, and sludge from construction waste treatment processes using various materials containing carbon dioxide. CONSTITUTION: An environmentally-friendly construction waste recycling method includes the following: one or more materials of dust containing air(6), washing water(7), and sludge(8) are treated using various materials containing carbon dioxide. A plurality of reactions is implemented. Recycled aggregate, combustible materials, and recycling materials of high quality are obtained. The alkalinity and the heavy metal contents of the recycled aggregate, the combustible materials, and the recycling materials are reduced.



1st Main Claim

[MT] 1. (1) (10), the dispenser (11), crushing construction waste, to bring stacked (15) pulverized 14, 12, 13), one or more of screening, from construction waste, recycled aggregate to (2), (3) recycling the water quality, (4) one or more of re-acquisition, and other material 5, import of construction waste, crushing, crushing, screening, stacked air dust generated in at least one of (6), (8) the wash water (7), the sludge according to the handling of one or more of (1), (2) the construction waste, recycled aggregate, (3), (4), (5) recycling material the combustible air (6), (7), washing water dust other material (8), the sludge where one or more, or at least one of the one or more places, or stacked on the inner surface, the top, outside, the outside of the skin, an outer skin, one or more of the edge area, perimeter rim, or import water, added water, lysate, screening of water, crushed, one or more of the water, the occurrence of stacked or one or more of, or at least one place on the interior of the stacked, the epidermis, the top, outside, the outside surface of the shell, one or more of the edge area, perimeter rim, wherein the input hopper (61) position 60, 62, 63, the crushing unit crushing device 64 yards (65) screening device (66) wash water treatment apparatus 67 dust air treatment equipment Sludge treatment device 68, the top surface of one or more of the inside, outside, the outside, epidermis, shell, one or more of the circumference, the edge portion of the cage, or import of import, input hopper installed, the crushing device, the crushing device, screening device install installation installation should place, dust, air treatment device installation-yard, wash water treatment device installation, sludge processing apparatus, the upper surface of the one or more installation, the epidermis, the outer shell, inside, outside, the outside, at least one of the edge portions of the perimeter, cage, or import space, crushing, screening, input space space, crushing space, less space, process space, wash water treatment space space air dust, sludge treatment space, the total area, the one of the part of the area of one or more of the internal space of the device, the installation space, the epidermis, the top, outside, the outside surface of the shell, one or more of the edge area, perimeter, cages, the first material, second material, third material, claim 4, claim 5, claim 6, material material material, claim 8, claim 9, claim 7 material, the material of the material or two or more of the mixed material 10 material supply (51) (50) material, or a bottle, tanks, containers, boxes, one of the chamber in the interior of the cage, the first material, second material, third material, Claim 4, claim 5, claim 6, material material material, claim 8, claim 9, claim 7 material, the material of the material or two or more of the mixed material 10 material supply (51) (50), construction waste, recycled aggregate therein, recycled material, or other material, air, water, dust, or purchase one of the sludge, or the construction waste, recycled aggregate, recycled material, or other material, air, water, dust, a predetermined one of the sludge, chamber of the vessel, tanks, containers, boxes, or embedded in the interior of the cage and one first therein first material, second material, third material, claim 4, claim 5, claim 6, material material material, claim 8, claim 9, claim 7 material, the material of the material or two or more of the mixed material 10 material supply (51) to (50), construction waste, recycled aggregate, recycled material, air, water, dust and other material in at least one of the sludge, or the construction waste, recycled aggregate, recycled material, or other material, air, water, dust, sludge itself, one or more of the particles or components, construction waste, recycled aggregate 40, or, recycled material, or other material, air, water, dust, sludge particles or between particles and one or more of the components configuration 41 components, construction waste, recycled aggregate between, or recycled material, or other material, air, water, dust, sludge itself, one or more of the particles or the construction waste, recycled aggregate components 40 and recycled material, or other material, air, water, dust, sludge particles or between particles and configure one or more of the components and ingredients of the carbonation reaction between (41), attaching the mortar isomerization reaction, lime, calcium reduced reduction, reduction, alkali component, reduced also in reducing, alkaline water, reducing its attachment reduction, reduction, reduced debris, organic matter decomposition, adsorbing the organic contaminant reduction, reducing contaminants, heavy metal adsorption, heavy metals, oil component reduction, reducing oil component decomposition, dust reduction, air purification, one or more of reduced moisture purifying water (42), to be such that the generated to import, put the construction waste, crushing, crushing, screening, stacked in one or one or more of the performance of both in the case of both is brought a construction waste, construction waste is introduced into the hopper, and the crushed construction waste, recycled aggregate construction waste, recycled material, selected from one or more other material, is pulverized, recycled aggregate, recycled material, or other material, one or more of the ongoing stacked from construction waste, recycled aggregate, the recyclable material, or other material, belt, one Acquiring the above, importing the construction waste in the hopper, crushing the water introduced, recycled aggregate crushed recycled material, or other material, belt, with one or more of screening, by one or more of the crushing the ice from construction waste, recycled aggregate, recycled material, to obtain one or more of the other material, the dust, sludge air, at least one of the wash water the wash water treatment sludge air, dust, adsorbing the contaminants from one or more of reducing contaminants, heavy metal, heavy metal adsorption, oil component reduction, fuel component decomposition, dust reduction, air purification, water purification, reducing one or more of reduced moisture, the entrance 60 is brought a construction waste, the semi stance brought into place fork or input devices by a construction waste input hopper, the crushing device, screening device, one of the inlet equipment or devices other than the fork can be added to the construction waste to a hopper, the input hopper (61) equipment, construction waste, the hopper to be added is injected into the input hopper crushed

construction waste, is introduced into the device, or one or more of screening device or crushing equipment through the belt conveyer or transfer device, screening device of In one or more flows to the crushing device (62), crushing construction waste, as a device that breaks or jaw crusher (Impact crusher), cone crusher, roller Crusher (Hammer crusher, a roll crusher, a roll crusher, double, triple rod mill, a sand mill, comprising one or more of the number of copies or the construction waste is crushed to facilitate separation or selection of construction waste, the keureo letting the crushing device configuration, Impact crusher (jaw crusher), at least one of the roller and the others may not necessarily, ham, Merck, the keureo letting the keureo keureo letting the double, triple rod mill, a sand mill, a, the crushing device optionally includes more than one device or any two or more in the case consisting of two or more, or two or more continuously installed in one or more of screening device installed in between, two or more of the crushing device if there is continuously installed, and crushing operation is continuously carried out between two or more of the crushing device when installed in a screening device one or more of the screening and crushing operations are mixed or alternating, the crushing device is performed, the number of copies in the uncrushed or crushed by the conveyor belt or screening device, the crushing device, transfer device, yard Selecting at least one of the flows of the construction waste, recycled aggregate apparatus 63, recycled material, or other material, as a device for separation into one or more of screening, screen, sorting, manpower, the sorting tree sorting Rommel, magnetic separation, wind graders, prongs per group, vibration sorter shipbuilding, cyclone separators, gravity sorter sorter, optical sorter and the screening comprising one or more of screening, sorting manpower in the configuration of the device screen, the sorting tree sorting Rommel, one or more of magnetic separator (and other wind sorter to be included per group, vibration sorter, shipbuilding, rake, cyclone separators, gravity sorter sorter, optical sorter and the screening device is optionally included in the case where more than one device is configured as at least two or more, or two or more continuously installed between one or more of the crushing device or any two or more of the screening apparatus, when installed in a continuously screening operation it is continuously carried out between two or more of the screening device, one or more of the crushing device when installed in a screening and crushing operations are mixed or alternating is carried out, is performed in the mixed crushing and screening operation is performed in a random order by a mix, and that the selection is carried out in alternating And crushing operations performed alternately in this order, wherein the screening device separate from the belt conveyer or transport equipment, water by screening crushing device, the crushing device, flows to the yard of one or more devices other than the belt conveyor conveying equipment is transferred object, inputs, one or more of screening of water, crushing device, screening device, the crushing device equipment that can be transferred as one or more of the crushing device, screening device, by at least one of recycled aggregate, recycled material, or other material, at least one of generated or generated or separated from each other, the crushing device (64) is a device communication of grinding or cutting, cutter comprising one or more of the shredder, the combustible cutting a grinding or, to reduce the size of the flexible precision screening or recycled or to carry easily, the precise selection of the flammable flammable material, wood and other combustible materials to flow a cyclone separator separating the optical sorter, performed by at least one of the other is the flammable combustible timber (other than in the flammable flammable material, the combustible, flammable, has other combustible Solid fuel, biomass, a fuel boiler fuel, biofuel, incineration plants, cement factory, one or more of the raw material, the raw material is used as the embedding material, the embedding material for the four landfills yard (65) embedded in the material, the recycled aggregate, recycled material is, the material of one or more other stacked, or place the dust into the air (6), the transfer of construction waste, crushing, crushing, screening, or generated from one or more of the stacked using the air dry crushing, screening, generated by at least one of recycled aggregate, recycled aggregate, the flammable or construction waste, recycled material, or other material, or psoriasis, used dry cleaning waste sludge from the dust dust is mixed with air or gas, the air treatment apparatus 66 is an apparatus for processing to purify the air or dust, fan, blower, baghouse, an inhaler, collector, a bag filter, the air filter, activated carbon filter, suction filter, comprising one or more of the configuration of the dust from the air treatment apparatus, at least one of a blower, dust and other inhaler, a bag filter to be included, the air filter, activated carbon filter, suction filter are optionally including a waste treatment plant of the fan or air dust precipitator, a bag filter, the air filter, One of suction filter, activated carbon filter, is transferred to a waste treatment plant of the blower 15, the air is blown into the air or dust precipitator, a bag filter, the air filter, activated carbon filter, one will transfer to the adsorption, and the dust collector to remove the dust from the dust and the air, and the suction device for sucking air into the gun by waste treatment plant of dust or released into the atmosphere, the bag filter (72d), the air filter, activated carbon filter, one sucks the suction, and the air in the air dust collector for collecting carbon dioxide or carbon dioxide collector, the predetermined portion of the air gun or waste treatment plant, or a fan, blower, baghouse, an inhaler, collector, a bag filter, the air filter, activated carbon filter, one or more of the adsorption filter is provided on the inlet or outlet by the collector has one of the captured carbon dioxide is used as the first material and the entrapped air has been used as one of the 8 material, wherein the filter is a fan, blower, the suction device is provided on the rear end of one or more of air or dust and for filtering the incoming air, wherein the air filter is a fan, a blower, inlet group of one or more shear or Air or dust is installed at a rear end, and a filter for filtering the air flowing into the activated carbon filter is a fan, blower, the suction device is provided on the rear end of one or more of air or dust with activated carbon, for filtering the air flowing into the suction filter is a fan, blower, the suction device is provided on the rear end of one or more re-dust suction filtering the air flowing into the air or the wash water (7), crushing, screening of construction waste to use one or more of water, with water or occurs in the process of crushing, screening wet caused by at least one of recycled aggregate, recycled, or the construction waste, recycled material, other material in water, the water used for wet cleaning, the cleaning liquid or water or water treatment apparatus 67 is an apparatus for handling boil wash water to purify or settling tank, the water tank, the wet cyclone, the aeration tanks, neutralization, the coagulation bath is composed of one or more of the filtration tank and the water tank (100) in the configuration of the cleaning water treatment apparatus, one or more of the neutralization basin containing the at least one settling tank, cyclones, necessarily, aeration tanks other wet, filtration tank is optionally included in the coagulation bath, the collecting tank for collecting the wash water to the water tank, the water tank A settling tank, or discharged to the outside, a wet cyclone, the aeration tanks, neutralization, coagulation bath is introduced into one or more of the filtration tank, or recycled to the washing water recycled and neutralize the neutralization basin, the neutralization tank of the tank, or discharged to the outside, the aeration tanks or settling tank, wet cyclone, the coagulation bath is introduced into one or more of the filtration tank, or recycled to the recycled, the wet cyclone to remove the particles present in the wash water, the water is discharged to the outside of the wet cyclone, or the aeration, sedimentation tank, neutralization tank, at least one of coagulation bath is introduced into the filtration tank, or, or, the recyclable recycle the washing water of the aeration tank, the aeration basin aeration of the water is discharged to the outside, or settling tank, neutralization, coagulation bath is introduced into one or more of the filtration tank, or recycled are recycled to the wash water, the coagulation bath, wherein the coagulation bath tank to agglomerate, water, or discharged to the outside of the aeration tank, neutralization, precipitation, filtration tank flows or with one or more of the recycle or re-circulating the washing water to the clarifier tank, the settling tank to precipitate the water is discharged to the outside or, or Neutralization tank, the aeration tanks, coagulation bath is introduced into one or more of the filtration tank is recirculated, or recycled through the filtration

tank for filtering the water level of the wash water, the water tank is discharged to the outside, or recycled to the recycling, it is recycled to the recycling the construction waste water in one or more of the crushing, screening, or the process of using a wet crushing with water, where one or more of screening, or construction waste, recycled aggregate, recycled material, or other material with at least one of wet cleaning to recycle the sludge, is recycled to the wash water (8) in the course of processing, neutralization tank, the aeration tank, the coagulation bath, the sedimentation tank, in one or more of filtration tank, or using water to precipitate, crushing, screening wet where there is one or more of, the sludge precipitated precipitate the sludge processing device 68 as a device for reducing the moisture, dryers, dehydrator, and comprising one or more of, the dehydrating the sludge dewatering device, the dryer to dry the sludge, the sludge is to import, import the waste water, the input hopper Installation, Setup, screening device installed crushing device installed, yard, the yard, grinding apparatus, dust, air treatment apparatus installed in place should wash water treatment apparatus is installed, install, import space sludge processing apparatus input space, crushing, screening, space, crushing space, less space, dust, wash water treatment space space air treatment space, one or more of the sludge, or a processing space, import, import, input hopper installed water crushing, crushing, screening device installed device installation, yard, the yard unit installation should place, dust, wash water treatment device installed air treatment equipment installation, installation, import space sludge processing apparatus input space, crushing, screening, space, crushing space, less space, process space, wash water treatment space space air dust, sludge treatment space, the total area, the one or more of the part of the area of the device, one or more of the installation space, the space for the import, crushing, screening space input space, crushing space, less space, process space, wash water treatment space space air dust, sludge treatment space, respectively, in a space in which the fetch operation is performed operation is performed in the area, and the testee crushing operation is to be performed, is carried out in the space, the space, the space action is performed, this operation is carried out in the space, and dust stacked processing operation is performed in the air, water treatment operations are carried out in a clean room space, sludge treatment operation is performed in the space, the operation is carried out a part, the part of the area of a part of the area is at least

Although urban areas contain ?The maximum range of 50m<sup>3</sup> operation is performed in the entire area, the total area of the device installation space, crushing, screening, import construction waste, crushing, stacked, dust, wash water treatment, air treatment required to perform the sludge treatment space the device is installed, and wherein the recycled aggregate aggregate components contained in construction waste material of the material, the combustible materials contained in the construction waste in flammable or combustible material, wherein the recycled material is cast iron, from materials contained in construction waste material, soil, sediment, and nonferrous metals caused the metal at least one of selection, the other contained in the construction waste, recycled aggregate from the flammable material, recycled material, wherein two or more of the mixed material other than the material supply (51) to (50), and at the same time supply the differential supply supplied from the supply, or may be mixed, the simultaneous supply of one of the one or two or more materials are mixed in the first time, at the same time, supplied to the supply of the discrimination is divided into two or more materials are supplied to the one or more times, the mixed supply of more material is supplied the case One or a mixture of any two or more materials to be at the same time is supplied to the number 1 is the other one or more materials to be supplied to the one or more times, or more than once, the divided into more than two times each supply is supplied to the case of a time interval, the time interval is 1 minutes supplied? In the range of 10 days supply of administration, injection, insertion, addition, contact, purchase, bursting, spray, foam, spray, spray, spray, dusting, sprinkling, affixing, passing through one of the aeration, the supply of the material or material or material supply device 20 by the transfer pipe 22 and the supply pipe 25, the material supply device 20 performed the material feed tube 22, material collecting bin (23) (21) material through the valve 24, the material supply pipe (25) of the material supply tube 30, a nozzle (31), (33) engine (32) tube 34, a sprinkler 35 YUGONGGWAN nebulizer 36, water lattice aperture (37), comprising one or more of the atmospheric air, the material collector, landfill, incineration device, a combustion apparatus, gas discharge device, exhaust gas system, apparatus, device, unit, a gas outlet, a gas corruption extraction port, chimneys, either one or more of the tags in the stack, gas, vapor flow together, gas, air, carbon dioxide, air, or capture a portion of the shape of the bubble trapping or absorbing or sucking the fixtures, the material the material trapped in the collector, or stored in a storage material or material feed tube 22, material supply pipe of the hollow tube, the nozzle pipe, tube, sprinklers, yugongggwan, atomizer, tanks, containers, container, water chamber aperture, the rim is provided in at least one of the box, the landfill is Post-consumer waste, or embedded in the waste or waste is buried by decomposition of waste gas occurs, or divergence or corruption or the exhaust or the exhaust generated or the incineration device, combustion system, the combustion of the material, the gas burning apparatus, gas exhaust unit discharge device for discharging gas-, or combustion gas incineration equipment, and wherein the exhaust apparatus, corruption, fermentation apparatus, the flammable material or device to decompose, corruption, fermentation occurs, or the gas discharge or the exhaust emitted or generated or equipment, and wherein the gas is air, gas combustion apparatus, landfill, incineration equipment, exhaust equipment, gas discharge device, corruption, fermentation device electrolysis apparatus, or present on one or divergence occurs in one discharge or generated or the shape of the vapor or gas or material, wherein the material from the material feed tube is trapped, the material feed tube of the hollow tube, reservoir, diffusers, yugongggwan, grid nozzle, tube, atomizer, sprinklers, tanks, containers, water stop, containers, boxes, cage chamber for transporting the material to at least one of the material reservoir is constant of pipe, To size and the container or box or cage to the first material, second material, third material, claim 4, claim 5, claim 6, material material material, claim 8, claim 9, claim 7 material, the material of the material or two or more of the mixed material 10 material storage that stores (50), the more the material reservoir when storing a number of storage and is composed of two or more than two, or as many as the number of the number of the target material reservoir storage, or consist of one or more partition walls with one reservoir, or consists of a number of storage target material with as many times as the number of the partition wall, the partition wall of the reservoir and is installed on the inside of storing more than one storage substance is a function for separating the so as not mixed with each other, stored in the material storage and the first material, second material, third material, claim 4, claim 5, claim 6, material material material, claim 8, claim 9, claim 7, material 10 material is material, the material of the present invention, by collecting the trapped material that are sold commercially, commercially purchased or purchased it, it manufactured artificially obtained from nature, in that market, or one or two or more mixed, the Material stored in the material supply pipe of the hollow tube, the nozzle pipe, tube, sprinklers, yugongggwan, atomizer, tanks, containers, container, water aperture, the chamber being provided on at least one of the box, the rim supply valve are material feed tube or the material supplied from the material supply pipe valve for adjusting the amount of the material, the material supply pipe is trapped group or a material feed tube or material of the material to be supplied from the reservoir tube, nozzle, pipe, tube, yugongggwan, nebulizer, sprinklers of lattice aperture, a container, a tank, a container, a chamber, a box, and the tube to provide one or more of cage, wherein said hollow tube, nozzle, pipe, tube, yugongggwan, nebulizer, sprinklers transfer tube or materials, the material of the aperture attached to one end of the supply pipe material or material trapped group or a transfer tube or the material supply pipe to supply the material to be supplied from the first material, second material, third material, claim 4, claim 5, claim 6, material material material, claim 8, claim 9, claim 7 material, the material of the material or two or

more of the mixed material 10 material (50), injection, administration, added to, contact, purchase, jet, spray, spray, foam, aeration, spray, dusting, sprinkling, affixing, one of the pass That is, the hollow tube can be ejected to the material is formed in the center of a hollow tube or hose or pipe, wherein the nozzle is a spraying or spray material small holes are formed in the pointed distal end. the material, and the diffusers can be aeration or foam, or slots are formed in or on the surface of the outer tube around or, the yugongggwan material be a perforated holes are formed in the outer peripheral surface or around or tube, and wherein the grating tube material be a perforated holes are formed in the outer peripheral surface or around or lattice, the company was able to tube is a material sprinklers or spraying a sprinkler type as a spray, and the sprayer can spray the material, and the material with water by the water aperture can be sprayed as a spray or aperture, the material supply is material collector, a material conveying pipe, material, material supply valve, the material feed tube storage tube of the hollow tube, the nozzle pipe, tube, sprinklers, yugongggwan, atomizer, If the cooking of both water, air trapped by air, gas, landfill, incineration device, a combustion apparatus, exhaust equipment, gas discharge device, corruption, fermentation device electrolysis apparatus, a gas outlet, a gas extraction port, either chimney, one or more of the tags in the stack, gas, vapor flow together, gas, air, carbon dioxide, air bubbles, or capture or absorption which the shape, material or suction collector material is material trapped in the reservoir, or material supply pipe of the hollow tube, the nozzle pipe, tube, sprinklers, yugongggwan, atomizer, is provided on one of the physical aperture material from the material feed tube by collecting and storing the material or material, material supply pipe material is transferred to the material stored in the material storage and supply pipe of the hollow tube, the nozzle pipe, tube, sprinklers, yugongggwan, atomizer, water aperture, material supply pipe provided to one of a collector or material transport pipe by material or material of the material to be supplied from the reservoir, a nozzle pipe, tube, yugongggwan water sprinkler heads, nebulizer, grid line, is provided in at least one of diaphragm, material supply valve by an amount of the material supplied from the material feed tube is adjusted, and the material of the hollow tube attached to one end of the supply pipe, an institution, yugongggwan, grid nozzle pipe, The sprinkler, atomizer, by one or more of the aperture of the first material, second material, third material, claim 4, claim 5, claim 6, material material material, claim 8, claim 9, claim 7 material, the material of the material or two or more of the mixed material 10 material (50), injection, administration, added to, contact, purchase, jet, spray, spray, foam, spray, dusting, sprinkling, affixing, passing through the air supply (51) to one of the one or more UES, or or contain the supply when the supply pressure of gravity, atmospheric pressure, and as one of low-pressure, medium pressure, high pressure engine, the low-pressure is 0.1 kg/cm<sup>2</sup> or less, the intermediate pressure is 0.11? And a pressure ranging from about 10 kg/cm<sup>2</sup>, and a pressure equal to or greater than the pressure of 10.1 kg/cm<sup>2</sup>, wherein the first material comprises carbon dioxide, carbon dioxide, carbon dioxide, carbonic acid, carbonated solution, sodium carbonate, and wherein the second material is silicon carbide, calcium carbide, CAC<sub>2</sub> and the third material is sodium hydroxide, sodium silicate, Waste Foundry Sand, slag and the 4 Pfc(per fluoro compound), perfluorinated compounds, and material is CF<sub>4</sub>, CH<sub>3</sub>F<sub>4</sub>, C<sub>2</sub>F<sub>6</sub>, C<sub>2</sub>F<sub>4</sub>, SF<sub>6</sub>, NF<sub>3</sub> carbon fluoride, the fifth material gas incineration, landfill gas, the exhaust gas of the combustion gas in the exhaust gas and the material gas 6, plant fermentation gas decomposition gas, corruption, and one of the 7 material gas, hydrogen peroxide, H<sub>2</sub>O<sub>2</sub> aqueous hydrogen peroxide, sulfuric acid, hydrogen peroxide, sodium, and the medicines, 8 material is sulfur, sulfur acid, acid acid, ash and the 9 material is air, oxygen, ozone, air, compressed air, air, compressed air can, aeration, heated air, water, water, nano, micro-bubbles, aeration, hot water, pressurized, micro-bubble bubble, nano-bubbles bubbles of air bubbles, heating-and the 10 EM (Effective Microorganisms, beneficial microorganisms, microorganism), substances, the photocatalyst, and the phytoncide The artificially prepared carbon dioxide and carbon dioxide, the carbon dioxide is calcium carbonate or calcium carbonate artificially prepared in the sludge, the carbon dioxide generated by reacting an aqueous solution of calcium carbonate or calcium carbonate, construction waste, recycled aggregate sludge, recycled material, or other material, air, water, dust, sludge treatment or one or more of the first material from the creation of the at least one up to 9 material selectively sludge generated by supplying calcium carbonate or calcium carbonate carbonated water, the carbonated water is produced by the artificially artificially the carbonated water produced in the water or aqueous solution of carbonic anhydrase, generating carbon dioxide and an organic acid is added to the catalytic action of the carbonic anhydrase in the carbon dioxide generated by the reaction of an organic acid and carbon dioxide is the carbon dioxide generated occurs produced water or carbonated water, dissolved in an aqueous solution, wherein the carbonic anhydrase, carbonic anhydrase present in the methane bacteria containing the carbon dioxide generated in the sodium hydrogen carbonate, potassium hydrogen carbonate, calcium bicarbonate (CA(HCO)), (NAHCO), (NACO), (KHCO), (KCO), (CACO) soda (MGCO) potassium carbonate, calcium carbonate, and magnesium carbonate and at least one selected from the organic acid is citric acid, oxalic acid, acetic acid, fumaric acid, malic acid, succinic acid, Acetic acid, butyric acid, palmitic acid, tartaric acid, ascorbic acid (Vitamin C), sulfonic acid, sulfonic acid, tartaric acid, citric acid (citric acid), citric acid, alpha-ketoglutaric acid, succinic acid, 8-glyceraldehyde, (DPGA) (PGAL), and of the glycerol glycerol ether and at least one selected from the group consisting of acid (PGA), wherein the micro air, air, air, water, nano, micro-bubbles may, ultra, ultra-bubble, bubbles in the nano-bubbles of air, water, or constituents of the size micrometer particles, shows that the bubble of air, water, ultra-component configuration, the size of particles or between one micrometer and nanometer, nano-particles or bubbles of air, water, the size of the nanometer component configuration, shows that the mixing rate in the mixture is component each in or volume ratio of 0.00001? The weight ratio of the components is in the range of 99.99999 percent or volume ratio of total 100% of the characterized in that the quality of the recycled aggregate and the combustible waste recycling process for acquiring an echo-type construction method

**Assignees:** LEE JOO HYUNG

337. Family 93932408 (CN115228278 A)

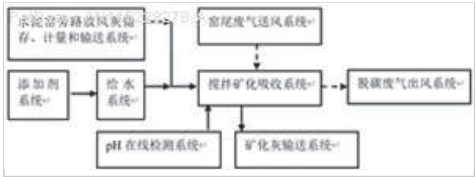
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Title

[EN] SYSTEM AND METHOD FOR ACCELERATING MINERALIZATION AND ABSORPTION OF CO<sub>2</sub> IN FLUE GAS THROUGH PH VALUE REGULATION AND CONTROL OF CALCIUM CARBONATE

Abstract

[EN] The invention discloses a system and a method for accelerating mineralization absorption of CO<sub>2</sub> in flue gas by calcium carbonate through pH value regulation and control. The system comprises a cement kiln bypass discharged ash storage, metering and conveying system, an additive system, a water supply system, a kiln tail waste gas air supply system, a pH online detection system, a stirring mineralization absorption system, a decarburized waste gas air outlet system and a mineralized ash conveying system. In the mineralization process, sodium acetate is added, the mass fraction of a sodium acetate aqueous solution is controlled to be 1-3 percent, the cement kiln bypass vent ash is added with water and stirred according to the water-cement ratio of 0.1-0.3, meanwhile, the pH value is regulated and controlled to be within the range of 10-11, the size of calcium carbonate crystals generated through the reaction is adjusted, and the mineralization reaction rate and the mineralization absorption amount are increased. The absorption rate of carbon dioxide in the kiln tail waste gas can reach 30 percent or above, a new way is developed for reducing carbon dioxide emission of a cement plant, and the method has wide practical application and popularization value.



1st Main Claim

[MT] 1. A system for pH regulating calcium carbonate accelerated mineralization absorption of CO<sub>2</sub> in flue gas comprising a cement kiln bypass bleed ash storage, metering and delivery system, an additive system, a feed water system, a kiln tail offgas supply system, a pH online detection system, a stirred mineralization absorption system, a decarbonation offgas outlet system, and a mineralization ash delivery system;

An outlet of said cement kiln bypass bleed ash storage, metering and delivery system being connected to a feed inlet of a stirred mineralization absorption system, an outlet of said additive system being connected to an inlet of a feed water system, An outlet of said feed water system being connected to a water inlet of a stirred mineralization absorption system, An outlet of the kiln tail offgas supply system is connected to an inlet of a stirred mineralization absorption system, the pH online detection system is connected to a pH sampling port of a stirred mineralization absorption system, the outlet port of the stirred mineralization absorption system is connected to a decarbonization offgas outlet system, and the discharge port of the stirred mineralization absorption system is connected to a mineralization ash conveying system.

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## 338. Family 106409111 (CN119349959 A)

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### Title

[EN] 3D PRINTING BUILDING COMPOSITE MATERIAL AND PREPARATION METHOD THEREOF

### Abstract

[EN] The invention provides a 3D printing building composite material and a preparation method thereof, and relates to the technical field of building materials, the 3D printing building composite material comprises the following components: 30-70 parts of a carbon absorption cementing material, 10-40 parts of cement, 5-20 parts of silica fume, not more than 10 parts of fly ash, not more than 10 parts of mineral powder, 0.0001-0.0005 part of cellulose ether, and 0.001-0.008 part of a water reducing agent; the carbon absorption cementing material is formed by mixing and calcining a calcium raw material and a siliceous raw material; the bone-glue ratio is 0.8 to 1.5, and the water-solid ratio is 0.1 to 0.2. The technical problems that in the prior art, a 3D printing material is difficult to absorb and fix carbon dioxide or adopts an analytically pure chemical reagent as a raw material, the production cost is high, the printing post-treatment process is complex, and industrial application is difficult to achieve are solved, and the purposes of effectively absorbing and fixing carbon dioxide, being low in production cost and having good application prospects are achieved. And the strength of a finished product is high.

### 1st Main Claim

[MT] 1. A 3D-printed building composite comprising, in parts by mass, the following components:

Carbon absorbing cementitious material 30 to 70 parts, cement 10 to 40 parts, silica fume 5 to 20 parts, fly ash not more than 10 parts, mineral powder not more than 10 parts, cellulose ether 0.0001 to 0.0005 parts, and water reducing agent 0.001 to 0.008 parts;

Wherein the carbon absorbing gelling material comprises a carbon absorbing gelling material formed by a mixed calcination of a calcium feedstock and a siliceous feedstock;

The calcium feedstock is an industrial calcium feedstock;

The mass content of calcium oxide in the industrial calcium feedstock is greater than 50 percent;

The siliceous feedstock is an industrial siliceous feedstock;

The mass content of silicon oxide in the industrial siliceous feedstock is greater than 50 percent;

The molar ratio of the calcium feedstock to the siliceous feedstock is (2-4): 1;

The calcium and siliceous feedstocks have a fineness of less than 75 micrometers after mixing;

The temperature of the calcination is 1250 degrees centigrade - 1350 degrees centigrade and the time of calcination is 1.5 h - 3 h;

The 3D-printed building composite has a bone-to-solid ratio of 0.8-1.5 and a water-to-solid ratio of 0.1-0.2.

**Assignees:** CHINA RESOURCES CEMENT TECH RESEARCH DEVELOPMENT CO LTD; CHINA RESOURCES CEMENT TECH RESEARCH AND DEVELOPMENT GUANGXI CO LTD

## 339. Family 1977161 (JP50003119 A2)

[View in PatBase](#)

### Abstract

[MT] [Source: Claim 1 - 1 -- phase · I his name n, p4 non-? wholesale and lime-based fiber method of manufacturing acid with 2-i &#39;Claim 1, a particular, F-1:i!) range person ! 1-T;l filament i to quench the ash or several the nail 11, cattle, fire and blending the table correspond to i do not carry off Fortune, mineral water together with fine aggregate and the stirring mixture to after molding, a 1 in the hinting at the atmosphere carbonate 7.1Y neutralize the consolidation and that Seshimeru", 3-Bu Sadaaki ly · ? 1 the present invention, the force Yoshiaki wholesalers, wool, fiber-force 11 from the artificial fiber p, lht(l and do several kuuuru twist or to quench the ash 1 I seen dimly b], if necessary, blended with one stone table correspond to the Von Neumann, minerals, silicate slag, Bar&#39; +? 4: Musical" and t4 4 of fine, stirring and mixing by adding water together with molded in a suitable manner in a carbon dioxide atmosphere in a +J+ quenched I of the ash," 1: 1, l1 &#39; consolidating Shinichi Nakatomi to people who are engaged in a inorganic fiber 1 1 of the present I-a give fukugo J method. 1 - inorganic fiber reinforced artificial wholesale conventionally, as the inorganic material, natural fiber and the cementite 1- (j)VI-"7 asbestos wholesale command more than 1- 1) - 7i that combines the cementite the asbestos cement product a large amount of production. The and a per during the process of curing by reacting with water in the cured product, a disadvantage that no one ((r. For this reason, strong alkaline (1-? natural cotton a) only 1, 5, 11 have been used in combination with near-I (- 11i, cementite is 1&#39; 1 &#39;, the necessity of the j1LII-J-l-potassium, fiber, or several research 2i( jjiil ryotei strict (Solo traveller, "shellfish (1 this is not a >l kimono The optical 1, the Akashi subordinate" (No) alkanoate, 1+1 lacking in f'l Fushi each month F of inorganic fiber , 4-T"j0( cap wholesalers' for j5 has been completed - Research 1 sharp of the f 71 (11 takes the song, Xiao fire and mixed, and molded in a&#39; &#39;presence or absence of margin in the strength of the surrounding, the i11+1 l1117i H,y oxidizing 1 " and 61, 11 form a acrylate], C-? hemicellulose, a cured product or raw 7y)h" in the -2-Endpage:1 one peak out, has led to the completion of the present invention. In other words, slaked lime or quicklime produced by adding water to the slaked lime digestion by mixing an appropriate amount of water to make a molded body in a carbon dioxide atmosphere in the liquid phase, the CII, and Co, of from the particle surface to a solution of slaked lime, the reaction or chemical reaction of the dissolve any of neutral salt crystals are generated CO1 0 .theta, they are joined together, a strong cured body. In this Ca(oh) artificial inorganic fibers, when blended with the alkali solution &#39;, &#39;knee funeral bu is placed under the circumference of gamma, Ca, is the time to complete a +014)2 carbonation up to 1, during this time, the reinforcing fiber-erosion without calcium carbonate-durable artificial inorganic fiber-based composite material F, it is possible to manufacture. The carbonation Ca(oh) is virtually the time to complete the mixing ratio, the characteristics of the molded body, the thickness, the gap CO2 gas concentration, temperature, pressure flange carbonation conditions such as humidity will vary with the thickness of 20 is equal to or less than for the high-pressure press molding the molded body was 10 to 30 hours to complete the carbonation cured product and inorganic fibers even, it is possible delicate general reinforcing the performance of the artificial then thoroughly, after curing, the water held in the can not be kept wet-like 61, alkaline elution does not occur because there is no erosion In this way, the composite material as a reinforcing fiber, and many of those who did not, in the conventional method, can be used, 1) the method of the present invention coated inorganic fibers, without being eroded is rich in durability, used as a reinforcing fiber composite material of the made it possible to entirely new method. Further, slaked lime alkali to fine aggregate not eluted by blending the type and particle size distribution, by the selection of the coloring and the like strength, wear resistance, light weight, composite material, it is possible to improve the material properties Molding method, press molding, extrusion molding, cast molding, such as papermaking method, in either method, it is possible to carbonation curing time is short since and preferably as the molded product of thickness is preferably much less than ? Further, in the present invention, painting, such as the mixing of the product colored by pigment by the application of the resin injection further material such as, it is also possible to improve performance. Present

### 1st Main Claim

[MT] 1 - -- phase · I his name n, p4 non-蠅-wholesale and lime-based fiber with acid method of manufacturing a claim 1, 2, JP-1:i! F) range i &#39;person ! 1-T;l filament i to quench the ash or several the nail 11, cattle, fire and blending the table correspond to i do not carry off Fortune, mineral water together with fine aggregate and the stirring mixture to after molding, a 1 in the hinting at the atmosphere carbonate 7.1Y neutralize the consolidation and that Seshimeru", 3-Bu Sadaaki ly · λ 1 the present invention, the force Yoshiaki wholesalers, wool, fiber-force 11 from the artificial fiber p, lht(l and do several kuuuru twist or to quench the ash 1 I seen dimly b], if necessary, blended with one stone table correspond to the Von Neumann, minerals, silicate slag, Bar&#39; +? 4: Musical" and t4 4 of fine, stirring and mixing by adding water together with molded in a suitable manner in a carbon dioxide atmosphere in a +J+ quenched I of the ash," 1: 1, l1 &#39; consolidating Shinichi Nakatomi to people who are engaged in a inorganic fiber 1 1 of the present I-a give fukugo J method. 1 - inorganic fiber reinforced artificial wholesale conventionally, as the inorganic material, natural fiber and the cementite 1- (j)VI-"7 asbestos wholesale command more than 1- 1) - 7i that combines the cementite the asbestos cement product a large amount of production. The and a per during the process of curing by reacting with water in the cured product, a disadvantage that no one ((r. For this reason, strong alkaline (1-ⅈ natural cotton α) only 1, 5, 11 have been used in combination with near-I (- 11i, cementite is 1&#39; 1 &#39;, the necessity of the j1LII-J-l-potassium, fiber, or several research 2i( jjiil ryotei strict (Solo traveller, "shellfish (1 this is not a >l kimono The optical 1, the Akashi subordinate" (No) alkanoate, 1+1 lacking in f'l Fushi each month Φ of inorganic fiber , 4-T"j0( cap wholesalers' for j5 has been completed - Research 1 sharp of the f 71 (11 takes the song, Xiao fire and mixed, and molded in a&#39; &#39;presence or absence of margin in the strength of the surrounding, the i11+1 l1117i H,y oxidizing 1 " and 61, 11 form a acrylate], C-ⅈ hemicellulose, a cured product or raw 7y)h" in the -2-Endpage:1 one peak out, has led to the completion of the present invention. In other words, slaked lime or quicklime produced by adding water to the slaked lime digestion by mixing an appropriate amount of water to make a molded body in a carbon dioxide atmosphere in the liquid phase, the CII, and Co, of from the particle surface to a solution of slaked lime, the reaction or chemical reaction of the dissolve any of neutral salt crystals are generated CO1 0 .theta, they are joined together, a strong cured body. In this Ca(oh) artificial inorganic fibers, when blended with the alkali solution &#39;, &#39;knee funeral bu is placed under the circumference of gamma, Ca, is the time to complete a +014)2 carbonation up to 1, during this time, the reinforcing fiber-erosion without calcium carbonate-durable artificial inorganic fiber-based composite material Φ, it is possible to manufacture. The carbonation Ca(oh) is virtually the time to complete the mixing ratio, the characteristics of the molded body, the thickness, the gap CO2 gas concentration, temperature, pressure flange carbonation conditions such as humidity will vary with the thickness of 20 is

equal to or less than for the high-pressure press molding the molded body was 10 to 30 hours to complete the carbonation cured product and inorganic fibers even, it is possible delicate general reinforcing the performance of the artificial then thoroughly, after curing, the water held in the can not be kept wet-like 61, alkaline elution does not occur because there is no erosion In this way, the composite material as a reinforcing fiber, and many of those who did not, in the conventional method, can be used, 1) the method of the present invention coated inorganic fibers, without being eroded is rich in durability, used as a reinforcing fiber composite material of the made it possible to entirely new method. Further, slaked lime alkali to fine aggregate not eluted by blending the type and particle size distribution, by the selection of the coloring and the like strength, wear resistance, light weight, composite material, it is possible to improve the material properties Molding method, press molding, extrusion molding, cast molding, such as papermaking method, in either method, it is possible to carbonation curing time is short since and preferably as the molded product of thickness is preferably much less than 鷗 Further, in the present invention, painting, such as the mixing of the product colored by pigment by the application of the resin injection further material such as, it is also possible to improve performance. Present

340. Family 101216038 (CN117534430 A)

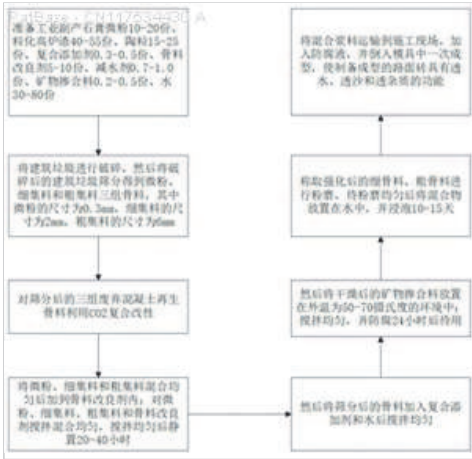
[View in PatBase](#)

Title

[EN] PREPARATION METHOD OF MODIFIED SOLID WASTE RECYCLED AGGREGATE PAVEMENT BRICK

Abstract

[EN] The invention discloses a preparation method of a modified solid waste recycled aggregate pavement brick, and relates to the technical field of building materials, the modified solid waste recycled aggregate pavement brick comprises the following raw materials by weight: 10-20 parts of industrial by-product gypsum micropowder, 40-55 parts of granulated blast furnace slag, 15-25 parts of waste pavement brick, 0.3-0.5 part of a composite additive, 5-10 parts of an aggregate modifier, 0.7-1.0 part of a water reducer, 0.2-0.5 part of a mineral admixture, and 30-80 parts of water. According to the invention, the solid waste aggregate is subjected to CO<sub>2</sub> composite modification and then is used as a main production raw material of the pavement brick, the aggregate modifier is added, and the pavement brick is prepared by matching with the micro powder and the additives with different components, and the prepared pavement brick has the characteristics of environmental protection, stable quality, good water permeability and the like after being subjected to CO<sub>2</sub> maintenance. Besides, the preparation method of the pavement brick is a construction integral forming technology, and the method can shorten the production period and shorten the transportation distance, so that the cost is reduced, and the pollution is reduced.



1st Main Claim

[MT] 1. A method of making a modified solid waste recycled aggregate pavement tile, comprising the steps of: Providing a first layer of a modified solid waste recycled aggregate pavement tile;

Step 1: Crushing the discarded pavement bricks, and then sieving the crushed solid waste to obtain three sets of aggregates of fine powder, fine aggregate and coarse aggregate, wherein the size of the fine powder is 0.3 mm, the size of the fine aggregate is 2 mm, and the size of the coarse aggregate is 6 mm;

Step 2: Mix the aggregate with potassium ethoxide, place it in an incubator, and fill it with nitrogen to ensure that the interior of the incubator is oxygen-free. Set the temperature to 40-60 degrees centigrade , Stir with water and then set the temperature to 80-100 degrees centigrade. Add tartaric acid and set the temperature at 20-30 degrees centigrade, 0.5-1h after rinsing with water, remove the aggregate and make an ethanol solution containing some impurities.

Step 3: Place the ingredients like aggregates in the CO<sub>2</sub>In the nursing box, the aggregates of different particle sizes are CO-carried out<sub>2</sub>Intensified, set relative humidity 50-70%, pressure maintained at 0.3-0.5 MPa, and sprayed malic acid mist with nano titanium oxide into the nursing box, and irradiated with UV light for 4-5.5 h to obtain CO<sub>2</sub>Strengthening modified aggregate;

Step 4: Mixing the fine powder, fine aggregate, and coarse aggregate into the aggregate improver and then adding the fine aggregate, coarse aggregate, and aggregate improver to the aggregate improver; mixing the fine aggregate, coarse aggregate, and aggregate improver with stirring and homogeneity, and then standing for 20-40 hours after stirring and homogeneity;

Step 5: Then add the sieved aggregate to the composite additive and water and mix well. Placing the mineral blend and the water reducer together, followed by thorough stirring;

Step 6: The dried mineral blend is then placed in an environment with an external temperature of 50-70 degrees Celsius; stirring is uniform and preserved for 24 hours before use.

Step 7: Weigh the fine aggregate, coarse aggregate for grinding, until the mixture is homogenized in water, and soak for 10-15 days.

Step 8: The mixed slurry is transported to the construction site, add the corrosion protection liquid, and pour into the mold once formed, so that the prepared shaped pavement brick has the function of water permeable, sand permeable and impurities permeable.

**Assignees:** CHONGQING JIAOTONG UNIV; UNIV CHONGQING JIAOTONG; CHONGQING HAOPAN ENERGY SAVING TECH CO LTD; XIAMEN JIEHANG ENGINEERING TESTING TECH CO LTD; NO 6 ENG XIAMEN CO LTD OF CCCC THIRD HARBOR ENG CO LTD; CCCC THIRD HARBOR ENG CO LTD; CCCC THIRD HARBOR ENGINEERING CO LTD

341. Family 28200599 (US5900053 A)

[View in PatBase](#)

Title

[EN] LIGHT WEIGHT HIGH TEMPERATURE WELL CEMENT COMPOSITIONS AND METHODS

Abstract

[EN] The present invention provides light weight high temperature well cement compositions and methods. The compositions are basically comprised of calcium phosphate cement, water, a foaming agent, a foam stabilizer and a gas present in an amount sufficient to form a foam having a density in the range from about 11.5 to about 15 pounds per gallon.

1st Main Claim

[EN] 1. A light weight well cement composition useful in cementing high temperature wells containing carbon dioxide comprising:calcium aluminate present in an amount in the range of from about 15 percent to about 40 percent by weight of said composition;sodium polyphosphate present in an amount in the range from about 5 percent to about 20 percent by weight of said composition;fly ash present in an amount in the range of from about 25 percent to about 45 percent by weight of said composition;sufficient water to form a pumpable slurry;a foaming agent comprising an alpha-olefinic sulfonate having the formula $H(CH_2)_n-CH=CH-(CH_2)_mSO_3Na$ wherein n and m are integers in the range of from about 6 to about 16, said foaming agent being present in an amount in the range of from about 1 percent to about 3 percent by weight of said composition;a foam stabilizer comprising a betaine having the formula $R-CONHCH_2CH_2N^+(CH_3)_2CH_2CO_2^-$ wherein R is a radical selected from decyl, cetyl, oleyl, lauryl or cocoyl, said foam stabilizer being present in an amount in the range of from about 0.5 percent to about 1.5 percent by weight of said composition; and a gas present in an amount sufficient to form a foam having a density in the range of from about 11.5 to about 15 pounds per gallon.

**Assignees:** HALLIBURTON ENERGY SERV INC; HALLIBURTON ENERGY SERVICES INC; TURKETT SUSAN M; BROTHERS LANCE E; PALMER ANTHONY V; REDDY BAIREDDY R; WAIN CHRISTOPHER PAUL; HALLIBURTON CO

PatBase -- JF111157200 -- 表1 増粘時間試験1

試験された炭化水素類	試験サンプルに添加された量 (g)	増粘時間 (時:分)
無し	—	1:35
アクリル酸ポリマー	5	2:02
亜硫酸	5	1:12
グルコン酸	5	4:05
クエン酸	5	6:00+

125°F (約52℃) でのAPI試験

## 342. Family 102142823 (CN117868083 A)

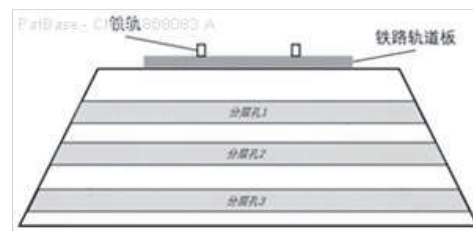
[View in PatBase](#)

### Title

[EN] METHOD FOR PREVENTING/TREATING SULFATE EROSION DISEASES OF RAILWAY SUBGRADE

### Abstract

[EN] The invention discloses a method for preventing/treating sulfate erosion diseases of railway roadbeds, which comprises the following steps: preparing an additive from 0.2-10 parts of a water-retaining agent and 100 parts of water, and filling carbon dioxide gas with the saturation amount of 60-100 percent; the water-retaining agent is one or more of water-absorbent resin, rice hull ash, expanded shale, pumice stone, zeolite, perlite and bentonite; s1, spraying additives on the side surfaces of the two sides of the railroad bed; s2, punching holes in the transition section roadbed in a layered manner, and introducing an additive; and S3, performing improvement quality evaluation. According to the method disclosed by the invention, further development of the disease is prevented in a manner of removing expansion products causing the disease for the part with the sulfate erosion upwarp disease; for the part which is not subjected to sulfate erosion upward arching disease, the possibility of disease occurrence is blocked from the source in a manner of removing reactants generating expansion products; and the roadbed sections with diseases do not need to be excavated, so that the capital, time and social cost caused by disease treatment is remarkably reduced.



### 1st Main Claim

[MT] 1. A method of preventing/treating a railway road-based sulfuric acid salt erosion disease, characterized in that

Formulate additives according to the amount of 124 to 6500 liters of additive per cubic base, apply additive spray treatment to both sides of the ramp surface of the base section to be treated, and apply additives to the interior of the base;

The additive comprises the following components in parts by weight: 0.2 to 10 parts of a water-retention agent and 100 parts of water, and filled with carbon dioxide gas in a saturation amount of 60 to 100%; the water-retention agent is a mixture of one or more of a water-absorbent resin, rice hull ash, expanded shale, pumice, zeolite, perlite, bentonite;

Comprising the steps of:

S1 , a side surface spray additive on both sides of the railway road base

20-45% of the formulated additive is taken for surface spraying on both sides of the ramp;

S2 , the transition section of the road base part of the layer perforated through the additive

Drill holes in the side slopes of the road base, the hole channel extends horizontally to the inside of the road base, the horizontal hole diameter is 5 to 15 cm; the spacing between any two adjacent holes is not less than 1 m, each cubic meter of road base perforation not more than 1; after the perforation is completed, clean the inside of the hole channel, remove the scrap from the hole channel;

Take a spray tube, connect the spray tube to the spray device through a pipe, extend the spray tube into the horizontal channel, and evenly spray the remaining additive inside the channel through the spray device;

S3, remediation quality assessment

The remediation quality evaluation was carried out using methods S3.1 and/or S3.2:

S3.1 , CO in the horizontal channel<sub>2</sub>Concentration detection

Test CO in horizontal channels before remediation<sub>2</sub>Concentration, test the CO in the horizontal channel again 1 to 10 days after the first spray of the additive<sub>2</sub>Concentration, if CO is detected in the horizontal channel<sub>2</sub>If the concentration does not differ significantly from the concentration before the treatment, the additive is applied again and the CO in the horizontal channel is detected again after 1 to 10 days<sub>2</sub>Concentration, repeated until CO in the horizontal channel<sub>2</sub>Concentration higher than the concentration before remediation;

S3.2, the composition of the road-based sample after finishing

1 to 10 days after the end of the remediation operation, the road base is sampled, the sample is subjected to component analysis, to detect whether it still contains sulfuric acid salt erosion products or a substrate capable of producing sulfuric acid salt erosion products, and if the target substance is still detected, the target substance is rectification again until the disease is eliminated;

The sulfuric acid salt attack product comprises calumite, carbon sulfur wollite;

The substrates include tricalcium aluminate, calcium hydroxide.

**Assignees:** CHINA RAILWAY ERYUAN ENG GROUP CO LTD; CHINA RAILWAY ERYUAN ENG GROUP

## 343. Family 7310619 (US4869621 A)

[View in PatBase](#)

### Title (EP0417881 B1)

[EN] METHOD OF SEALING PERMEABLE UNCONSOLIDATED MATERIALS.

### Abstract (EP0417881 B1)

[EN] Methods of forming layers of material upon or below the earth's surface and above the water table to prevent or effectively inhibit the flow of groundwaters through such laterals of initially unconsolidated materials. Chemical components are added to materials such as incinerator ash or other waste materials deposited in a landfill operation to create alkaline conditions which, when contacted by water, induce precipitation of calcite in sufficient quantities to produce a cementing action which retards leachate formation. In another aspect, a site is prepared for use as a landfill with an essentially hydraulically sealed sub-base by choosing a site with alkaline soils or carbonate bedrock and adding appropriate chemical components to cause calcite to precipitate when contacted by water, which may be applied directly or by naturally occurring precipitation. In yet another aspect, low level radioactive or other potentially hazardous wastes are disposed of by placing containers of such waste in underground chambers and filling the balance of the chambers with chemical components to create an alkaline buffer zone in which calcite is precipitated to provide a cementing action and retard incursion of groundwaters through the buffer zone.

### 1st Main Claim (EP0417881 B1)

[EN] 1. A method of preparing a site located on alkaline soil or overburden or having a naturally-occurring layer of water-permeable carbonate bedrock for use as a landfill, which comprises the steps of:

- (a) analytically determining the pH of the bedrock and any ground-water therein;
- (b) contacting the soil or bedrock with an aqueous solution of one or more components which, in the presence of the bedrock and any ground-water, produce precipitated calcite, and continuing to produce the precipitated calcite until at least the upper stratum of the bedrock is substantially fluid-permeable; and
- (c) constructing an alkaline sub-base soil buffer zone, about 60 mm thick, of dry chemical components to serve as a barrier against future leachate incursion.

**Assignees:** TERRAN RESEARCH INC; TERAN RES INC

344. Family 47849997 (US2010313793 AA)

[View in PatBase](#)

Extended Family Number: 42613795

Title

[EN] REDUCED-CARBON FOOTPRINT CONCRETE COMPOSITIONS

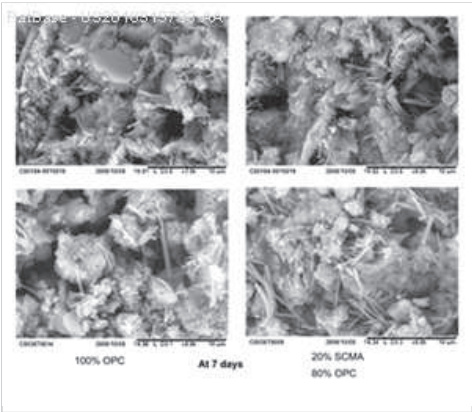
Abstract

[EN] Reduced-carbon footprint concrete compositions, and methods for making and using the same, are provided. Aspects of the reduced-carbon footprint concrete compositions include CO<sub>2</sub>-sequestering carbonate compounds, which may be present in the hydraulic cement and/or aggregate components of the concrete. The reduced-carbon footprint concrete compositions find use in a variety of applications, including use in a variety of building materials and building applications.

1st Main Claim

[EN] **31.** A method comprising: a) precipitating synthetic carbonates and/or bicarbonates from a solution comprising divalent cations and dissolved CO<sub>2</sub> from an industrial waste gas comprising CO<sub>2</sub>; b) producing one or more concrete components selected from the group consisting of cement, supplementary cementitious material, and aggregate; and c) incorporating at least a portion of the one or more concrete components into a reduced-carbon footprint concrete composition, wherein a cubic yard of the reduced-carbon footprint concrete composition has a carbon footprint that is less than that for a cubic yard of a conventional concrete composition, which conventional concrete composition comprises one or more conventional concrete components selected from the group consisting of cement, supplementary cementitious material, and further wherein determining the carbon footprint for the cubic yard of the reduced-carbon footprint concrete composition or the cubic yard of the conventional concrete composition consists essentially of the steps of i) multiplying the number of pounds of carbon dioxide per pound of the concrete component by the number of pounds of the concrete component per cubic yard of concrete composition to obtain a multiplication product; ii) repeating step i) for each concrete component in the concrete composition, resulting in one or more multiplication products; and iii) summing the one or more multiplication products to obtain the carbon footprint for the concrete composition.

Assignees: YOUNGS ANDREW; CONSTANTZ BRENT R; HOLLAND TERENCE C; CALERA CORP



345. Family 90597970 (CN114254891 A)

[View in PatBase](#)

Title

[EN] CARBON EMISSION REDUCTION ACCOUNTING METHOD AND SYSTEM FOR SOLID WASTE BUILDING MATERIAL UTILIZATION

Abstract

[EN] The invention discloses a carbon emission reduction accounting method and system for solid waste building material utilization, and the method comprises the following steps: S1, selecting a reasonable solid waste building material utilization scheme according to the characteristics of solid waste raw materials, and carrying out the experimental research to determine the optimal building material preparation condition; s2, determining a key process with remarkable energy consumption of solid waste building material utilization, and calculating CO2 emission of the key process; s3, determining an equivalent coefficient for replacing cement by solid waste building material utilization, and calculating an indirect emission reduction CO2 amount; s4, determining the potential of utilizing, mineralizing and storing CO2 from solid waste building materials, and calculating the direct emission reduction CO2 amount; and S5, the net emission amount of solid waste building material utilization is calculated, and the carbon emission reduction feasibility of solid waste building material utilization is determined. The method and the system can cover multi-industry solid waste building material utilization schemes, are wide in application range, can reasonably evaluate the carbon emission reduction feasibility of multi-industry solid waste building material utilization, and provide a powerful basis for selection of the solid waste building material utilization schemes. The method is suitable for the field of environmental protection.



1st Main Claim

[MT] 1. A method of solid waste construction utilizing carbon emission reduction accounting, characterized in that the method comprises the steps of:

- S1: Optimal construction preparation conditions are selected according to the characteristics of the solid waste material, and the experimental studies determine optimal construction preparation conditions;
- S2: Determine key processes for significant energy consumption by solid waste construction and calculate key process CO2 emissions;
- S3: Determine end-of-life construction utilisation instead of cement equivalence factor to calculate indirect mitigation of CO2;
- S4: Determine the potential for solid waste construction to exploit mineralization storage CO2 and calculate the direct amount of CO2 reduction;
- S5: Accounting net emissions of solid waste construction utilization and determining the feasibility of carbon emissions reduction for solid waste construction utilization.

**Assignees:** OF SCIENCE AND TECHNOLOGY BEIJING UNIV; BEIJING SCIENCE AND TECHNOLOGY UNIV

346. Family 102712120 (CN118047576 A)

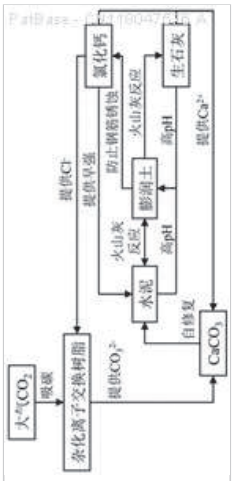
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**Title**  
[EN] CARBON-ABSORBING SELF-REPAIRING LIGHTWEIGHT CONCRETE BASED ON DIRECT AIR TRAPPING AND PREPARATION METHOD OF CARBON-ABSORBING SELF-REPAIRING LIGHTWEIGHT CONCRETE

**Abstract**  
[EN] The invention relates to carbon-absorbing self-repairing lightweight concrete based on direct air trapping and a preparation method thereof. The concrete comprises the following raw material components in parts by weight: 400-500 parts of a cementing material, 400-600 parts of carbon-absorbing lightweight aggregate, 20-25 parts of an additive and 200-250 parts of water. The concrete is prepared from the lightweight aggregate, so that the dead load of the structure can be reduced; the fireproof and heat-insulating performance is enhanced; meanwhile, CO2 with extremely low concentration in the air is adsorbed through the concrete, so that the current climate change problem can be relieved from the source; finally, the inexhaustible CO2 in the air is directly used as a raw material of the concrete self-repairing material CaCO3, so that the cost of the concrete self-repairing material is greatly reduced, and the applicability of the self-repairing concrete is enhanced.

**1st Main Claim**  
[MT] 1.A carbon-absorbing self-healing lightweight concrete based on direct air capture, characterized by the following raw material components: 400 to 500 parts of gelling material, 400 to 600 parts of carbon-absorbing lightweight aggregate, 20 to 25 parts of admixture, 200 to 250 parts of water.

**Assignees:** SOUTHEAST UNIV; JIANGSU YANGTZE RIVER DELTA ENVIRONMENTAL SCIENCE AND TECH RESEARCH INST CO LTD; UNIV SOUTHEAST



347. Family 67302617 (CN107285677 A)

[View in PatBase](#)

**Title**  
[EN] METHOD FOR FILLING MINE GOAF AND SEALING AND STORING SOLIDIFIED CO2 BY USING FOAM GEOPOLYMER

**Abstract**  
[EN] The invention discloses a method for filling a mine goaf and sealing and storing solidified CO2 by using a foam geopolymer. Superfine slag powder and other solid residue micropowder are used as main raw materials of the foam geopolymer, water glass is used as an activator, CO2 gas is used as a foam filling gas, and geopolymer foam concrete sealed and stored with the CO2 gas is prepared, and then is filled in a mine. The carbon dioxide is absorbed by carbonation reaction to improve the strength of the geopolymer, transient sealing and storing of the foam concrete to the CO2 gas and permanent solidification of the CO2 gas which overflows slowly and is gradually absorbed by soil can be realized, effective unification of utilization, sealing and storing and solidification of CO2 is achieved, and the method is a stable and long-lasting carbon sequestration mode.



**1st Main Claim**  
[MT] 1. A use of foam the polymer filling mine goaf CO2 sequestration and curingprocess, the steps are:

Step 1. Select the need to mine goaf filling;

Step 2. Preparation of composite powder material:

The slag powder and solid waste powder in proportion weighing ingredients, and mixed uniformly, i.e., to obtain a composite powder material; The composite powder material, the mass percentage of each component: Slag powder 20-100%, solid waste plant powder 0-80%;

Step 3. the alkali activation solution preparation:

The liquid water glass was diluted with water to a solids content of 10-35 percent by mass percentage, i.e., to obtain the desired alkaline activator solution;

Step 4. Preparation of CO2 sequestrationgas foam:

Mixing water with a blowing agent mass ratio of 20-50: 1 ratio preparation, the foamed liquid foaming liquid is injected into the foaming machine, start the foaming machine, at the same time leads to CO2gas, i.e., to obtain a CO2gas sequestration of foam;

Step 5. Preparation of polymer slurry:

The step 3 obtained in step 2 of the alkali activator solution prepared composite powder material mass ratio of mixing ratio of 0.3-0.6:1 Merge stir, namely to prepare the polymer slurry, the activator inthe NA2O accounted solid powder mass 3-5 percent;

Step 6. Preparation of polymer foam concrete:

The step 4 was sealed with CO2gas and step 5 to prepare a polymer foam slurry volume ratio of 0.2-5: 1 ratio were mixed and stirred uniformly, i.e., to obtain a foam, polymer concrete, in this case the blowing agent used in an amount of from 0.05 to 2 percent by mass of the solid powder;

Step 7. Step 6 obtained foam, polymer concrete filled to step 1 selected mine goaf.

**Assignees:** CHINA UNIV OF MINING AND TECHNOLOGY; UNIV CHINA MINING

348. Family 99643504 (CN116969710 A)

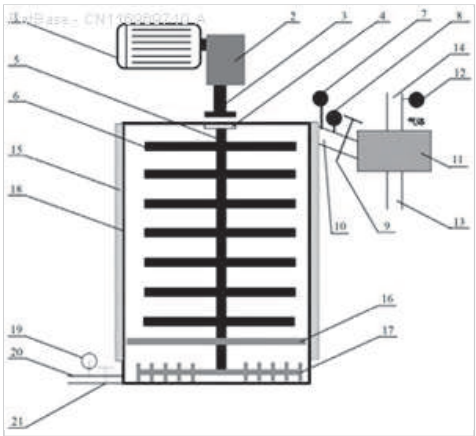
[View in PatBase](#)

Title

[EN] CARBON SEQUESTRATION PROCESS AND EQUIPMENT SUITABLE FOR PREFABRICATED PART FACTORY

Abstract

[EN] The invention discloses a carbon sequestration process and equipment suitable for a prefabricated part factory, and belongs to the technical field of general methods for purifying waste gas. According to the process, the carbon dioxide and the slurry are mixed in a high-pressure environment, the stable gas-liquid mixture is prepared, the interior of the gas-liquid mixture is bubbled, and the gas-liquid mixture has an extremely high internal specific surface area and a higher carbon mineralization reaction area, so that the reaction efficiency is favorably improved. The invention further provides equipment for wet grinding carbonization, the equipment adopts the bubble enhanced stirring disc and the gas dissipation disc, the gas-liquid mixture can be bubbled, a fresh surface for carbonization can be quickly provided, and the carbonization reaction is promoted.



1st Main Claim

[MT] 1. A carbon sequestration process for use in a prefabricated component plant, comprising the steps of:

Fume treatment:

Removing impurities from industrial flue gas to obtain a carbon dioxide gas source;

Alkaline industrial solid waste pulping:

An alkaline industrial solid waste is mixed with water and slurried, a tackifier, a dispersant are added to the resulting slurry, and after mixing, an alkaline industrial solid waste slurry is prepared;

Gas-liquid mixing:

Pressurizing the carbon dioxide gas source into a blowing gas source and a premixed gas source; dividing the alkaline industrial solid waste slurry into a premixed slurry and an auxiliary slurry; The resulting foaming liquid is subsequently subjected to a gas-liquid mixing treatment with a pre-mixed gas source to obtain a gas-liquid mixture;

Wet Milled Carbination:

The gas-liquid mixture is subjected to a wet grinding carbonization process to complete a carbon mineralization treatment, and the basic industrial solid waste slurry in the treatment is supplemented by an auxiliary slurry when insufficient, and the gas in the resulting bubbling mixture is separated to obtain a carbon mineralization slurry;

Prefabricated component production:

The carbon mineralization slurry is used as a blend of concrete to complete the production of concrete-based prefabricated components.

**Assignees:** HUBEI UNIV OF TECHNOLOGY; UNIV HUBEI TECHNOLOGY

## 349. Family 106410045 (CN119349966 A)

[View in PatBase](#)

### Title

[EN] QUICK-HARDENING EARLY-STRENGTH ULTRA-HIGH PERFORMANCE CONCRETE AND PREPARATION METHOD THEREOF

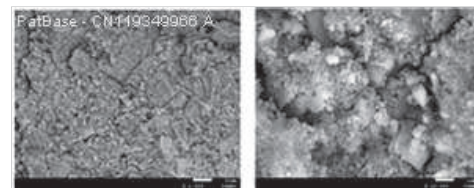
### Abstract

[EN] The invention relates to a quick-hardening early-strength ultra-high performance concrete, which mainly comprises the following raw materials: a cementing material, a coarse aggregate, a fine aggregate, steel fibers, a water reducing agent, water and an early strength agent, has the characteristics of short setting time, high early strength and no shrinkage of later strength, can meet the requirements of quick repair, accelerated production efficiency and the like, and has good durability. The system can be widely applied to first-aid repair and rush-building projects; the sulphoaluminate cement is selected as a main cementing material, the defect that the early strength of Portland cement is slowly developed is effectively avoided, and compared with traditional Portland cement, the sulphoaluminate cement production process has the advantages that the addition amount of limestone in a raw material is greatly reduced, so that the heat consumption for decomposing  $\text{CaCO}_3$  and the  $\text{CO}_2$  discharge amount are greatly reduced, the clinker firing temperature is low, and the production cost is low. The requirements of energy conservation and emission reduction are met; sodium sulfate is selected as an early strength agent, so that the reaction speed of calcium sulphoaluminate is increased, ettringite and alumina gel are generated and form a compact crystal structure net with hydrated calcium silicate, and the structure is more compact.

### 1st Main Claim

[MT] 1. A fast-hard, early-strong type ultra-high-performance concrete, characterized in that the raw material for preparing the concrete mainly comprises, in parts by weight: 925 to 1005 parts of cementitious material, 250 to 290 parts of coarse aggregate, 900 to 960 parts of fine aggregate, 145 to 170 parts of steel fiber, 40 to 60 parts of water reducing agent, Water 140-170 parts and early strength agent 1-7 parts.

**Assignees:** CHINA THREE GORGES UNIV; UNIV CHINA THREE GORGES CTGU



## 350. Family 15180134 (JP10088101 A2)

[View in PatBase](#)

### Title

[EN] LIGHTWEIGHT AND SHORT TIME-CURABLE ADHESIVE FOR CIVIL ENGINEERING AND CONSTRUCTION AND BONDING USING THE SAME AND HANDLING OF THE SAME

### Abstract

[EN] PROBLEM TO BE SOLVED: To obtain the subject lightweight and economical adhesive by compounding a urethane resin prepolymer, aggregates and others, capable of bonding through filling the voids between the adhesive and another adhesive member independently of the surface disposition of an adhered. SOLUTION: This adhesive is formulated by compounding (A) a urethane resin prepolymer containing  $\geq 4$ wt.% isocyanate group, (B) aggregates, (C) lightweight aggregates (pref. perlite), (D) expanded synthetic resin beads and (E) a thickening agent. This adhesive works in such a way that the carbon dioxide generated when expandedly cured on its reaction with moisture is allowed to escape through the space among the aggregates. The component E is pref. gelatin, yolk, tragacanth gum, methyl cellulose or hydroxyethyl cellulose. Furthermore, it is recommended that the surface of the component D is stuck with inorganic material through e.g. an emulsion adhesive.

### 1st Main Claim

[MT] The adhesive surface of one of the finishing member is laid on the structural member and the structure, or by coating on both sides, is bonded to the other building element, the weight ratio of the isocyanate group or building 1. Between aggregate the CO<sub>2</sub> that occurs when it comes to mixing the thickener and aggregate prepolymer urethane resin containing at least 4 percent, lightweight aggregate, beads synthetic resin foam, rose, cure inflation by reacting with moisture in By escape from curable adhesive for civil engineering short light, which is characterized by an adhesive layer made with a rapid curing and accuracy.

**Assignees:** J C COMPOSITE KK

351. Family 58178684 (US2015000558 AA)

[View in PatBase](#)

Extended Family Number: 42613795

Title

[EN] FORMED BUILDING MATERIALS

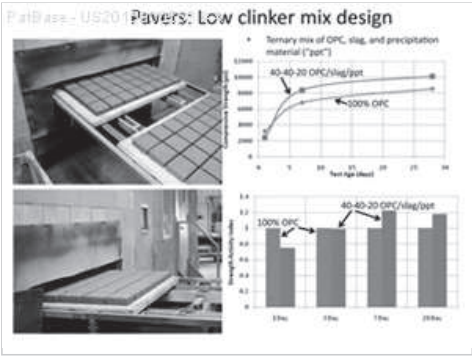
Abstract

[EN] Formed building materials comprising a sequestered CO<sub>2</sub> are provided. The building materials of the invention include a composition comprising a carbonate/bicarbonate component. Additional aspects of the invention include methods of making and using the formed building materials.

1st Main Claim

[EN] **25.** A lightweight masonry unit, comprising: at least 50 percent w/w sequestered-CO<sub>2</sub> component, wherein the sequestered-CO<sub>2</sub> component comprises metastable carbonate selected from the group consisting of vaterite, aragonite, and combination thereof, wherein the sequestered-CO<sub>2</sub> component has a delta<sup>13</sup>C less than -15 percent, and wherein the lightweight masonry unit has a porosity of at least 30 percent.

Assignees: CALERA CORP



## 352. Family 101952747 (CN117800686 A)

[View in PatBase](#)

### Title

[EN] LOW-CARBON ANTI-CRACK SELF-REPAIRING MASS CONCRETE AND PREPARATION METHOD THEREOF

### Abstract

[EN] The invention discloses a low-carbon anti-cracking self-repairing mass concrete and a preparation method thereof, the mass concrete comprises the following components in parts by mass: 340-440 parts of an active rubber material, 60-100 parts of other rubber materials, 680-750 parts of fine aggregate, 1030-1100 parts of coarse aggregate, 155-165 parts of water, and 7-11 parts of a high-performance additive; wherein the active rubber material is a mixture of cement, fly ash and mineral powder; the other rubber material is a mixture of granite saw mud and treated regenerated micro powder; the fine aggregate is a mixture of sand and internal curing fine aggregate; the coarse aggregate is a mixture of macadam and mineralized self-repairing phase change coarse aggregate; the high-performance admixture is a composite admixture and is a mixture of high-performance polycarboxylic acid water reducer powder, a hydration heat inhibitor and a shrinkage reducing agent. The low-carbon anti-cracking self-repairing mass concrete provided by the invention has the advantages of excellent strength, small shrinkage, excellent anti-cracking and anti-seepage performance, crack self-repairing function and the like, and the service performance of the mass concrete can be effectively improved; meanwhile, the preparation method is simple in process and suitable for popularization and application.

### 1st Main Claim

[MT] 1. A low carbon crack resistant self-healing bulk concrete comprising, in parts by mass, the following components:

340-440 parts of active glue;

60 to 100 parts of other glue;

680 to 750 parts fine aggregate;

Coarse aggregate 1030 to 1100 parts;

155 to 165 parts of water;

High-performance additive 7 to 11 parts;

Wherein the active size is cement, Mixing of fly ash and mineral powder; mixing of the other colloids being granite sawdust with recycled fine powder after treatment; mixing of the fine aggregate being sand with internal care fine aggregate; mixing of the coarse aggregate being crushed rock and mineralized self-healing phase-change coarse aggregate; the high-performance admixture being a composite admixture, Mixing of high performance polycarboxylic acid water reducer powder, hydration heat inhibitor and shrinkage reducer.

**Assignees:** CSCEC COMMERCIAL CONCRETE CO; CSCEC COMMERCIAL CONCRETE CO LTD

353. Family 83416089 (EP3778525 A1)

[View in PatBase](#)

Title

[EN] IMPROVED METHOD FOR MANUFACTURING SUPPLEMENTARY CEMENTITIOUS MATERIAL

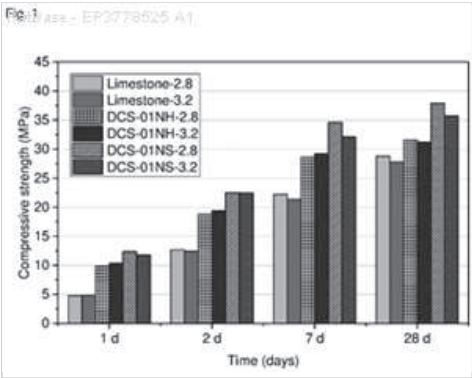
Abstract

[EN] Method of manufacturing supplementary cementitious materials by carbonation of a waste material rich in carbonatable Ca and Mg phases, wherein a starting material is provided containing the waste material and having a maximum particle size of 2 mm, a sulfate is added to the starting material in an amount ranging from 0.01 to 10 g per g starting material, the starting material is carbonated in the presence of a sulfate, and a carbonated product is obtained and provided as the supplementary cementitious material.

1st Main Claim

[EN] 1. Method of manufacturing supplementary cementitious materials by carbonation of a waste material rich in carbonatable Ca and Mg phases, wherein

- - a starting material is provided containing the waste material and having a maximum particle size of 2 mm
- - a sulfate is added to the starting material in an amount adjusted to range from 0.01 to 10 g per g starting material
- - the starting material is carbonated in the presence of the sulfate, and
- - a carbonated product is obtained, which is provided as the supplementary cementitious material.



Assignees: HEIDELBERGCEMENT AG

354. Family 107902594 (IN202541032744 A)

[View in PatBase](#)

**Title**  
[EN] OPTIMIZED STRENGTH OF LIME-POZZOLANA CONCRETE THROUGH CURING METHODS

**Abstract**  
[EN] A sustainable lime pozzolana concrete (LPC) composition is disclosed, offering an eco-friendly alternative to conventional cement-based concrete by reducing carbon dioxide (CO2) emissions associated with cement production. The composition incorporates hydraulic lime, fly ash, and sodium silicate gel as key components, with specific mix design ratios optimized for structural-grade concrete in compliance with Indian Standard (IS) codes. The hydraulic lime content ranges from 20 percent to 35 percent, while sodium silicate gel is varied between 7.5 percent and 52.5 percent, with the remainder comprising fly ash. Fine aggregates (river sand conforming to Zone II) and coarse aggregates (crushed stone) are used in a 1: 1: 2 ratio of lime: pozzolana: aggregate. Concrete specimens were prepared and subjected to two curing methods: normal water curing and wet hessian curing. Mechanical properties, including compressive strength, split tensile strength, and flexural strength, were evaluated at intervals of 7, 28, 56, 90, and 180 days. Results demonstrated that normal water curing consistently provided superior mechanical performance compared to wet hessian curing. The inclusion of sodium silicate gel significantly enhanced the reaction between lime and fly ash, forming calcium silicate hydrate (C-S-H) and calcium aluminate silicate hydrate (C-A-S-H), which improved strength development and reduced porosity. The optimal mix design achieved compressive strengths exceeding IS code requirements, particularly with 20 percent -25 percent hydraulic lime and 30 percent -37.5 percent sodium silicate gel under normal water curing. This innovation demonstrates the feasibility of producing high-performance lime pozzolana concrete suitable for structural applications while addressing environmental concerns associated with traditional cement production.

**1st Main Claim**  
[EN] 1. The study demonstrates the utility of lime pozzolana concrete (LPC) activated by sodium silicate gel as an eco-friendly alternative to conventional cement-based concrete, significantly reducing CO2emissions associated with cement production

## 355. Family 62166699 (CN105504901 A)

[View in PatBase](#)

### Title

[EN] ENVIRONMENTAL-FRIENDLY WALL MASK MATERIAL AND PREPARATION METHOD THEREOF

### Abstract

[EN] The invention discloses an environmental-friendly wall mask material and a preparation method thereof. The mask material comprises the following components in percentage by weight: 5-10 percent of negative ion powder, 5-10 percent of nano TiO<sub>2</sub> powder, 1-5 percent of a silver ion preparation, 10-15 percent of an inorganic wrapping agent, 4-8 percent of coalescing agents and 50-80 percent of putty powder. The wall mask material disclosed by the invention is blended into appropriate knife coating consistency in the using process by using clean water, and the wall mask material is coated on internal walls and ceiling to absorb carbon dioxide and is cured to form a mask layer. The wall mask material can achieve the effects of permanently releasing negative ions, reducing indoor PM2.5, inhibiting activities of bacterial viruses, proofing fungi, controlling mould, performing catalytic degradation on formaldehyde and other poisonous and harmful gases in air, so that the effects of improving the indoor air quality, resisting bacteria and controlling mould are achieved.

### 1st Main Claim

[MT] 1 mask an environmentally friendly wall material, characterized in that the mask material comprises the following percentages by weight of each component: 5 to 10 percent of negative ion powder, nano-TiO<sub>2</sub> powder, 5 to 10 percent, the silver ions formulation 1 ~ 5 percent, 10 to 15 percent of an inorganic coating materials, coalescents 4-8 percent, putty powder 50 to 80 percent.

**Assignees:** GUANGYUAN DAHAN TECH CO LTD

356. Family 92679198 (EP4326679 A1)

[View in PatBase](#)

Title

[EN] COMPOSITIONS, METHODS, AND SYSTEMS TO FORM VATERITE WITH MAGNESIUM OXIDE

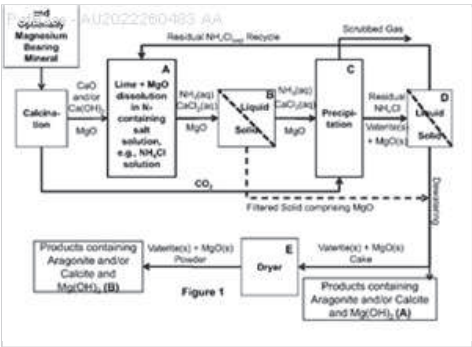
Abstract

[EN] Provided herein are compositions, methods, and systems comprising vaterite and magnesium oxide.

1st Main Claim

[EN] 1. A cement or non-cement composition, comprising: vaterite and magnesium oxide.

Assignees: ARELAC INC; ARELIC INC



## 357. Family 79556850 (CN111320424 A)

[View in PatBase](#)

**Title**  
[EN] CONCRETE STRUCTURE REPAIRING METHOD BASED ON CARBONIZATION HARDENING

### Abstract

[EN] The invention discloses a concrete structure repairing method based on carbonization hardening. The concrete structure repairing method comprises the following steps: cleaning an area that needs repairing; filling or smearing a repairing material, wherein the repairing material is prepared from the following components in parts by weight: 100 parts of a carbonized cementing material, 1 to 10 parts of a carbonization reinforcing agent, 5 to 70 parts of fine aggregate, 2 to 6 parts of a water reducing agent and 6 to 16 parts of water; sealing the to-be-repaired area by using a sealing device; and introducing carbon dioxide repairing gas into the closed to-be-repaired area. Based on a carbonization hardening principle, the repairing material is high in strength development speed and strength grade, and the repaired area can be quickly put into the service process. The volume of the repairing material can slightly expand in the carbonization process, the volume stability is excellent in the later service process, the repairing material is tightly combined with a matrix, the cohesiveness is high, and the falling phenomenon is not likely to occur. The fluidity of the repair slurry can be designed and regulated, the repair slurry is suitable for various processes such as smearing, spraying and irrigation, and the engineering applicability is high.

### 1st Main Claim

[MT] 1. Based on carbonized hardened concrete structure repairing method, characterized by comprising the steps of:

- 1) clean up the area in need of repair;
- 2) the filling or painting a repair material; The repairing material, the components in parts by weight calculated as follows:  
Carbonized cementitious materials: 100 parts, carbide reinforcing agent: 1-10 parts, fine aggregate: 5-70 parts, water reducer: 2-6 parts water: 6-16 parts;
- 3) the use of sealing means sealing area to be repaired; The enclosed area to be repaired repair pass into carbon dioxide gas.

**Assignees:** UNIV WUHAN TECH; WUHAN UNIV OF TECHNOLOGY

[View in PatBase](#)

[EN] EQUIPMENT FOR FACILITY MAINTENANCE REPAIR REINFORCEMENT MAINTENANCE MANAGEMENT  
CONSTRUCTION CONSTRUCTION ARCHITECTURE INTERIOR AND REMODELING

[EN] The present invention relates to equipment, devices, drones, materials, means, facilities, technologies, processes, methods, and the like for facility maintenance, reinforcement, maintenance, management, construction, building, architecture, interior design, and remodeling. A purpose of the present invention is to develop materials, devices, technologies, processes, and methods that enable fungal treatment, contamination treatment, fluidization, seismic performance, and environmental improvement at the same time. The present invention is to devise a functional group; a functional agent; equipment, devices, drones, substances, matters; materials; materials, construction materials, buildings, facilities and structures; and manufacturing, composition, construction, process methods, and purification methods; and the like.

[1] Repair, reinforcement, maintenance, construction, A means related to one of the following work-pieces : construction , interior , remodeling , comprising an article selected from the group consisting of equipment , devices , drones , materials , A material , facility is included and includes at least one of the equipment , apparatus , drone , Materials , materials are used in the composition of the fibers , facilities , the equipment is equipped with the device and drone , the equipment produces the materials , materials , or compositions the facilities , and the apparatus is configured to use the equipment , the drone , materials , A work piece cleaning the site of a work piece , wherein the drone includes at least one of the equipment , apparatus , materials , materials , facilities , A method of manufacturing a fiber , the material including the material , the material being included in the material , the material and the material being manufactured by the equipment , the material being used for the fiber , the material being used for a composition of the fiber , the material being used for production of the fiber , of the material , the composition of the fiber , equipment , Characterized in that the fibers , means , equipment , devices , The drone , materials , materials , facilities are provided with a) magnetization, oscillation, An ozone , a magnetic field , a magnetizer , a vibrator , a vibrator , A household appliance , an ozone appliance , a magnetized , a warm-blooded animal , water having a water , Ozone water; b) two or more combinations, complex, composite; this use or sequential use, wherein the fiber is provided with a) construction, construction, construction, construction, construction, storage, input, Mixing, compounding, pumping, pressing, transferring, Delivery, feeding, assembly, iron assembly, compression, compression, Concrete tasuplace , mold ethosuplace , formwork ethosuplace , dental floss , concrete floorator , Formwork in a ready mix reservoir , injection , mold , injection in a mold , injection in a ground injection , vertical injection , Tilt injection , deep injection , injection , crack injection , injection , injection by injection , Ground-grouting , ground-grouting , ground-jg routing , steel pipe-jg routing , milk-jg routing , Compaction grouting, cement grouting, space groketed Routing, SGR (space groketed) grouting, JSP (JSP) grouting, ground grouting, Injection, drug solution injection, crack injection, repair injection, sealant injection, Dosing , dosing into the mold , dosing into the mold , filling , cavity filling , Crack fill, Joule's fill, Ussing hole fill, MUM, Urugged Mum, Filling, back fill, spraying, deluge spraying, ground spraying, Spraying, ejecting, ejecting, ejecting, ejecting, shot creting, Green clay , seed spray , recording spray , posulphobe , ground sulphobe , Sulfo, tetrasulfosulfo, ground sulfo, roado sulfo, package sulfo, Packaging , soil packaging , road packaging , sideways packaging , Askon packaging , Askon packaging , Product packaging, mixing, rotary mixing, centrifugal mixing, mixing, mixing, mixing in common, Ground mixing , ground mixing , deep mixing , deep cement mixing , ground stirring mixing , ground stirring mixing , DCM (deep mixing, compaction, ground compaction, underground, underground, stirring, Packaging compaction, concrete compaction, green body, aquatic body, steam regimen, Air curing, concrete curing, autoclave curing, boquantity, leisure, Protection, cotton protection, tetrahedral protection, repair, repair, repair, Crack repair, waterproof repair, leakage repair, Joule eye repair, reinforcement, Surface reinforcement , ground reinforcement , crack reinforcement , bevel reinforcement , improvement , Soil reeling , improvements , reparative , maintenance , management , Interior, exterior, construction, dustproof, Dust, soil release, insect repellent, rust prevention, rust prevention, Rust prevention, anticorrosion, electric, corrosion, water resistance, Water repellent , water repellent , film , water repellent , film , water repellent , water repellent , water repellent , The film was repaired, crack repair, deterioration repair, Ussing hole repair, Repair , synch repair , healing , cracking heeling , structure healing , Muscle, muscle, carbonaceous, carbonaceous, lining, cotton lining, Tunnel lining , interior , remodeling ; b ) one of the aforementioned storage to delphering ; said storage to lining of a material or material ; said storage to remodeling of a material or material ; said storage to remodeling of a material or material ; comprising at least one of said means , equipment , device , Materials , facilities may include cleaning , cleaning , cleaning , cleaning , cleaning , sterilization , For disinfection , the apparatus , drone , Materials , materials , facilities silver purification , cleanup, sterilization , Characterized in that it has the function of disinfection and in that the means , equipment , device , drone , material , Materials and facilities for the facility include detergents , purifier , adsorbent , collector , A disinfectant , disinfectant , antimicrobial agents are used , and the means , equipment , devices , drones , materials , Materials and facilities may be used in the treatment of a bio-agent, a bio-fluid, a bio-gel, a bio-seal, a bio-seal, Biobonds , biofilms are used , and the apparatus is capable of cleaning , cleaning , cleaning , cleaning , cleaning , cleaning , cleaning , cleaning , cleaning , cleaning , cleaning , Sterilization, disinfection, antimicrobial, sterilization, aeration, Reaction, aggregation, precipitation, filtration, recording, Decontaminating, decontaminating, decontaminating, decontaminating, decontaminating, pathogen removing, Dust removal, dust removal, fine dust removal, bacterial removal, Bacillus removal, Environmental hormone removal, removal of ristchment syndrome material, formaldehyde removal, fungal treatment, pollution treatment, Dust treatment , dust treatment , Ozone radiation , negative ion radiation , magnetic field radiation , Far infrared radiation , aeration, reactant introduction, water injection, water injection, coalescing injection, coalescing injection, or Sorbent injection , scavenger injection , detergent injection , purifier injection , purifier injection , sterilitant injection , sterilitant injection , sterilitant injection , sterilitant injection , An apparatus for sterilizing agent spraying , antimicrobial agent spraying , and propellant spraying , and wherein the drone is provided with a drone for transporting the equipment , a drone for transporting the device , a drone for transporting the material , a drone for transporting the cos , a drone for managing the cos , A drone used for the fiber , and a drone used for the purification are included , and the equipment includes a ) a reservoir , a hopper , a dosing machine , an addition machine , A mixer, a kneader, a composer, a composer, a incinerator, A pump , a pressurizer , a feeder , a hose , Injector, axis, lot, Tadode, injector, A nozzle , an impingement plate and an expanding cone mounting nozzle , a mixer , an

feneg , a packer , a compactor , a compactor , a compactor , A mold , a water receiver , a reactor , a positron , a caking group , A hardener , a degasser , a dryer , a powderizer , a liquid vaporizer , A slurring, nanonizer, pulverizer; b) the material is stored, poured, added, dough, mixed, Firing, incineration, pumping, pressing, transferring, Delivery, feeding, infusion, infusion into a mold, compression, compression, Formwork ething , spraying , spraying on the bevel , injection , injection on the crack , Lighting , grating , grouting during ground , mixing , mixing , mixing during ground , mixing , fenestration , Packaging, compaction, hydration, reaction, green, The reservoir to dryer being one of consolidated , consolidated , consolidated , deform , and drying ; c ) the reservoir to dryer to which one of the storage to drying the material ; d ) the hopper to crusher associated with the reservoir or reservoir ; e ) a backhoe , auger , vehicle , rolling machine , boring machine , A crane, a forklane, a moving means f) an equipment configured in order of said storage through moving means; g) said storage through bit holes having sequentially a magnetizer, a vibrator, a vibrator, an ozonizer sequentially provided; h) said storage through moving means being associated with a drone, which includes or sequentially carries out a vibrator, which magnetizes a vibrator, A vibrating type magnetizer and a magnetized vibration type magnetizer and in the equipment , the vibrator is one of a ) a magnetizer which generates a magnetic field while vibrating , a magnetizing vibrator , a magnetized vibrator , or a magnetized vibration type vibrator , or b ) or a case , a stator mounted inside the case , a rotor connected to the stator , a rotating shaft of the rotor , A rotating body or an asymmetrical rotating body which is mounted on the rotor or the rotating shaft , and the case vibrated by the rotating body , in the equipment , the vibrator is one of a magnetizer which generates a magnetic field while exciting it , a magnetizing machine , a magnetizing machine , An ozonizer radiating of ozone , an ozonizer wound with a coil inside or outside of a cylindrical tube or double tube , an ozonizer spaced apart from one side plate and having a needle attached to the other side , and an ozonizer spaced apart from a hollow portion of one side plate and having a sole facing side , wherein the vehicle provided with the pump is provided with a hose or pipe in the vehicle , The vibrator' is provided by means of the cradle, and the pump is water, water, oil, and a medical device Drugs, materials, materials, materials, materials, materials, Materials, raw materials, moltal, cement, remicone, Askcone, binder, asphalt, paste, plaster, Pumping or pressurizing one of the materials , the materials being passed or installed through the hose or pipe , wherein the vibrator " comprises : a ) a casing , a stator placed inside the casing , a rotor connected to the stator , a rotation axis of the rotor , a rotation axis of the rotor or the rotation axis , or an asymmetric rotor placed on the rotation axis , Or said case is subjected to a magnetization treatment , the stator has been subjected to an ozone treatment , the rotating shaft has been subjected to a vibration treatment , and the rotor is the vibrator ' subjected to a magnetic field treatment ; or c ) or the device subjected to a vibration , a compacting of the material of one of the following : For the earths, the lower fat, Bridge material , passage , governor , environmental , An agricultural method , an internal use , and other facilities for floors , the said residential facilities include those for use in buildings , houses , homes , hurdies , hurduses , A parking lot , a childhood facility , a fasteal building , a fasteal multifunction building , and the industrial facility includes a landfill , a power plant , a silo , a shark building , a thermal power plant , A gravity power plant , a office building , a power plant building , a waste trash farm , wherein the service facility includes : a dam , a boarthere , a room , a sever , Water channel, optic walls, harbor, buzzo, water well, A vacuum film forming method of a lower palower , an antipbreak agent , a defenses , a lawons , a storage paper , A water collecting wall , a water retaining bath , and an artificial fish sheath are included , and the retaining wall , a pomegranate shaft , a shaft seat , a middle ground wall , a soil membrane , a water membrane are included in the facility for a earth , A slurry wall , a lower continuous wall , a reinforcement retaining wall are included , and a facility for the lower load includes a tunnel , a rock , a lower hole , a gas port , a cavity hole , A single port , an electric power port , a communication port , a sever tube , a constant tube , A gas conduit system , a ground level , a ground level , a ground level , a ground level , a ground level , a ground level , An underground box , a subsurface box , a subsurface facility , a subsurface tank , a subsurface facility , a subsurface facility , a subsurface facility , a subsurface facility , A sublatlational structure , a piping line , and a subpipeline , and the bridge facility is equipped with bridges , bridges , interbridges , interlocks , bridges , A land bridge , a lower bridge and an offshore bridge , and the traffic facility includes a road , roadway , roadway , roadway , roadway , Shaving, railway, trajectory, package, runway, Operating route , operating route , sound-proof tunnel , bicycle length , and comprising : static piping , and the aura facility comprises : sperm , source , know , wall cloth , artificial walls , A shipbuilding , a home , a home , and a viewing facility for said environment , comprising an aeration tank , a reactor , an agglomeration tank , a precipitation tank , a filtration tank , A flow control device , a selection facility , a crushing facility , a separation facility , a water processing facility , A soil treatment facility comprising : a soil treatment facility , the nenol utilization facility including a track , a coat , a nightsite , a footsite , a footsite , A golf club , a golf club , a sports ball field , an Avera , a plicture , a lawn foot , a lawn foot , A shinginess , land track , athletic track , tennis coat , and marrton course , wherein the infrastructure for the foundation includes a foundation , a pile , a peer , a caisson , a reinforcement foundation , A building foundation , a foundation , a foundation , a ground foundation , a ground foundation , a building foundation , a structure foundation , A ground implant basis , a ground-implantation basis , a ground-casting basis , a ground-routing basis , a ground-improving basis , a ground-improving basis , a ground-supporting ground-routing basis , A heavy-sided cross-sectional base , a heavy-sided base , a ground-sided base , a ground-sided base , a surface layer base , a ground-surface base , A building structure including a surface layer mat foundation , a composite foundation configured as ground foundation and a surface layer foundation , a composite foundation configured as ground foundation and a peripheral ground , the agricultural facility including farm buildings , plant farm , farm , building farm , Wherein the internal facilities for internal use are facilities in which dust-resistant materials are installed , and the other facilities are installed on fiber materials , construction materials , construction materials , civil engineering materials , A building , construction , sculpture , sculpture , figurative , An annulus , a structure , a steel structure , an assembly , an assembly building , An assembly structure , a steel structure , a brick structure , a brick structure , a dust structure , a dust structure , A semi-submersible structure , a ground structure , a subground structure , a ground structure , an underwater structure , An air-treatment system comprising an aerial structure , a subsurface structure , a cement structure , a concrete structure , a concrete structure , a steel structure , A construct on a base , said material comprising a common material , a building material , a civil engineering material , a civil engineering material , an oototing material , A vibration resistant material , and a segment material , the common material comprising : a beam , a rod , and a segment material , the common material comprising a beam , a rod , A table , a plate , a tube , a board , a board , a board , A laminate , a sheet , a board , a mat , a mold , A mold , a panel , a board , a scaffold , a material , A construction material , a construction material , a wood material , a construction material , a wood material , a building material , A steering member , an interior material , an exterior material , a packaging material , a road material , Levodopa, a green toon, a oxontoon, a courtoon, a formwork, a formwork, An earthquake reinforced dust , a gypsum material , a cement material , an asphalt material , Concrete materials, reinforced concrete materials, construction materials, work materials, building materials, Civil engineering materials , civil engineering materials , construction materials , civil materials , construction materials , civil materials , building materials , Casting material , manufacturing material , fiber material , coating material , photocatalyst coating material , Cement secondary product , redeemal secondary product , remial secondary product , asphalt secondary product , Askicon

secondary product, Assembling materials, assembled foods, prefabricated building materials, reinforced concrete material, re cast material, PC material, PS or post stress materials, PSC material, cured gun material, cured gun material, post cured gun material, hydration reaction and post cured gun material, hydration reaction and poolane reaction and post cured gun material, and said building material includes walls, doors, domes, visits, A window, window, window, wall paper, A floor, piping, toilet, bidet, panel, Eash, local tubes, tiles, bricks, blocks, A device comprising a base, a wall, a partition, a girder, a pillar, A chassis, a duct, a duct, a piping, a pipeline, A tank, a box, a membrane having a partition, a slab, An interior panel, and an exterior panel, wherein the civil material comprises: an interior panel, an exterior panel, and wherein the civil engineering material comprises one or more of a fume tube, a conduit, a duct, A box, tank, manhole, water bath, gredstone, Collection plates, brace plates, brace plates, brace plates, plates, brace plates, border holes, A separation zone, a multiple conduit, a U-shaped tube, a drainage water, a drainage water tube, a drainage water tube, A constant tube, a lattice block, a bevel block, a reinforcing block, a reinforcement block, a reinforcement block, a reinforcement block, A male underdrain, good underdrain, storage box, storage box, storage box, storage box, A cerium tube, a clay tube, a cement tube, a concrete tube, a storage tank, A water collecting bath, an excellent storage bath, a rainwater storage bath, a tetroport, a mixing material, Injection material, adult material, filler material, filler material, filler material, filler material, A powder material, an embedding material, a packaging material, a compaction material, a waterproof material, Water-blocking material, water-permeable material, permeable material, filtering material, adsorbent material, A trapping material, an injection material, a routing material thereof, a shot-crete material, a green-green material, A spray material, a seed spray material, wherein the artificial grass material is a deck, a sperm, a turf, a packaging material, an artificial turf, An artificial turf, a wood deck, and a composite wood, wherein the base material comprises: a foundation, a pile, a peer, a caisson, a reinforcement foundation, A rounary basis, factory file, embedding basis, anti-tabasis, rotary encasing basis, A field Tartsue file, caisson, a foundation caisson-strength caisson, a pile file, A ground middle, a ground Gig routing basis, a ground file, a ground column peer, a ground column caisson, a ground caisson, An energy pile, energy-based, geothermal circulation pipe is built-in, the tunnel material comprising a liner, a lining, a lining material, a tunnel liner, a tunnel lining, A waterproof material and a shot creting material, wherein the dust resistant material comprises a beam, a bar, a rod, Plates, wire bones, girders, gratings, H-beams, I-beam, sheet, mat, net, transverse beam, A vertical beam, an arch material, a reinforcement material, a reinforcing plate, a carbon plate, A bracket, a frame, a platform, a bracing, a carbon sheet, A carbon mat, a carbon net, a reinforcing sheet, a reinforcing mat, a reinforcing net, A cantilever material, a dust resistant reinforcing material, an L-type reinforcing material, a type I reinforcing material, an H-type reinforcing material, A T-shaped stiffener, a X-shaped stiffener, a  $\square$ -shaped stiffener, an X-bracing, an X-bracing, a steel bracket, A steel frame, a steel platform, a steel bracing, a steel up bracing, a bolt hole forming reinforcement, upper and lower branches and a middle web, wherein the segment materials comprise a segment, a segment, a tunnel segment, a TBM tunnel segment, a Shield tunnel segment, A bridge segment, a bridge upper plate segment, a building segment, an assembly segment, a liner segment, A lining segment, and a tunnel lining segment, wherein the material is selected from the group consisting of a function, a function, a function, a function material, a mineral material, A material for reinforcement material, a flow material, a gas retention material, a waste material, a capture material, A catalyst material, an actinide material, a resin material, a nutraceutical material, a nano material, A bierror material, an ionic material, and a dust-resistant material, wherein the function is a hydration reactant including a hydration reaction of  $\text{CaO} + \text{H}_2\text{O} = \text{Ca}(\text{OH})_2$ , a hydration fixing agent including a hydration reaction of  $2\text{Na}_2\text{SiO}_3 + \text{H}_2\text{O} \rightarrow \text{Na}_2\text{Si}_2\text{O}_5 + 2\text{NaOH}$ , a silica including  $\text{Al}_2\text{O}_3$  alumina, a catalyst agent including  $\text{TiO}_2$ , A carbonation agent including a carbonation reaction of  $\text{Mg}(\text{OH})_2 + \text{CO}_2 \rightarrow \text{MgCO}_3 + \text{H}_2\text{O}$ , a byproduct agent for forming an Fe oxidation reaction, and a physical vapor deposition agent capable of increasing the number of individuals by decomposition of microorganisms, and the functional agent includes a purifier-containing echo agent, a  $\alpha \times 10^{(-9)}\text{m}$ -sized particle or a nano-metal-containing nano-metal-acid, A fiber-containing fiber binder, a fiber-containing binder, a bonding function-containing binder, a solidifying function-containing phytonics, a plant or microorganism-containing bio-agent, a plant or microorganism-containing bio-agent, a resin-containing smart-product-containing re-cresent, a microorganism cultured in an incubator with a vibrator or magnetizable group, A green material containing sawdust, a yellow material containing iron, a carbon material containing nanocarbon, A geopolymer-containing dust material, a nanofiber material containing a nanofiber, a phyton material containing a plant or a fuctiated, a bio material containing a plant or microorganism, and a smart material containing a latex are included, and the functional substances are water, water, water, water, oil, and Group, high, agent, powder, and composition A drug, if, good, SOL, gel, pool, Dead, ball, sphere, ring, Albon, Sulfo, phosphorus, charcoal, soil, stone, Oxa, Ku, chips, kuu, sulfur, A salt, a succinate, a leaf, a flower, a seed, a seed, a seed, Rice, bran, and the mineral material comprises soil, soil, tothite, clay, clay, and the mineral material comprises soil, soil, tomaton, clay, Yellow, tonetos, chantos, macattos, minerals, lumina, Ore, rock, rock, rock, rock, rock, rock, stone, stone, Tin, stone powder, ceramic, silica, silica fume, Hamartosis, chaptosa, apatite, dolomite, magnetite, Maximantially, precipitated steel, kaolin, germanium, perlite, Smectite, dolomite, bentonite, zeolite, vermiculite, Amadite, montmorillonite, and said reinforcing material comprises iron, rods, beams, frames, jolitrade, and steel material comprises at least one element selected from the group consisting of iron, rods, beams, Copper, metal, iron yarn, steel wire, steel wire, steel wire, A grid, a wire, a cation, an anion, a fiber, Mesh, iron powder, iron chip, iron chip, Steel rods, lattices, FRP, fibers, fibers, Nylon, graphene, vinylon, binder, adhesive, A plastic, a glass fiber, a carbon fiber, an FRP fiber, a polyester, a plastic, a glass fiber, a carbon An aramid fiber, a polyethylene fiber, a polypropylene fiber, a polyvinyl alcohol fiber, a wire mesh, and wherein the plant material comprises a seed, a plant, a tree, a root, a stem, a seed, a seed, Seeds, fruits, muds, peels, peels, Apple, grape, kale, vegetable, grain diet, Starch, starch, talking, straw, chaff, rosin, starch, starch, starch, tchin, Bamboo, pine, Bouwon, Doubon, Doubon, Lines, Lignin, Pine, Prae, Prae, Buca, Buca, Buca, Buca, Kinkgo, Phorchid, horseshoe ve, and said gas retention material is selected from the group consisting of air, gas, oxygen, hydrogen, nitrogen, and bamboo, and bamboo, A gas mist, wherein the waste material contains carbon, ozone, air bubbles, foam and steam, and the waste material contains ash, waste powder, iron powder, stone powder, dust, Paddle, sludge, slime, slag, by-products, Waste, a passenger shell, a passenger shell, a passenger shell, a closed concrete, Waste tires, waste glass, waste vinyl, waste rubber, waste sand, Waste plastic, lung lime, waste gypsum, waste fiber, chalky dust, wherein the collecting material includes true char, a catalyst, an enzyme, a catalyst, an enzyme, an enzyme, an enzyme, Carbon, graphite, charcoal, wood chips, wood flour, Sawdust, fiber, rice bran, carbon, wood chip, An activated carbon, a filter cloth, sponge, and phytic mos, wherein the catalytic material is a catalyst, a forward catalyst, a sub-catalyst, a photocatalyst, a  $\text{TiO}_2$   $\text{ZnO}$ , CDs,  $\text{ZnS}$ , Gap, CDS, CdTE,  $\text{SnO}_2$ ,  $\text{Nb}_2\text{O}_5$ ,  $\text{KTaO}_3$ ,  $\text{MoSe}_2$ ,  $\text{ZnSCdSe}$ ,  $\text{Ni-K}_4\text{Nb}_6\text{O}_{17}$ ,  $\text{ZrO}_2\text{SrTiO}_3$ , wherein the acinoid material comprises a pharmaceutical agent, a drug, a drug, a pigment, a glaze, Sulfuric acid, hydrochloric acid, nitric acid, a carbon agent, a nanoase, An active agent, a flocculant, a detergent, a clarifying agent, a water purification agent, a water purification agent, An aeration agent, a reactive agent, an adsorbent, a trapping agent, a bactericide, A disinfectant, an antimicrobial agent, a bacteriostatic agent, a foaming agent, A water-repellant agent, a water-repellant agent, a water-repellant agent, a plasticizer, A mixing agent, an additive, a solidifying agent, a heat

blocking agent , a flame retardant agent , A chemical agent , a chemical agent , a chemical agent , a chemical agent , a chemical agent , an acidic agent , Alkaline agents , surfactants , carbon dioxide , calcium hydroxide , sodium hydroxide , Aluminum sulfate , ferrous sulfate , ferric chloride , a zero-valent metal , a zero-valent metal , a zero-valent metal , a zero-valent metal , An antioxidant , a UV stabilizer and a UV blocker , wherein the resinous material includes at least one of rubber , resin , urethane , urea , epoxy , and UV blocker selected from the group consisting of rubber , Acrylic, uracil, latex, binder, monomer, Oligomers, artificial resins, polymeric resins, ion exchange resins, geopolymer, Geotextile, cellulose, polylactic acid, hemicellulose, expanded polypropylene (EPP) Expanded polystyrene (EPS), expanded polyethylene (EPE), anthracite, super absorbent polymer, SAP (CMC) Acrylic Urethanes, hydraulic acrylics, hydraulic acrylics, hydraulic Urethanes, hydraulic urea, hydraulic uracil, A hydraulic latex , a hydraulic acrylic urethane , silica , a silica SOL , a silica gel , Silica, microsilica, hybrid silica, acrylic emulsions, acrylates, An acrylamide natural resin , and the nutrient material is selected from the group consisting of calcium , potassium , sulfur , phosphoric acid , glucose , calcium , An amino acid , a vitamin , a nutrient , an inorganic substance , an organic substance , Ginseng, ginseng, tri, flushing, mercury, mercury, Hastri, gorse, licorice, Hose, Hose, Heggard, Long-diameter, ductwosulfur, right-sulfur, large-sulfur, A rerpa , a vulcanizer , a counterweights , a recording , Gauge, Organopees, rolling, rolling, tinnites, tines, Guara, mizzanine, lactation, nutrient, nutrient, nutrient, Germanium, collagen, glucosamine, magnesium, grape seed oil, Chlorella , said Nanomaterial comprising : nanometric materials , nanoobjects , nanoobjects , nanoobjects , nanometals , nanoiron , Nanosilver, nanotungsten, nanotitanium, nanocarbons, nanocarbons, Nano-gold , nano-Platinum , and nano-activated carbon , and the bierror material is selected from the group consisting of micro-organisms , lactic acid bacteria , radiomycetes , photosynthetic bacteria , Rugomycetes, useful microorganisms, aerobic microorganisms, anaerobic microorganisms, basophils, Anaerobic microorganisms, collagen, keratin, syndecans, integrins, Elastin, Bacillus, cereus, subtilis, pasutes, Bacillus subtilis, Bioagents, Biogels, biosilanes, A bioseal, biobond, biofilm; said biofilm including microorganisms; wherein said ionic material is C, H, O, N, S, K, P, F, ca, mg Si, Fe, Me, Al, Na, Cu, Zn, ppb, CR, CX Oh, MGO, Cao, K2O, Na2, SiO2, Al2O3, Fe2O3, CaSi, CaMg, CaFe, CaMe, MGE, MgMe, FeMe CaMgFe, CaMgMe, MgFeMe, CaMgFeMe, CaMgFMe, CaMg agent, A method for producing a material selected from the group consisting of CaFe agents , CaMe agents , MgFe agents , MgMe agents , The CaMgFe agent, the CaMgMe agent, the MgFeMe agent, the CaMgFeMe agent, the CaMgFeMe agent, the +2+2+Si containing agent is made of CaMgFeSi, the CaFeMgSi agent, Ca\*Fe mg Si Polymer, ca<"2>Si Polymer, ca<"1>Ce, which are selected from the group consisting of beams, bands, rods, iron bones, Girders, gratings, H-beams, I-beams, sheets, Mat, net, cross beam, longitudinal beam, arch, A reinforcing plate , a reinforcing plate , a carbon plate , a bracket , a frame , A platform, a bracing, a carbon sheet, a carbon mat, a carbon net, A reinforcing sheet , a reinforcing mat , a reinforcing net , a cantilever material , a dust resistant material , A vibration resistant material , a vibration resistant reinforcing material , an L-type reinforcing material , a type I reinforcing material , an H-type reinforcing material , A T-shaped stiffener , a X-shaped stiffener , a □-shaped stiffener , an X-bracing , an X-bracing , a steel bracket , A fiber tool means characterized in that it comprises a steel frame , a steel platform , a steel bracing , a bolt hole forming reinforcement , and a reinforcing material composed of upper and lower branches and an intermediate web

**Assignees:** I ONE CO LTD

359. Family 95321572 (US2023002276 AA)

[View in PatBase](#)

Title

[EN] CARBON NEGATIVE CONCRETE PRODUCTION THROUGH THE USE OF SUSTAINABLE MATERIALS

Abstract

[EN] The present invention relates to additives and, more specifically, the use of biochar, in concrete and other cementitious materials to provide for building materials that have a lower carbon footprint than their traditional counterparts. Traditional methods for production of cement produce large amount of carbon dioxide (CO2). When coupled with the massive demand for cement building materials around the world, this means that the cement production has a significant impact on the amount of CO2 produced globally. By including biochar and other additives along with, or instead of some traditional components of cement, one may be able to provide for cementitious building materials that sequester carbon, rather than release it.

1st Main Claim

[EN] 1. A cementitious material comprising:  
Portland cement;  
sand; and  
biochar.

Assignees: HEROSAND LLC

PatBase - US2023002276 AA				
Table 2				
No.	Design (PSI)	Compressive Strength (Psi)	PSI	CO2-Reduction (%)
Control	3000	3375	2400	-
1A	3000	3400	2700	70%
1B	3000	3310	1970	28%
A	3000	4000	3900	100%
B	3000	4200	3300	111%
C	3000	4600	3800	120%
D	3000	4600	3700	124%

## 360. Family 106847081 (DE102023003452 A1)

[View in PatBase](#)

### Title

[MT] CHEMICAL REPROCESSING OF CONCRETE

### Abstract

[MT] [0000] The invention describes a catalytic process for the simple and comprehensive decomposition of cement stone. The process can be used to decompose cement stone in construction waste and thus release the aggregates. Various materials can be extracted separately from the cement stone using chemical and non-chemical methods.

The materials obtained from the decomposed cement paste can be used as CO<sub>2</sub>-negative precipitated CaCO<sub>3</sub> (Precipitated Calcium Carbonate, PCC), Supplementary Cementitious Materials (SCM) or as starting materials for cement without CO<sub>2</sub> debt from the raw materials.

With the method described, it is also possible to convert calcium carbonate into soluble calcium salts. It is therefore an alternative method for producing PCC from limestone, which already works at 100 degrees centigrade

### 1st Main Claim

[MT] Method for treating cementitious materials, comprising the following steps: i. providing at least one cementitious material, wherein the cement contained can still be settable and/or set, preference is given to set cementitious materials that arise as waste material, such as old concrete or cement screeds; ii. optionally crushing the at least one cementitious material to an acceptable size, preferably <200cm maximum diameter, preferably <50cm maximum diameter, preferably <20cm maximum diameter, particularly preferably <8cm maximum diameter, to increase the reaction rate particularly preferably <4cm maximum diameter, but without destroying the aggregates contained, therefore preferably with sizes >0.1cm intended smallest diameter, preferably >0.5cm intended smallest diameter, preferably >1cm intended smallest diameter, particularly preferably >3cm intended smallest diameter and if very large aggregate is known particularly preferably >6cm intended smallest diameter; iii. Adding to the at least one raw material a salt whose cation is in equilibrium with the corresponding base when water is added; the salt is preferably an ammonium salt with NH<sub>3</sub> as the corresponding base, ammonium chloride is particularly preferred; iv. optionally heating the mixture, preferably to boiling while removing the resulting gases; v. optionally separating the reaction mixture into solution and solid by suitable measures, such as sedimentation or filtration.

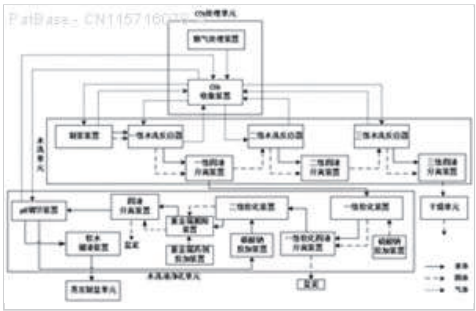
**Assignees:** HOFMANN TOMMY ALFRED

361. Family 96067811 (CN115716078 A)

[View in PatBase](#)

**Title**  
[EN] CARBON DIOXIDE RESOURCE UTILIZATION METHOD AND SYSTEM

**Abstract**  
[EN] The invention discloses a system for resource utilization of carbon dioxide. The system comprises a CO<sub>2</sub> treatment unit, a washing unit, a washing liquid purification unit, a drying unit and an evaporation salt-making unit. The method mainly comprises the following steps: purifying flue gas by a flue gas purifying device, collecting the flue gas in a CO<sub>2</sub> collecting device, and conveying the flue gas to a pulping device and various stages of washing reactors through the CO<sub>2</sub> collecting device, so that the problem of removal of insoluble chlorine in fly ash is solved, and the content of calcium in fly ash slag is increased; after the fly ash is subjected to multi-stage reverse water washing treatment, fly ash material slag and all stages of water washing liquid are obtained; drying the fly ash material slag to obtain a washed fly ash finished product with the chlorine content of less than or equal to 1 percent; the primary water washing liquid enters a water washing liquid purification system, is subjected to softening, heavy metal reduction and pH regulation treatment and then enters an evaporation salt production system, and potassium chloride and sodium chloride products are obtained; a countercurrent elution mode is adopted in the washing process, and the water consumption for washing is reduced; a pH detector is arranged in the whole process, and the liquid inlet amount and the carbon dioxide gas introduction amount of each stage are accurately controlled; in the water washing liquid purification unit, the pH value of the water liquid is adjusted by combining carbon dioxide with hydrochloric acid, which is different from the conventional method for adjusting the pH value of the water liquid by only adopting reagents such as hydrochloric acid, so that the acid consumption is reduced, and the treatment cost is saved.



**1st Main Claim**

[MT] 1. A system for the resource utilization of carbon dioxide, characterized in that the system comprises Co<sub>2</sub>A treatment unit, a water washing unit;

The Co<sub>2</sub>The treatment unit comprises a flue gas treatment device and Co<sub>2</sub>A collecting device;

The flue gas treatment device comprises at least one of flue gas purification, physical absorption, membrane separation, and chemisorption;

The water washing unit comprises a pulping reactor, a fly ash dosing device, a pulping water injection device, a primary water washing reactor, a primary solid-liquid separation device, Secondary water wash reactor, secondary solid-liquid separation unit, tertiary water wash reactor, tertiary solid-liquid separation unit, Co<sub>2</sub>Advocacy means;

Both the fly ash dosing device and the pulping water injection device outlet are connected to a pulping device slurry inlet, the pulping device slurry outlet is connected to a primary water wash reactor slurry inlet, the primary water wash reactor slurry outlet is connected to a primary solid liquid separation device inlet, and the primary solid liquid separation device liquid outlet is connected to a primary solid liquid separation device A first stage solid-liquid separation device solid outlet is connected to a second stage water washing reactor slurry inlet, a second stage water washing reactor slurry outlet is connected to a second stage solid-liquid separation device slurry inlet, and a second stage solid-liquid separation device liquid outlet is connected to a slurry water injection device inlet A solid outlet of a solid-liquid separation device is connected to the tertiary water-washing reactor slurry inlet, a slurry outlet of a tertiary water-washing reactor is connected to the slurry inlet of a tertiary solid-liquid separation device, and a liquid outlet of a tertiary solid-liquid separation device is connected to the slurry inlet of a secondary water-washing reactor, The three stage solid-liquid separation device solids outlet is connected with a drying unit inlet;

The Co<sub>2</sub>The gas outlet of the collection unit is connected to the gas inlet of the pulping unit and to the gas inlet of each stage of the water washing reactor; the gas inlet of the pulping unit and the gas inlet of each stage of the water washing reactor are connected to the gas inlet of the flue gas purification unit; and the gas inlet of the pulping unit and the gas inlet of each stage of the water washing reactor are connected to Co<sub>2</sub>Advocacy devices.

**Assignees:** BEIJING ZKGR ENVIRONMENTAL PROTECTION TECH CO LTD

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363. Family 99311962 (CN116854495 A)

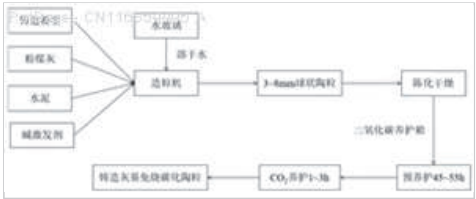
[View in PatBase](#)

Title

[EN] PREPARATION METHOD OF CAST ASH-BASED UNFIRED CARBONIZED CERAMSITE

Abstract

[EN] The invention discloses a preparation method of cast ash-based unfired carbonized ceramsite, the cast ash-based unfired carbonized ceramsite is mainly prepared from the following raw materials: casting dust, fly ash, water glass, cement and an alkali activator, the dry materials are uniformly mixed to form an ash material, the ash material is put into a granulator, a water glass aqueous solution is sprayed for granulation, and a ceramsite green body is obtained; placing the prepared ceramsite in a room for aging and drying, then transferring the ceramsite into a carbon dioxide curing box for pre-curing, and finally continuously performing CO<sub>2</sub> curing in the box to obtain the casting ash-based unfired carbonized ceramsite. The preparation method is simple and easy to implement, the raw materials are low in price and easy to obtain, a large amount of casting dust and fly ash can be consumed, and waste recycling is achieved; the ceramsite is prepared through carbon dioxide curing, the curing period is shorter, and meanwhile carbon fixation can be achieved; the prepared cast ash-based unfired carbonized ceramsite has a good fixing effect on heavy metals in the raw materials, and can be well applied to sewage treatment.



1st Main Claim

[MT] 1. A method for preparing cast gray-based burn-free ceramic carbide granulate, characterized by comprising the steps of:

- Step 1, the batching water glass is dissolved in deionized water to form a binder solution, and the pretreated cast dust is mixed uniformly with fly ash, cement, and alkali excitators to form an ash, the cast dust and fly ash being the main raw materials;
- Step 2, pelletizing: First put the ash material into the granulator and rotate it to mix evenly, shut down the granulator and spray the binder solution several times; start the granulator and continue to spray the binder solution to granulate the ceramic particles in the process;
- Step 3, room temperature aging: The prepared ceramic granulate is subjected to room aging and drying;
- Step 4, pre-care: Transfer the burnfree ceramic particles dried in the room to the carbon dioxide care box for pre-care;
- Step 5, CO<sub>2</sub>Maintenance: Continue to CO in the tank<sub>2</sub>Conservation, you can cast gray-based burn-free carbonized ceramic particles.

**Assignees:** UNIV NANJING INFORMATION SCIENCE AND TECH; NANJING UNIV OF INFORMATION SCIENCE AND TECHNOLOGY

## 364. Family 96515285 (US2024375998 AA)

[View in PatBase](#)

### Title (EP4155279 A1)

[EN] METHOD FOR MANUFACTURING SUPPLEMENTARY CEMENTITIOUS MATERIAL

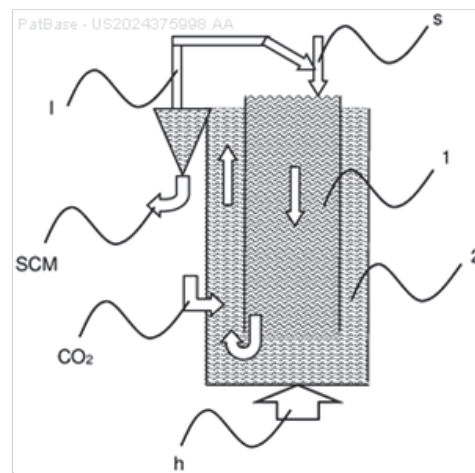
### Abstract (EP4155279 A1)

[EN] Method for producing a pozzolanic product by hydrothermal treatment of a feedstock comprising silicate, aluminate, and/or aluminosilicate materials, and a source of calcium ions, wherein the feedstock has a molar ratio of Ca:(Si+Al) from 0.4 to 1.2 and a maximum content of hydrated cement paste of 10 wt.-%, to provide a hydrate product, and subsequent carbonation of the hydrate product to provide a pozzolanic product comprising calcium carbonate and silica gel, alumina gel and/or silica-alumina gel; pozzolanic product obtainable by the method; use of the pozzolanic product as supplementary cementitious material; method for manufacturing a composite cement and a composite cement comprising the pozzolanic product and an hydraulic cement.

### 1st Main Claim (EP4155279 A1)

[EN] 1. Method for manufacturing a pozzolanic product comprising:

- - hydrothermal treatment of a feedstock comprising silicate, aluminate, and/or aluminosilicate materials, and a source of calcium ions, wherein the feedstock has a molar ratio of Ca:(Si+Al) from 0.4 to 1.2 and a maximum content of hydrated cement paste of 10 wt.-%, providing a hydrate product and
- - subsequent carbonation of the hydrate product providing the pozzolanic product comprising calcium carbonate and silica gel, alumina gel and/or silica-alumina gel.



**Assignees:** HEIDELBERG MAT AG; HEIDELBERGCEMENT AG; HSUSTAINABILITY GMBH; HCONNECT 2 GMBH

365. Family 93400596 (CN115073126 A)

[View in PatBase](#)

Title

[EN] METHOD FOR FIXING CARBON DIOXIDE BY USING SILICON-CALCIUM-BASED SOLID WASTE AND APPLICATION THEREOF

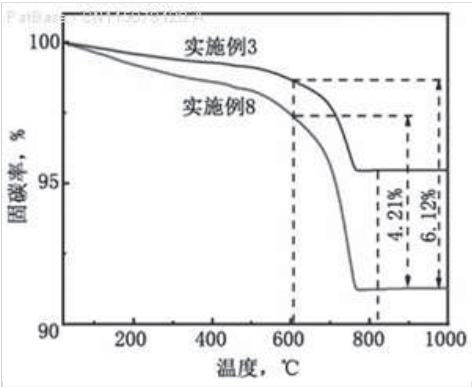
Abstract

[EN] The invention relates to the field of flue gas treatment and building materials, in particular to a method for fixing carbon dioxide by using silicon-calcium-based solid waste and application of the method. According to the method for fixing carbon dioxide by using the silicon-calcium-based solid waste, heat generated by mineralization reaction in a system reaches conditions required by hydrothermal reaction by controlling blank filling in a reaction kettle, so that the mineralization reaction and the hydrothermal reaction can be performed in the system. According to the method, a large amount of reaction heat generated during fixation of carbon dioxide by dicalcium silicate and tricalcium silicate in the solid waste can be fully utilized to synergistically prepare the building material product with good carbon fixation performance and excellent physical performance, the solid waste treatment cost is greatly reduced, an external heat source is not needed, the environment temperature is increased through the reaction heat, and the environmental pollution is reduced. Further, the mineralization efficiency is improved.

1st Main Claim

[MT] 1. A method for solid waste fixation of carbon dioxide using silica-based calcium waste, characterized in that the heat generated by the mineralization reaction in the system is brought to the conditions required for hydrothermal reactions by controlling the embryo filling in the reaction kettle, so that both mineralization and hydrothermal reactions can be carried out in the system.

**Assignees:** JIANGSU JICUI FUNCTIONAL MATERIALS RES INST CO LTD



366. Family 97648685 (TW202403150 A)

[View in PatBase](#)

Title

[EN] COLD-STIRRING AND COLD-PAVING ASPHALT MIXED-PAVING MATERIAL AND PRODUCING METHOD THEREOF ADDING RAW MATERIALS SUCH AS INTERFACE COAGULANT, RETARDER, AND WATER-BASED PHOTO-CURABLE RESIN

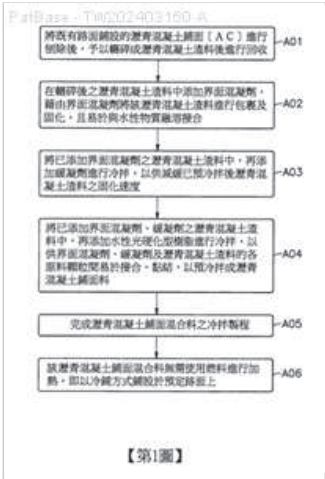
Abstract

[EN] The invention relates to a cold-stirring and cold-paving asphalt mixed-paving material and its producing method. After removing the asphalt concrete (AC) paving paved on the existing road surface, it is crushed into asphalt concrete slag for recycling. Moreover, it is added with an interface coagulant to pack and solidify the asphalt concrete slag so as to easily dissolve and bond with aqueous substance, and retarder is further added to perform cold-stirring so that the solidifying rate of the asphalt concrete slag that has been pre-cold stirred can be slowed down. Afterward water-based photo-curable resin is added to perform cold stirring to easily join and bind among raw material particles, thereby completing the fabrication of the asphalt concrete paving material through pre-cold stirring. The asphalt concrete paving material does not need to use fuel for heating and can be paved on predetermined road surfaces by way of cold-paving, reducing emissions, such as carbon dioxide and heat, thereby achieving the purpose of saving power usage.

1st Main Claim

[MT] 1. A cold mix cold laid asphalt mixed paving material comprising asphalt concrete slag, interfacial coagulant, retarder and aqueous photohardened resin, wherein: Said resin is a water-soluble resin;

Assignees: TANG PO YU



## 367. Family 93881836 (JP2022162955 A2)

[View in PatBase](#)

### Title

[EN] HARDENED BODY, AND METHOD AND APPARATUS FOR PRODUCING THE SAME

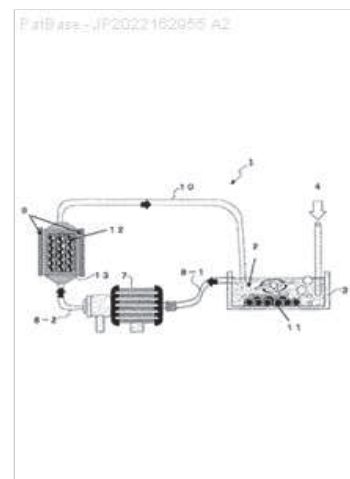
### Abstract

[EN] To provide a hardened body, especially a hardened body for construction material, made by using as much collected CO<sub>2</sub> as possible, the CO<sub>2</sub> being in a state of being dispersed after being discharged into air during calcination in the past when cement is produced. SOLUTION: A method for producing a hardened body includes: a step (I') of adding particles each containing a Ca source and/or a Mg source to a liquid containing at least water; a step (II) of dissolving CO<sub>2</sub> in the liquid obtained in the step (I), thereby obtaining a liquid containing Ca(HCO<sub>3</sub>)<sub>2</sub> and/or Mg(HCO<sub>3</sub>)<sub>2</sub>; a step (III) of shaping an aggregate into a predetermined shape; a step (IV) of adding the liquid containing the Ca(HCO<sub>3</sub>)<sub>2</sub> and/or the Mg(HCO<sub>3</sub>)<sub>2</sub> to the predetermined shape obtained in the step (III); and a step (V) of changing circumstances in the predetermined shape obtained in the step (IV), thereby obtaining the hardened body formed by having the aggregate and carbonate existing in the aggregate. SELECTED DRAWING: Figure 1

### 1st Main Claim

[MT] 1. A cured product comprising: aggregates; and a substance present between the aggregates, wherein the substance contains 50 percent by weight or more of a carbonate in 100 percent by weight of the substance.

**Assignees:** UNIV TOKYO; TOKYO UNIV OF SCIENCE; TAIHEIYO CEMENT CORP; SHIMIZU CONSTRUCTION CO LTD; UNIV OF TOKYO; HOKKAIDO UNIV; KOGAKUIN UNIV; UTSUNOMIYA UNIV; SHIMIZU CORP; UNIV HOKKAIDO; UNIV OF SCIENCE TOKYO; UNIV KOGAKUIN; UNIV UTSUNOMIYA; NAT UNIV CORP HOKKAIDO U



368. Family 99294602 (KR102585792 B1)

[View in PatBase](#)

Title

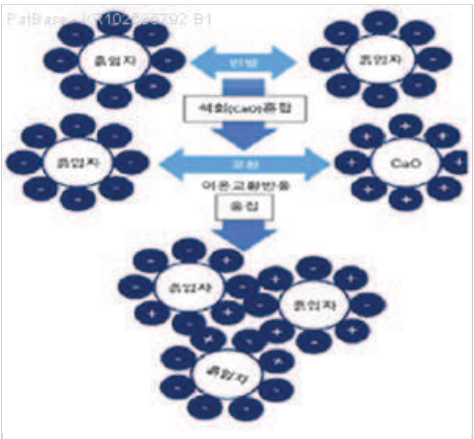
[EN] MANUFACTURING PRODUCTION AND CONSTRUCTION METHOD OF LOW CARBON GREEN CEMENT USING RECYCLING OYSTER SHELLS

Abstract

[EN] Provided is a manufacturing, production, and construction method of green cement by using shells, wherein the green cement is a cement substitute for construction structures, ground and soil improvement, and the like. The method of the present invention comprises the steps of: preparing quicklime for recycling shells; producing green cement by using the calcined shell or quicklime prepared; and adding minerals to prevent soil acidification to the produced green cement to perform construction on site by using the mixture.

1st Main Claim

[MT] 1. Preparation step S1 of preparing fine lime for recycling; preparation step S2 of green cement using the prepared fresh lime for recycling and green cement prepared quicklime for green cement; and construction S3 of the produced green cement on sites of construction structures, ground and soil improvements, wherein step S1 of preparing fine recycling quicklime is removed by washing-1 to-1) Separating the parangles from which foreign substances have been removed into three sizes by grinding S1-2, powderizing each divided into three sizes into three sizes into three sizes, and burning each powder powdered the three sizes at a firing temperature of 650°C, 750°C, and 850°C respectively according to a particle size to remove carbon dioxide (S1-4), Said washing step ( S1-1 ) is a step of collecting and washing with water a parangle containing salt and organic substance to remove said salt and said organic substance , and is first washed immediately after said parangle is collected to remove both odor and dust , The secondary and tertiary washing the parents removed by grinding the parangles from which foreign substances are removed to separate them into three sizes in the step 0.2 of pulverizing the parangles from which the foreign substances are removed, and the step of pulverizing the parangles through the washing step into three sizes (S1-2) is the step of pulverizing the parangles of three sizes in which the step mm The step S1-2 of pulverizing the facet angle from which the foreign matter has been removed into three sizes by grinding the facet angle from which the foreign matter has been removed into three sizes is primary grinding (0.5 mm or less), secondary grinding (0.3 mm or less), tertiary grinding (0.2 mm or less), and pulverizing the ground facet angle separated by the three sizes into three respective crushed facets by three sizes, A ground facet angle of another one size is between 0.05 mm and less than 0.1 mm , and a ground facet angle of not more than 0.05 mm that is another size are each powdered to another powdered powder , the degree of powder of the ground facet angle of another one size is largest , then the degree of powder of the ground facet angle of the other size is large , Then 750 the degree of powder of the one sized ground facet is the smallest , and 850 the step of burning the ground facet powder with the three grains by grain size to remove carbon dioxide , wherein in the step of removing carbon dioxide , the temperature rising rate is about 1°C/min in the order of 650°C/min in the order of 6.0°C/min in the order of °C/min , 650 The baking temperature of the polygonal powder having a degree of pulverization of the other size is 750 °C. , the baking temperature of the polygonal powder having a degree of pulverization of the one size is 850 °C. , and in the step of powderizing each crushed angle separated by the three sizes at three sizes , each 650 °C. , 750 °C. , And firing Peach powders different in powder degrees respectively while fixed at 850°C and producing green cement using the prepared quicklime for dry powder recycling and quicklime for green cement comprises the following steps : mixing said quicklime, fly ash of speech , gypsum of a chemical company , gypsum (CaSO4) and silica fine powder of ersome lime to yield green lime, said green lime and said green cement In the step of mixing gypsum (Cao) of the chemical company, and blast furnace slag finely divided powder (GBFS) of the iron and silica fume to produce a green cement, when the green cement total complex is seen on a weight ratio of 100, the weight ratio of the fresh lime for the green cement is 15-35, the weight ratio of the fresh lime powder is 15-35, the blast weight ratio of 20-40, and 40 The weight ratio of fly ash is 15 to 35 and a weight ratio of silica fume 5 to 20 , and the baking temperature of 650 °C. , 750 °C. , and 850 °C. to calcine the polygonal powder produces the patn recycled quicklime by burning at a firing temperature of °C. , °C. , and °C. to remove carbon dioxide , wherein the fresh lime has a fine powder density of 2.59 to 2.91 g or less , Wherein the quicklime for green cement contains calcium carbonate (CaCO3) , and has a fine powder density of 2.59 to 2.91 g/cm3 , a degree of powder of 3000 cm 2/g or more , a loss on ignition is 4 % or less , and a particle diameter of 0.04 mm or less , Calcium oxide 60% or more, the blast furnace slag fine powder (GGBFS) has a density of 2.8 g/cm3 or more, a degree of fineness of 4000 cm<2>/g or more, a saline content of 1% or less, a loss of ignition is 3% or less, a degree of fineness of 2500 cm<2> or more, a loss of 1% or less, an amount of Al2O3 is 30% or more, The gypsum (CaSO4) has a fineness of 3,000 cm2/g or more and a loss on ignition of 5 % or less. The silica fume is spherical particles having an average particle diameter of 0.15 μm, a SiO2 content of 90 % or more, a density of 2.2 g/cm<3>, a fineness of 90,000 cm<2>/g or more, and a daily compressive strength of 16.13 MPa, a 3-day compressive strength of 16.13 MPa, a 7-day compressive strength of 45.045.045.045.045.60.1, and a specific gravity of, and a specific gravity of 5105, and a specific gravity of 6.90.2, and a specific gravity of 5.613 MPa, and a specific gravity of And 3 days of solidification treatment with the green cement before the sewage sludge solidification treatment which has a loss on ignition 55.2, and the target toer has pH 11.6, uniaxial compressive strength (kg/cm<sup>2</sup>) 1.6, hydrous ratio (%) 40.2 and 7 days after solidification treatment with said green cement, pH 10.86, holding strength (BR5.0) 8.03, uniaxial compressive strength (kg/cm<sup>2</sup>) Preparation of green cement of a cement substitute green cement having a function ratio (%) 30.0 of 1.8



PatBase



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Production

A method of construction .

**Assignees:** CHUNG YOUNG YEE; CHOO YEON MOON

369. Family 50903621 (US2012082839 AA)

[View in PatBase](#)

Extended Family Number: 42613795

Title

[EN] FORMED BUILDING MATERIALS

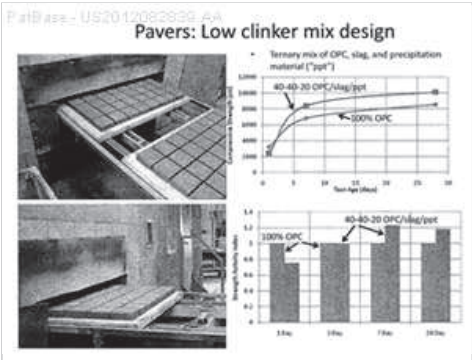
Abstract

[EN] Formed building materials comprising a sequestered CO2 are provided. The building materials of the invention include a composition comprising a carbonate/bicarbonate component. Additional aspects of the invention include methods of making and using the formed building materials.

1st Main Claim

[EN] 1. A method for producing a drywall product, comprising: a) processing a waste gas stream comprising carbon dioxide with a process water to produce an original composition comprising carbonates, bicarbonates, or a combination of carbonates and bicarbonates; b) removing at least a portion of the process water from the original composition to produce a concentrated composition, concentrated with respect to the carbonates, bicarbonates, or the combination thereof; d) producing from the concentrated composition a drywall slurry mixture; and e) depositing the drywall slurry mixture to form the drywall product.

**Assignees:** CALERA CORP; CALAS GUILLAUME; KENDALL TREAVOR; BOURCIER WILLIAM; CAMIRE CHRIS; LU PENG; HA ERIC; CHEN IRVIN; DEVENNEY MARTIN



370. Family 49934008 (US2011277474 AA)

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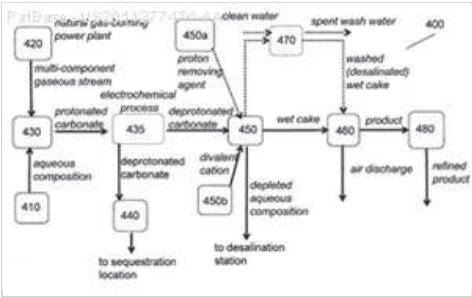
Extended Family Number: 42613795

Title  
[EN] METHODS AND SYSTEMS USING NATURAL GAS POWER PLANT

Abstract  
[EN] Provided herein are methods and systems for sequestering carbon dioxide from a multi-component gaseous stream, such as flue gas from natural gas-burning power plant to produce a protonated carbonate. Also provided herein are methods and systems for electrochemically producing proton-removing agents to form a deprotonated carbonate from the protonated carbonate. The electrochemical process may consume less energy than the amount of energy generated during production of the multi-component gaseous stream.

1st Main Claim  
[EN] 1. A method, comprising: a) contacting a flue gas from a natural gas-burning power plant with an aqueous composition comprising a proton-removing agent under conditions to produce a deprotonated carbonate wherein the natural gas-burning power plant generates 1 ton or less of carbon dioxide per megawatt hour; and b) producing a carbonate-containing precipitation material from the deprotonated carbonate.

Assignees: CONSTANTZ BRENT R; GILLIAM RYAN J



371. Family 48653354 (US2013059099 AA)

[View in PatBase](#)

Title

[EN] CEMENT-FREE ALKALI-ACTIVATED BINDING MATERIAL, AND MORTAR AND CONCRETE USING SAME

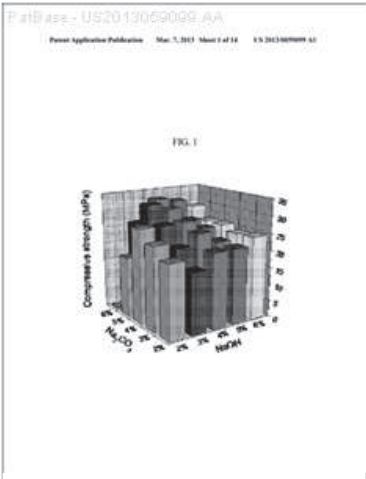
Abstract

[EN] The present invention relates to a cement-free alkali-activated binder. More particularly, the present invention relates to a cement-free alkali-activated binder having a novel combination ratio, which can improve the compressive strength of mortar and concrete in which the cement-free alkali-activated binder is used as a binding material instead of cement, and which can solve the low field applicability of mortar and concrete in terms of quick setting characteristics, fluidity loss, economic efficiency and the like, and to mortar or concrete comprising the same. The cement-free alkali-activated binder can improve field applicability by controlling the content and combination ratio of an alkali activator included in the cement-free alkali-activated binder, and can solve the problems of the toxicity of cement, the carbon dioxide (CO<sub>2</sub>) produced during the manufacturing of cement and the exhaustion of natural resources due to the production of cement.

1st Main Claim

[EN] 1. A cement-free alkali-activated binder, comprising: a source material selected from the group consisting of slag, fly ash, meta-kaolin, and a combination thereof; and a complex alkali activator including an alkaline hydroxide and a carbonate.

**Assignees:** UNIV NAT CHONNAM IND FOUND; SONG JIN KYU; YANG KEUN HYEOK



## 372. Family 82860817 (CN112194399 A)

[View in PatBase](#)

### Title

[EN] MODIFIED WASTE PUTTY AND PREPARATION METHOD THEREOF, AND SELF-LEVELING MORTAR

### Abstract

[EN] The invention relates to modified waste putty and a preparation method thereof, and self-leveling mortar. The preparation method of the modified waste putty comprises the following steps: taking wasteputty, immersing the waste putty in an organic solvent, taking out the waste putty, immersing the waste putty in water I, and taking out the waste putty to prepare a first intermediate; firing the first intermediate at the temperature of 300 degrees centigrade and 400 DEG C, calcining at the temperature of 900+/-50 DEG C, and cooling to prepare a second intermediate; mixing the second intermediate and water II, introducing carbon dioxide, adding a surface treating agent, and stirring to prepare a third intermediate; and dehydrating, drying and grinding the third intermediate. The prepared modified waste putty is good in hydrophilicity and dispersity, can be used in the self-leveling mortar, can fill gaps between aggregate and particles, is beneficial to growth of hydrated crystals, is beneficial to interface bonding of cement and fine aggregate, enables set cement to be more compact, and improves the mechanical properties of the mortar.

### 1st Main Claim

[MT] 1. A modified waste putty preparation method, characterized by comprising the steps of:

Take the waste putty, immersed in an organic solvent, remove and then soaked in water, remove, prepare a first intermediate I;

The first intermediate at 300 degrees centigrade -400 degrees centigrade, and then burning at 900 plus or minus 50 degrees centigrade calcination, and cooled to prepare a second intermediate;

Mixing said second intermediate and water II, with carbon dioxide, and then adding a surface treatment agent, stirring, to prepare a third intermediate;

The third intermediate dehydration, drying and grinding process.

**Assignees:** GUANGDONG BRIGHT DREAM ROBOTICS CO LTD

373. Family 99656519 (WO23208841 A1)

[View in PatBase](#)

Title (EP4514515 A1)

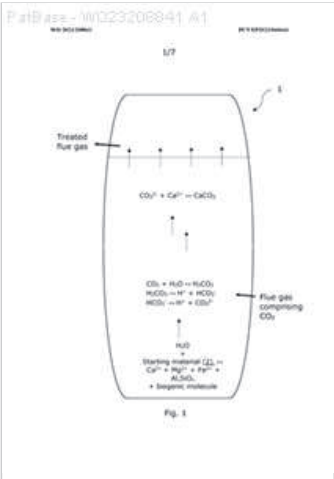
[EN] GEOCATALYSTS AND THEIR APPLICATION TO CONTROL COCAPTURE PROCESSES, ECONOMICALLY AND WITH ENVIRONMENTAL BENEFITS

Abstract (EP4514515 A1)

[EN] The application of geocatalysts in controlling CO2 capture processes in situ as well as in a reaction vessel, chamber or tower is described. More specifically, a process for controlling the reaction of a CO2-containing gas stream with one or more starting materials selected from waste building material, mineral, rock, sand, amorphous material or combinations thereof is disclosed; wherein said starting material comprises Si and/or Al, and one or more divalent cation(s), water, and one or more organic compound(s) to control the reaction; thereby providing a product comprising: at least one carbonate mineral and preferably colloidal silica.

1st Main Claim (EP4514515 A1)

[EN] 1. A process for controlling the reaction of: a CC>2-containing gas stream with one or more starting materials selected from stone wool, glass wool, mineral wool, waste glass, gypsum panels, gyprock, fibre acoustic panels, fire retardant panels, asbestos panels, fly ash, bottom ash, wood ash, biofuels ash, waste concrete, cement, mortar, or other building materials, such as bricks or ceramics or combinations thereof; wherein said starting material comprises Si and/or Al, and one or more divalent cation(s), water, and one or more organic compound(s) to control the reaction, provided that when the organic molecule is an organic acid, the pH of the process is maintained at or higher than at least one of the pKas of the organic compound; thereby providing a product comprising: at least one carbonate mineral and preferably colloidal silica.



Assignees: UNIV DANMARKS TEKNISKE; DANMARKS TEKNISKE UNIV

## 374. Family 73356194 (CN109400087 A)

[View in PatBase](#)

### Title

[EN] METHOD FOR ENHANCING ANTI-CARBONIZATION CAPACITY OF ALKALI STIMULATED CONCRETE, NAMELY,  $\text{Ca}(\text{OH})_2$  INTERNAL DOPING METHOD

### Abstract

[EN] The invention relates to a method for enhancing anti-carbonization capacity of alkali stimulated concrete, namely, a  $\text{Ca}(\text{OH})_2$  internal doping method. According to the method, 20 percent -30 percent (mass ratio of binding material)  $\text{Ca}(\text{OH})_2$  is doped when the alkali stimulated concrete is prepared, so that the content of anti-carbonization substance in alkali stimulated concrete is obviously increased, the anti-carbonization capacity is obviously improved and the durability of alkali stimulated concrete is enhanced. The doping of  $\text{Ca}(\text{OH})_2$  also can increase the content of active calcium in polymerization reaction environment, can boost the proceeding of polymerization reaction and the forming of polymerization products and can obviously promote the strength of alkali stimulated concrete. As a novel concrete material, the alkali stimulated concrete can be used for replacing cement concrete, can eliminate the environmental pollution problem caused by bulk deposition of solid wastes, can relieve excessive dependence on Portland cement, can reduce excessive consumption of non-renewable resources and is significant to countries, like China, suffering from shortage of energy sources and serious environmental pollution.

### 1st Main Claim

[MT] 1. A reinforced concrete carbonation resistance base excitation method - $\text{Ca}(\text{OH})_2$  internal doping method, characterized in that: In alkali-activated slag concrete, for example, raw material composition and mass percentage as follows: Cementitious material is granulated blast furnace slag powder 80% -70% (264-231kg/m<sup>3</sup>) doped amount; Milled powder, lime powder 20% -30% (66-99kg/m<sup>3</sup>) doped amount; Fine aggregate to coarse sand (651kg/m<sup>3</sup>) doped amount; Coarse aggregate is crushed stone (1056kg/m<sup>3</sup>) doped amount; The liquid sodium silicate modulus 1-3 (88kg/m<sup>3</sup>) doped amount; 17.6Kg/m<sup>3</sup> caustic soda (NaOH) doped amount; Water (92.4kg/m<sup>3</sup>) doped amount; Wherein the slag can be replaced by fly ash, red mud, ash and other industrial solid waste and garbage metakaolin, used to excite the base of concrete preparation.

Preparation method comprising: Weigh batching and mixing process, the preparation process, the specific method is as follows:

(1) weigh batching and mixing process: First, the weighed quantity of caustic soda was added to the test water, stirred and allowed to stand for cooling; At the same time, the slag powder, lime powder, after weighing the ingredients, and then the two gel material into the mixer and mixed for 5 minutes.

(2) Preparation process: Cooled to room temperature, NaOH solution was added stirring the pot, and then added to the mixed gel material, the first slow stirring for 10 seconds and then quickly stir for 20 seconds. Then add the liquid sodium silicate with test with sand and quickly stir for 30 seconds, and finally add gravel and quickly stir for 30 seconds to prepare molded.

**Assignees:** UNIV ANHUI SCI AND TECHNOLOGY; ANHUI UNIV OF SCIENCE AND TECHNOLOGY

375. Family 48137629 (CN101939269 A)

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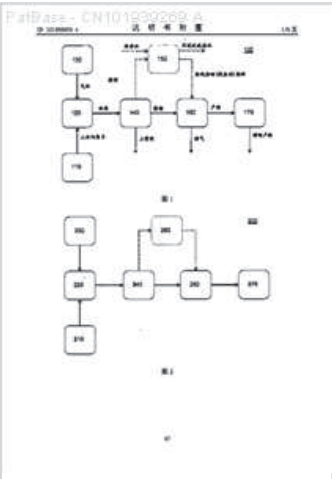
Extended Family Number: 42613795

Title  
[EN] REDUCED-CARBON FOOTPRINT CONCRETE COMPOSITIONS

Abstract  
[EN] Reduced-carbon footprint concrete compositions, and methods for making and using the same, are provided. Aspects of the reduced-carbon footprint concrete compositions include CO<sub>2</sub>-sequestering carbonate compounds, which may be present in the hydraulic cement and/or aggregate components of the concrete. The reduced-carbon footprint concrete compositions find use in a variety of applications, including use in a variety of building materials and building applications.

1st Main Claim  
[MT] A method, said method comprising: a) from a solution containing divalent cations and industrial waste gas containing CO<sub>2</sub> to produce synthetic carbonate component, and b) to reduce the carbon footprint of concrete composition the introduction of the synthetic carbonate component, wherein the carbon footprint reduction of concrete composition with respect to ordinary concrete composition having a reduced carbon footprint.

Assignees: CALERA CORP



376. Family 88110142 (KR102326873 B1)

[View in PatBase](#)

Title

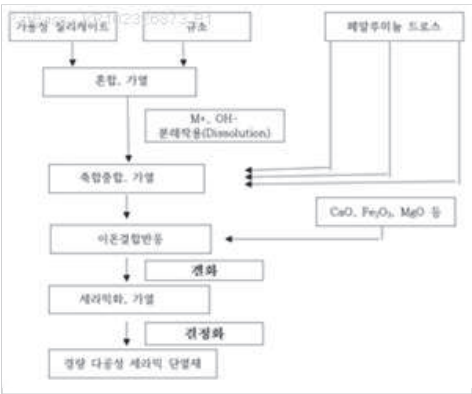
[EN] POROUS CERAMIC INSULATION MATERIAL USING WASTE ALUMINUM DROSS POWDER AND METHOD FOR MANUFACTURING SAME

Abstract

[EN] The present invention relates to a porous ceramic insulation material using waste aluminum dross powder and a method for manufacturing the same. The porous ceramic insulation material is manufactured using a porous ceramic insulation material composition containing: soluble silicate; silicon powder; waste aluminum dross powder surface-activated with alkali solution and waste aluminum dross powder surface-activated with acid solution; aluminum hydroxide; thickener, dispersant, and surfactant; quicklime; cement mixture; and hardener. According to the present invention, fly ash and bottom ash as coal-fired thermal power plant by-products are recycled, aluminum hydroxide used for artificial marble is recycled, and waste aluminum dross powder discarded after car aluminum wheel recycling is used. Accordingly, environmental pollution can be minimized. In addition, the porous ceramic insulation material as a construction material excellent in heat resistance, insulation, and mechanical strength can be provided at a low cost.

1st Main Claim

[MT] 1. A porous ceramic thermal insulation composition comprising soluble silicates; silicon powder; waste aluminum dross powder surface-activated with alkaline solution and waste aluminum dross powder surface-activated with acid solution; aluminum hydroxide; thickening agents, dispersing agents and surfactants; green lime; cement mixtures; and curing agents.



377. Family 52545005 (US2012312697 AA)

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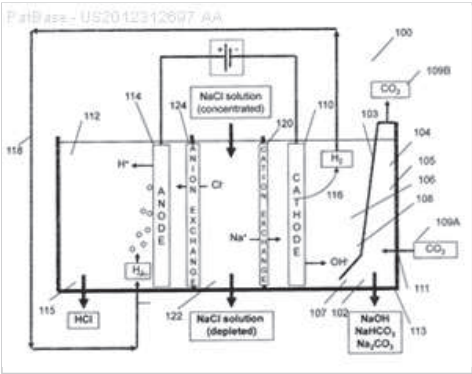
Extended Family Number: 42613795

Title  
[EN] CO2 UTILIZATION IN ELECTROCHEMICAL SYSTEMS

Abstract  
[EN] A low-voltage, low-energy electrochemical system and method of removing protons and/or producing a base solution comprising hydroxide and carbonate/bicarbonate ions, utilizing carbon dioxide in a cathode compartment that is partitioned into a first cathode electrolyte compartment and a second cathode electrolyte compartment such that liquid flow between the cathode electrolyte compartments is possible, but wherein gaseous communication between the cathode electrolyte compartments is restricted. Carbon dioxide gas in one cathode electrolyte compartment is utilized with the cathode electrolyte in both compartments to produce the base solution with less than 3V applied across the electrodes.

1st Main Claim  
[EN] 57. An electrochemical method comprising: contacting an anode electrolyte with an anode in an anode compartment; contacting a cathode electrolyte with a cathode in a cathode compartment wherein the cathode produces hydroxide ions; directing an industrial waste gas comprising carbon dioxide into the cathode electrolyte in the cathode compartment or directing carbon dioxide into the cathode electrolyte from a gas/liquid contactor that is in contact with an industrial waste gas; converting bicarbonate ions to carbonate ions in the cathode electrolyte and producing a pH differential between the anode electrolyte and the cathode electrolyte of between 6-12; and contacting the cathode electrolyte with a divalent cation solution to produce divalent cation carbonate and/or bicarbonate compounds, wherein the divalent carbonate and/or bicarbonate compounds comprise calcium, magnesium, or both calcium and magnesium.

Assignees: BOGGS BRYAN; KNOTT NIGEL ANTONY; DECKER VALENTIN; ALBRECHT THOMAS A; GORER ALEXANDER; JALANI NIKHIL; GILLIAM RYAN J; FARSAD KASRA; KOSTOWSKYJ MICHAEL; CELERA CORP



378. Family 41896973 (JP2008100893 A2)

[View in PatBase](#)

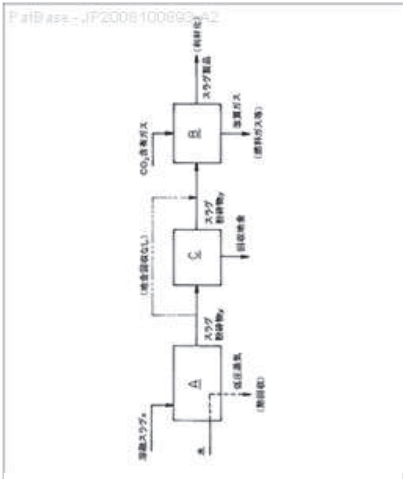
**Title**  
[EN] STEEL SLAG TREATMENT METHOD

**Abstract**  
[EN] PROBLEM TO BE SOLVED: To provide a steel slag treatment method by which steel slag soon after produced is quickly treated so as to be used as a resource under an environmentally favorable pattern/condition. SOLUTION: The steel slag treatment method has a step A for injecting molten slag or the like in a rotary drum in which a metallic ball group is housed, bringing the slag into contact with the metallic ball group rolling in the rotary drum to cool and pulverize the slag by the physical action of the rolling metallic ball group and a step B for bringing the pulverized slag material obtained in the step A into contact with carbon dioxide to react uncarbonated Ca in the pulverized slag material with carbon dioxide. The steel slag is treated up to granulated slag with durable and simple equipment, a pulverizing or aging treatment for recovering metal is unnecessary and such an environmental friendly slag product that high pH eluted water is not produced even when the treated slag is used for civil engineering material is obtained.

**1st Main Claim**

[MT] treatment of steelmaking slag according to claim 1, characterized in that the product or use and shipped as crushed slag to slag having passed through the step (B) 2.

**Assignees:** JFE STEEL KK; JFE HOLDINGS INC



## 379. Family 34204682 (US7176159 BA)

[View in PatBase](#)

### Title

[EN] CATALYST AND SORBENT MATERIAL FOR THE PRODUCTION OF HYDROGEN

### Abstract

[EN] A catalyst and sorbent is disclosed which comprises pellets with an absorbent core and a protective shell with a catalyst in the shell. Such material is especially well suited for steam reforming of hydrocarbons to produce hydrogen since a reforming catalyst can be incorporated in the shell and a sorbent for the by-product carbon dioxide can be used for the core. It is also well suited for producing hydrogen from carbon monoxide by means of the water gas shift reaction. The shell can be made sufficiently strong and durable for moving bed applications as well as fixed bed applications.

### 1st Main Claim

[EN] 1. A composition for promoting industrial gas-phase chemical reactions which produce H<sub>2</sub> and CO<sub>2</sub> while simultaneously separating the H<sub>2</sub> from the CO<sub>2</sub> comprising: an interior core comprising a calcium-based compound; a porous protective shell encasing the core, whereby the shell allows diffusion of CO<sub>2</sub> to the core; and a catalyst contained in the shell.

**Assignees:** UNIV IOWA STATE RES FOUND INC

380. Family 89062050 (US2021403335 AA)

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Title (EP4171785 A1)

[EN] METHODS AND SYSTEMS FOR FORMING VATERITE FROM CALCINED LIMESTONE USING ELECTRIC KILN

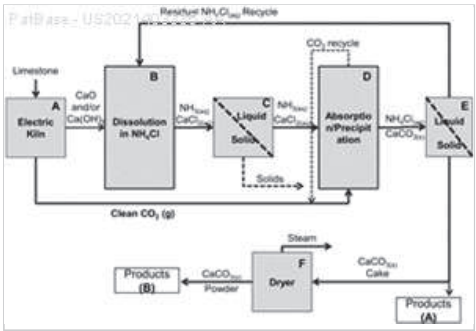
Abstract (EP4171785 A1)

[EN] Provided herein are zero carbon dioxide (CO<sub>2</sub>) emission processes and systems to carry out the processes, comprising a) calcining limestone in a cement plant in an electric kiln to form a mixture comprising calcium oxide and a first gaseous stream comprising clean carbon dioxide, wherein the clean carbon dioxide comprises no gaseous or non-gaseous components from combustion of fuel; b) treating the mixture comprising calcium oxide with a N-containing salt solution under one or more dissolution conditions to produce a first aqueous solution comprising calcium salt; and c) contacting the first aqueous solution with the first gaseous stream comprising clean carbon dioxide under one or more precipitation conditions to produce a precipitation material comprising vaterite, aragonite, calcite, or combinations thereof.

1st Main Claim (EP4171785 A1)

[EN] 1. A zero carbon dioxide (CO<sub>2</sub>) emission process, comprising: a) calcining limestone in a cement plant in an electric kiln to form a mixture comprising calcium oxide and a first gaseous stream comprising clean carbon dioxide, wherein the clean carbon dioxide comprises no gaseous or non-gaseous components from combustion of fuel; b) treating the mixture comprising calcium oxide with a N-containing salt solution under one or more dissolution conditions to produce a first aqueous solution comprising calcium salt; and c) contacting the first aqueous solution with the first gaseous stream comprising clean carbon dioxide under one or more precipitation conditions to produce a precipitation material comprising vaterite, aragonite, calcite, or combinations thereof.

Assignees: ARELAC INC; AIRUILAIKE CO LTD



381. Family 102961921 (DE102022004469 A1)

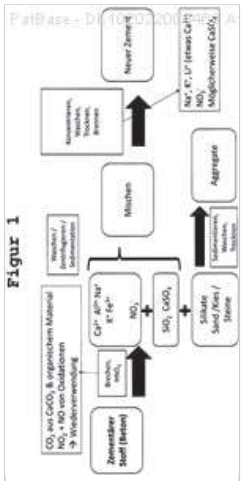
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**Title**  
[MT] CHEMICAL REPROCESSING OF CONCRETE

**Abstract**  
[MT] The invention describes a catalytic process for the simple and encompassed decomposition of cement stone. The method can be used to decompose cement stone into building scrap and thus release the aggregates. Various materials can be obtained separately from one another from the cement stone by means of chemical work-up. The substances obtained from the decomposed cement stone can be used as CO2-negative, faculted CaCO3 (precipitated calcium carbonate, PCC), complementary cementing materials (SCM) or as starting materials for cement without CO2 debt from the raw materials. To give calcium carbonate into soluble calcium salts. It is therefore an alternative method for the production of PCC from limestone, which already works at 100 degrees centigrade.

**1st Main Claim**  
[MT] 1. Method for treating cement-containing substances, comprising the following steps:  
i. providing at least one cement-containing substance, wherein the cement present may still be setting-related and/or set, preference is given to set cement-containing substances which are obtained as waste material, such as old concrete or cement screeds;  
ii. optionally comminuting the at least one cement-containing substance to acceptable size, preferably < 200 cm of maximum diameter, preferably < 50 cm of maximum diameter, preferably < 20 cm of maximum diameter, more preferably < 8 cm of maximum diameter, to increase the reaction rate, more preferably < 4 cm of maximum diameter, However, without the additives present being crushed, therefore preferably with dimensions of >0.1 cm of intensified minimum diameter, preferably >0.5 cm of intensified minimum diameter, preferably >1 cm of intensified minimum diameter, particularly preferably >3 cm of intensified minimum diameter and, with knowledge of very large additive, particularly preferably >6 cm of intensified minimum diameter;  
iii. To add a salt whose cation on addition of water is in equilibrium with the corresponding base to the at least one raw material, the salt is preferably an ammonium salt with NH<sub>3</sub> The corresponding base, particular preference being given to ammonium chloride;  
iv. optionally heating the mixture, preferably to boiling with removal of the gases formed;  
v. optionally separating the reaction mixture into solution and solid by suitable measures, such as sedimentation or filtration.

**Assignees:** HOFMANN TOMMY ALFRED



382. Family 60983284 (CN105116855 A)

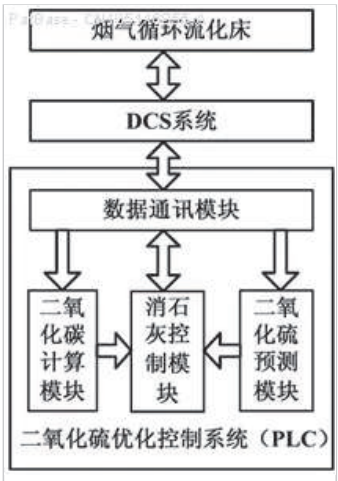
[View in PatBase](#)

Title

[EN] OPTIMAL CONTROL METHOD FOR FLUE GAS CIRCULATING FLUIDIZED BED DESULPHURIZATION

Abstract

[EN] The invention discloses an optimal control method for flue gas circulating fluidized bed desulphurization in the technical field of thermal power plant desulphurization. A DCS system is connected with a flue gas circulating fluidized bed and a PLC-based sulfur dioxide optimal control system. The sulfur dioxide optimal control system is formed as follows: a sulfur dioxide prediction module and a carbon dioxide calculation module are respectively connected with a data communication module and a hydrated lime control module, and the hydrated lime control module is connected with the data communication module. The data communication module and the DCS system exchange data. According to the invention, the content of CO<sub>2</sub> in the flue gas at the inlet of a desulfurization tower is calculated through an SO<sub>2</sub> prediction model. The feeding amount of hydrated lime can be adjusted timely, dynamically and accurately. Excessive emission of SO<sub>2</sub> and the waste of hydrated lime and resources are avoided fundamentally, and CO<sub>2</sub> emission is reduced to a certain extent. The method is of high reference value in engineering.



1st Main Claim

[MT] 1. Optimization method for controlling a circulating fluidized bed flue gas desulfurization, wherein, DCS systems are connected to a circulating fluidized bed flue gas sulfur dioxide and PLC-based control system optimization, optimization of the sulfur dioxide control system sulfur dioxide and carbon dioxide by the prediction module calculation module respectively connected data communications module and a control module slaked lime, hydrated lime control module data communication module; a data communication module and DCS systems to exchange data with each other; wherein said optimizing control method comprising the following components:

- 1) data communication module for exchanging data via ModBus protocol and DCS systems;
- 2) sulfur dioxide prediction module reads the real-time operational data from DCS system via data communication module: flue gas desulfurization tower inlet concentration of sulfur dioxide, flue gas desulfurization tower entrance flue volume, calcium hydroxide particle diameter, flue gas desulfurization tower exit velocity and lime for quantity, concentration slaked lime desulfurization tower desulfurization mechanism model predicts exports of sulfur dioxide;
- 3) carbon dioxide computing module reads through the data communication module from the DCS system real-time operating data: desulfurization tower entrance flue gas, sulfur dioxide and carbon monoxide volume, enter the total amount of wind to coal boiler and calculated smoke desulfurization tower entrance the volume of carbon dioxide Road;
- 4) Lime sulfur dioxide control module combines predictive value, calculated value of carbon dioxide, the desulfurization tower furnace temperature, furnace pressure and hydrated lime desulfurization tower through the data communication module reads the feeding amount of real-time operating data, through fuzzy PID regulation, slaked lime instruction to the feeding amount of data sent over the communications module to the DCS controller to DCS system issuing an instruction to the field device; wherein the predicted value of sulfur dioxide, carbon dioxide, sulfur dioxide value calculations and entrance desulfurization tower as given instruction, the furnace temperature and desulfurization desulfurization tower tower furnace pressure as feedforward command.

**Assignees:** UNIV NORTH CHINA ELEC POWER; NORTH CHINA ELECTRIC POWER UNIV

## 383. Family 96164965 (CN115745447 A)

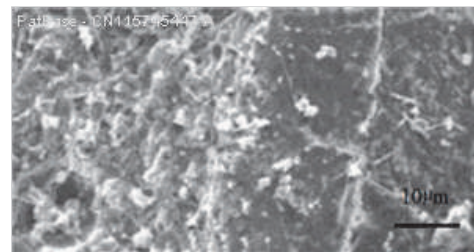
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### Title

[EN] CONCRETE PREPARED BY RECYCLING WASTE CONCRETE AND PREPARATION METHOD THEREOF

### Abstract

[EN] The invention provides concrete prepared by recycling waste concrete and a preparation method thereof, and belongs to the technical field of concrete. Waste concrete is smashed, soaked in an alkaline solution containing calcium ions and subjected to microwave heating, coarse aggregate and fine powder are obtained, the coarse aggregate and waste brick powder are mixed and calcined, carbonation, surface polydopamine modification, mixing with nano metakaolin and ball milling are conducted, and a reinforced mixture is obtained; mixing with water, calcium hydroxide and tetraethoxysilane, stirring and reacting to obtain a regenerated silicate material; stirring and reacting the fine powder with calcium hydroxide and sodium silicate under a microwave heating condition to obtain activated fine powder; the regenerated silicate material, the activated fine powder, the chemical additive, the fly ash, the slag powder, the cement and the water are uniformly mixed to obtain the concrete prepared by regenerating the waste concrete, the concrete has relatively good durability, low shrinkage rate and small water absorption rate, the waste concrete and waste wall materials such as waste bricks are used as raw materials, a large amount of building waste is recycled, and the cost is reduced. Wide application prospects are realized.



### 1st Main Claim

[MT] 1. A method for producing concrete for regenerating waste concrete, characterized in that the waste concrete is pulverized, immersed in an alkaline solution containing calcium ions, and subjected to microwave heat treatment. Obtaining a coarse aggregate and a fine powder, wherein the coarse aggregate is calcined in admixture with the waste brick powder after crushing the waste brick, and after carbonation, the surface is subjected to polydopamine modification, It is then mixed with nano metakaolin and reacted with ball milling to give a fortified mixture, which is mixed with water, calcium hydroxide, The orthosilicate is mixed and stirred to form a gel, pulverized, and dried to produce a regenerated silicate material; Stirred reaction with calcium hydroxide and sodium silicate to obtain activated fines; reacting the regenerated silicate material, activated fines, chemical admixtures, fly ash, The slag powder, cement, water are mixed uniformly to give waste concrete to be regenerated to prepare concrete.

**Assignees:** NATURE LUNENG ENG CO LTD

## 384. Family 94672500 (CN115385479 A)

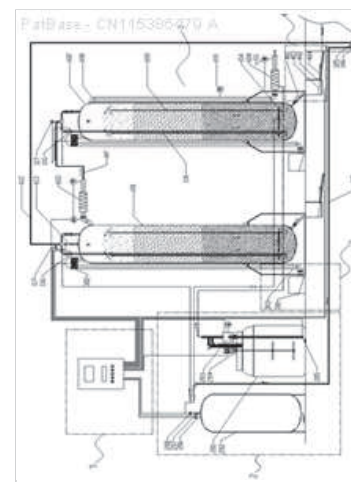
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### Title

[EN] POLYMERASE CHAIN REACTION (PCR) HARDNESS REMOVAL COUPLED CARBON CAPTURE MULTI-PHASE REACTION DEVICE AND METHOD FOR COAL CHEMICAL INDUSTRY WASTEWATER PELLETS

### Abstract

[EN] The invention relates to the technical field of coal chemical industry wastewater treatment, and particularly discloses a coal chemical industry wastewater pellet PCR hardness removal coupling carbon capture multi-phase reaction device and a coal chemical industry wastewater pellet PCR hardness removal coupling carbon capture multi-phase reaction method. The device comprises a PCR (Polymerase Chain Reaction) module, a dosing module, a crystal feeding module, a crystal discharging module and an intelligent control module, the PCR module is divided into a heavy-phase reaction tank and a light-phase reaction tank, and comprises a reaction tank filled with pellets, a medicament mixer, a first water inlet pump, a second water inlet pump and a water outlet pipe; the chemical dosing module comprises a chemical storage tank, a metering pump and a CO<sub>2</sub> storage tank; according to the multi-phase reaction device and method disclosed by the invention, CO<sub>2</sub> gas and PCR are synchronously introduced, so that CaCO<sub>3</sub> crystals are continuously generated by  $\text{Ca}^{2+}$  and are gathered and attached to the surfaces of pellets, and the crystals are continuously grown, so that large-particle seed crystals continuously move downwards, large-particle pellet crystals are discharged out of the reaction tank after the large-particle seed crystals reach the bottom of the tank body, and the hardness removal coupling carbon capture process is completed; and the problem that the seed crystal is lost along with water is effectively solved, and the hardness removal effect is improved.



### 1st Main Claim

[MT] 1. A Coated wastewater pellet PCR Dehardcoupled Carbon Capture Multiphase reaction apparatus, characterized by comprising a PCR module (1), a dosing module (2), a dosing module (3), a dosing module (3), a dosing module (3), a dosing module (2), a dosing module (3), a A discharge module (4) and a mental control module (5);

Said PCR module (1) comprises a heavy-phase reaction tank (101), at least one light-phase reaction tank (102), a first medicament reactor (103), a second medicament reactor (104), a first water inlet pump (105), A second inlet pump (106), a two-phase tank connection pipe (107) and an outlet pipe (108), the heavy-phase reaction tank (101) and the light-phase reaction tank (102) being vertically arranged and filled with pellets inside, The two-phase tank connection pipe (107) is provided between the upper ends of the heavy-phase reaction tank (101) and the light-phase reaction tank (102), and the first medicament reactor (103) is provided on the tank connection pipe (107), The outlet pipe (108) is connected to an upper end of a light phase reaction tank (102), and the second medicament reactor (104) is provided on the outlet pipe (108);

The heavy-phase reaction tank (101) is provided with a vaporized ash water inlet pipe a (112) having one end connected to a first feed pump (105) and an ammonia-vaporized wastewater inlet pipe (113) disposed at the other end extending into the lower end of the heavy-phase reaction tank (101), An aerator (114) at the bottom of the heavy-phase reaction tank (101) and the light-phase reaction tank (102) is connected together with a vaporized ash water inlet pipe B (115), and an end portion of the vaporized ash water inlet pipe B (115) is connected to a second feed pump (106);

The dosing module (2) comprises a medicament reservoir (201), a metering pump (203) and Co<sub>2</sub>A reservoir (202), the metering pump (203) having one end connected to the medicament reservoir (201) by tubing and the other end connected to the first medicament reactor (103), the second medicament reactor (104) by tubing, the CO being connected to the first medicament reactor (103), the second medicament reactor (104); The storage tank (202) is provided with two air lines connected to the gasified ash water inlet pipe a (112) and the gasified ash water inlet pipe B (115), respectively;

The seed delivery module (3) is arranged in no less than two sets and the seed delivery module (3) is arranged in correspondence with a heavy-phase reaction tank (101) or a light-phase reaction tank (102), comprising a seed delivery tank (301) and a seed delivery device (302), The seed transport device (302) is arranged at the upper end of a heavy phase reaction tank (101) or a light phase reaction tank (102) and is electrically connected to the output of the mental control module (5), the seed transport device (302) being connected to the seed transport tank (301) by a seed transport pipe (303);

The seeding module (4) is provided in no less than two sets, and the seeding module (4) is provided in correspondence with a heavy-phase reaction tank (101) or a light-phase reaction tank (102), including a seed discharge pipe (401) and a seed discharge filter tank (402), The seed discharge pipe (401) is connected to the lower end of the heavy-phase reaction tank (101) or the light-phase reaction tank (102), and the seed discharge filter (402) is provided below the seed discharge pipe (401) for receiving discharged material.

**Assignees:** GONGDA ENV CO LTD

## 385. Family 85077854 (KR102256470 B1)

[View in PatBase](#)

### Title

[EN] SELF-HEALING COMPOSITION AND CONCRETE REPAIR COMPOSITION THEREOF

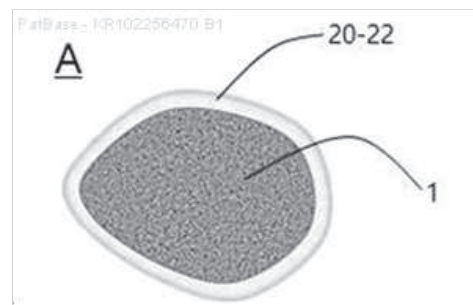
### Abstract

[EN] The present invention relates to a self-healing composition comprising: a composition (1) including 90 to 94 wt percent of calcium hydroxide, 3 to 6 wt percent of sodium carbonate, and 2 to 5 percent wt percent of bentonite; and a liquid (10) for kneading, which is mixed in the composition (1) to knead the composition (1), wherein the composition (1) and the liquid (10) for kneading are mixed in a weight ratio of 9:1 to 7:3. Calcium hydroxide, sodium carbonate, and bentonite are substances which react with halogen ions, such as CO<sub>2</sub>, Cl<sup>-</sup>, Br<sup>-</sup>, and degradation factors, such as SO<sub>4</sub>, present in a salty environment, and react with water or ions above to generate products such as C-H, gypsum, ettringite, CaCO<sub>3</sub>, and C-S-H, filling a crack surface. The present invention relates to the self-healing composition capable of self-healing by the moisture penetrating through a crack when a crack occurs in a vulnerable environment, and the concrete repair composition using the same.

### 1st Main Claim

[MT] 1. 3 to 6 parts by weight of 90~94% by weight calcium hydroxide; sodium bentonite 2-5% by weight of the composition, the composition comprising (1) (1) to be kneaded dough is mixed in the composition comprising the liquid (10), wherein the composition is a liquid 10 (1) and the dough is mixed at a weight ratio of 9:1~7:3, and the dough for the liquid 10 is mixed in ethanol and water, 9: 1 to 9.5: 0.5 are mixed in a weight ratio of 1, the coating solution is coated on the surface (20), the coating solution is from 1:20 is coated with a material 21 and water mixed in a weight ratio of 100 to 3: 97, the coating material 21 and a water-soluble polyvinyl alcohol PVA polymer is 5: 5 ~ 7: 3 are mixed in a weight ratio of 1, wherein the sodium carbonate, calcium hydroxide, (1) a mixture of the bentonite a composition for mixing the composition; wherein the composition of the dough kneading the dough by mixing the liquid (10); wherein the composition is a liquid 10 (1) and the dough is split; splitting the mixed dough in the dough (20) into a coating that is coated with the coating solution; by a manufacturing method comprising the step of splitting production and, at the same time the dough. The size of the length and width of 1~3mm, into 0.02~0.05mm, the coating step, and spraying the coating solution 20 to by heating to a temperature of 75 to 85 °C to form a coating layer (22), characterized in that the self-healing composition.

**Assignees:** DAUM ENG



## 386. Family 107444251 (CN119750972 A)

[View in PatBase](#)

### Title

[MT] A KIND OF LOW-CARBON FOAMED CONCRETE WITH EXCELLENT STABILITY AND PREPARATION METHOD THEREOF

### Abstract

[MT] [0001] The invention discloses a low-carbon foamed concrete with excellent stability and a preparation method thereof, and the preparation method is as follows: 1) weighing raw materials according to a ratio; 2) mixing pulp fiber with water to obtain a pulp fiber suspension; 3) mixing a physical foaming agent, a foam stabilizer and water evenly, stirring to obtain a foaming liquid, and introducing carbon dioxide gas into the foaming liquid to obtain foam; 4) mixing the pulp fiber suspension, low-calcium clinker, fly ash and the remaining water evenly, and then pouring the obtained foam into it, and continuously introducing carbon dioxide gas into the system while stirring to obtain a foamed concrete slurry; 5) casting the foamed concrete slurry into shape, placing it at room temperature to remove the mold, pre-curing, and then placing it in a carbonization chamber for carbonization to obtain a finished product. The invention introduces carbon dioxide into the low-calcium clinker by carbon dioxide foaming and secondary introduction of carbon dioxide gas to cause the low-calcium clinker to undergo a carbonization reaction, and can form a stable pore structure in the concrete.

### 1st Main Claim

[MT] 1. A low-carbon foamed concrete with excellent stability, characterized in that its preparation method is as follows:

1) Weigh the raw materials according to the mass ratio: 60-100 parts of low-calcium clinker, 10-40 parts of fly ash, 2-8 parts of pulp fiber, 0.4-0.9 parts of physical foaming agent, 0.1-0.2 parts of foam stabilizer, and 90-120 parts of water;

2) Mix the pulp fibers with 20 to 40 parts of water, stir evenly to fully disperse the pulp fibers, and let stand for 2 to 4 hours to obtain a pulp fiber suspension;

3) mixing a physical foaming agent, a foam stabilizer and 50 parts of water evenly, stirring to obtain a foaming liquid, and introducing carbon dioxide gas into the foaming liquid to foam to obtain foam;

4) mixing the pulp fiber suspension obtained in step 2), low-calcium clinker, fly ash and remaining water uniformly, and then pouring the foam obtained in step 3) into the mixture, and continuously introducing carbon dioxide gas into the system while stirring to obtain foamed concrete slurry;

5) The foamed concrete slurry obtained in step 4) is cast and formed, and after being placed at room temperature for 1 day, the mold is removed, and then it is moved into a standard curing room for pre-curing, and then placed in a carbonization room for carbonization, so as to obtain low-carbon foamed concrete with excellent stability.

387. Family 97819475 (CN116274270 A)

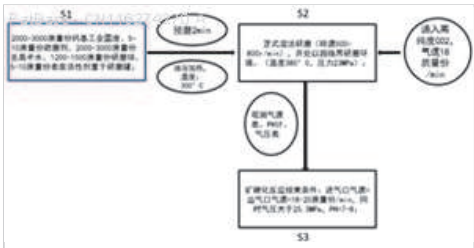
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Title

[EN] METHOD FOR EFFICIENT INTEGRATED CARBON SEQUESTRATION BY WET GRINDING

Abstract

[EN] The invention relates to the technical field of carbon dioxide sequestration, in particular to a method for efficient integrated carbon sequestration through wet grinding, and discloses the method for efficient integrated carbon sequestration through wet grinding. Comprising the following steps: putting 2000-3000 parts by mass of calcium-based industrial solid waste, 5-10 parts by mass of a grinding aid, 2000-3000 parts by mass of deionized water, 1200-1500 parts by mass of grinding balls and 5-10 parts by mass of a surfactant into a wet grinding machine, and carrying out wet grinding treatment. According to the efficient integrated carbon sequestration method utilizing wet grinding, by applying a high-temperature and high-pressure supercritical grinding environment, the diffusion coefficient of CO<sub>2</sub> in water is increased, the mass transfer resistance of CO<sub>2</sub> in water is eliminated, a new carbon mineralization reaction surface is continuously created under the action of wet grinding, the gas-solid type ore carbonization reaction rate is remarkably increased, and the carbon sequestration efficiency is improved. The ore carbonization reaction is completed in a short time, and the carbon sequestration raw material reaches a theoretical carbon sequestration value in the ore carbonization reaction.



1st Main Claim

- [MT] 1. A method for efficient integrated carbon fixation using wet milling, comprising the steps of: Providing a wet milling process;
- 1) carrying out a wet grinding treatment by placing 2000 to 3000 parts by mass of a calcium-based industrial solid waste, 5 to 10 parts by mass of a grinding aid, 2000 to 3000 parts by mass of deionized water, 1200 to 1500 parts by mass of grinding balls, and 5 to 10 parts by mass of a surfactant in a wet mill;
  - 2) Pass in CO<sub>2</sub> And keep the grinding environment constant at high temperature and high pressure, the grinding environment pressure and gas speed reach stability, the conditions for the end of the mineral carbonization reaction stop wet grinding to obtain slurry;
  - 3) The slurry is allowed to stand for 3-5 hours, put into the granulator, using the conveyor belt to be conveyed to the calciner for calcination, after calcination can be obtained as a solid carbon substrate for blending.

**Assignees:** UNIV HUBEI TECHNOLOGY; HUBEI UNIV OF TECHNOLOGY

388. Family 97963270 (CN116354625 A)

[View in PatBase](#)

Title

[EN] CARBON-SEQUESTRATION EARLY-STRENGTH CLINKER-FREE LOW-CARBON CEMENTING MATERIAL AND USE METHOD THEREOF

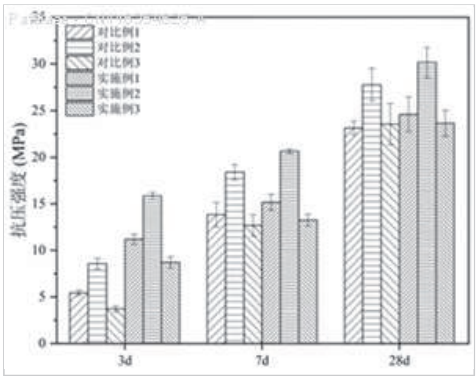
Abstract

[EN] The invention relates to a carbon-sequestration early-strength clinker-free low-carbon cementing material and a using method thereof. The raw materials comprise calcined clay and a calcium hydroxide component, and the mass ratio of the calcined clay to the calcium hydroxide component is (7-5): (3-5); when in use, the calcined clay and the calcium hydroxide component are taken in proportion and added into a stirrer to be mixed, and a gelling component is obtained; adding water and a water reducing agent into the gelling component, mixing, sealing a stirrer, and introducing CO<sub>2</sub> gas into the stirrer under a stirring condition; stirring is stopped after uniform mixing, and meanwhile, CO<sub>2</sub> gas is stopped from being introduced, so that a mixture is obtained; and pouring and molding the mixture, and removing the mold and maintaining after the mixture is condensed. The calcium hydroxide component in the raw materials and the calcined clay are subjected to a pozzolanic reaction to generate C-A-S-H gel and other products, and a strength source can be continuously provided for the low-carbon clinker-free cementing material and corresponding products; and by virtue of a mixing mode of introducing CO<sub>2</sub> while stirring, relatively excellent early strength development is realized.

1st Main Claim

[MT] 1.A low-carbon cementitious material with a solid-carbon premature strength without clinker, characterized in that the raw material comprises calcined clay and calcium hydroxide component, and the mass ratio of calcined clay to calcium hydroxide component is (7 to 5): (3 to 5).

**Assignees:** WUHAN UNIV OF TECHNOLOGY; UNIV WUHAN TECH



389. Family 57371569 (KR20140109071 A)

[View in PatBase](#)

Title

[EN] ECO-FRIENDLY COATING MATERIAL FOR ROAD PAVIG AND PAVING METHOD THEREOF

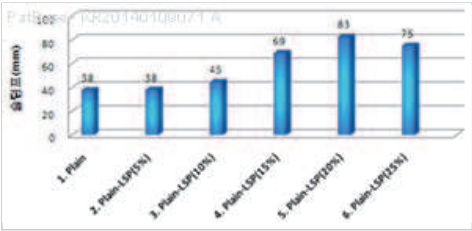
Abstract

[EN] Disclosed in the present invention are an environmentally friendly coating material for paving a road, which is characterized by comprising 5-10 parts by weight of a limestone powder for the weight of cement and having 0.40-0.45 of the ratio of water and a binder; and an environmentally friendly method for paving a road. Thus, bleeding is reduced, hydration heat is controlled, economic feasibility is increased, and carbon dioxide emission during manufacturing is reduced.

1st Main Claim

[MT] 1. 5 to 10 parts by weight, limestone powder cement; includes, water-binder ratio is characterized in that the environment-friendly road pavement 0.40~0.45 coating material.

**Assignees:** SAM WOO INNOVATION MAINTENANCE CONSTRUCTION CO LTD; KNU IND COOPERATION FOUND



390. Family 100406097 (CN117263536 A)

[View in PatBase](#)

Title

[EN] PREPARATION METHOD AND APPLICATION OF ULTRAHIGH-ACTIVITY SOLID WASTE-BASED CARBON SEQUESTRATION AUXILIARY CEMENTING MATERIAL

Abstract

[EN] The invention provides a preparation method and application of an ultrahigh-activity solid waste-based carbon sequestration auxiliary cementing material, and belongs to the technical field of building materials. The method comprises the following steps: (1) pre-grinding the medium-low-activity high-aluminum pozzolanic solid waste to a corresponding particle size range to obtain medium-low-activity high-aluminum pozzolanic solid waste pre-ground micro powder, and adding a corresponding composite chemical additive in the pre-grinding process; and (2) mixing the carbon sequestration solid waste, the medium and low activity high-aluminum pozzolanic solid waste pre-ground micro powder and the calcium-increasing component according to a specific mass ratio, and carrying out ultrafine grinding to a corresponding particle size range to obtain the ultrahigh activity solid waste-based carbon sequestration auxiliary cementing material. According to the ultrahigh-activity solid waste-based carbon sequestration auxiliary cementing material prepared by the method disclosed by the invention, the activity index of 30 percent of the cementing material can reach S130-S145 level, and the activity index of 50 percent of the cementing material can reach S120-S130 level.

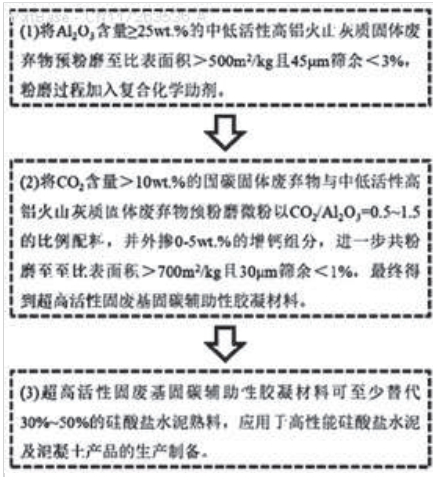
1st Main Claim

[MT] 1. A process for the preparation of an ultra-high activity solid waste carbon-based auxiliary cementing material, characterized in that the process comprises the steps of:

- (1) pre-grinding medium-low activity high aluminum pozzolanic solid waste to obtain medium-low activity high aluminum pozzolanic solid waste pre-grinding fine powder, adding the corresponding composite chemical auxiliary during pre-grinding;
- (2) mixing solid carbon waste with medium-low activity high aluminum pozzolanic solid waste pre-pulverized fine powder, calcium-enhancing component and ultra-fine pulverized to a predetermined particle size range, that is, to obtain ultra-high activity solid waste based solid carbon auxiliary cementing material;

The predetermined particle size range is 30 micro m sieve < 1 percent and specific surface area > 700m<sup>2</sup>.<sub>In the first place.</sub>

Assignees: NANJING UNIV OF TECHNOLOGY; UNIV NANJING TECH



## 391. Family 56733352 (KR101400483 B1)

[View in PatBase](#)

### Title

[EN] ECHO-FUNCTIONAL COMPOSITIONS OF BLOCKS

### Abstract

[EN] The present invention relates to a block for masonry and purification and, more particularly, to a block composition which is suitable for an eco-friendly environment while maintaining the strength of a cement block. One aspect of the present invention provides a block composition including: a stone material which includes 45 to 55 parts by weight of decomposed granite soil, 20 to 40 parts by weight of sericite, and 15 to 25 parts by weight of solidifier containing a pozzolanic mineral material; a natural mineral binder which includes alkali metal or alkaline earth metal; and an inorganic coagulant containing polyglutamic acid and calcium. Since the block of the present invention contains components returning to nature through weathering when long period of time passes after the block is discarded, the costs for processing wastes can be reduced. Also, the compressive strength of an existing cement block can be achieved, the energy used for sintering can be reduced and the emission of carbon dioxide which can be a cause of the green house effect can be suppressed by manufacturing bricks and blocks with non-sintering curing method without using an existing high temperature sintering process.

### 1st Main Claim

[MT] 1. Masato 45 to 55 parts by weight, sericite 20 to 40 parts by weight, containing a solidifying agent pozzolanic mineral material comprises 15 to 25 parts by weight; alkali metal or alkaline earth metal stone comprising a natural mineral binders; and, polyglutamic acids and calcium including an inorganic flocculant: including, but, wherein the natural mineral, 12 to 23 parts by weight of coupling agent is KCL, MGCL<sub>2</sub>, NACL 4 ~ 22 ~ 28 parts by weight of 9 parts by weight of 12 to 24 parts by weight of the CACL<sub>2</sub>, Na<sub>2</sub>SO<sub>4</sub>, and 1 to 4 parts by weight, the liquid comprising a binder 1 to 3% by weight with respect to 100 parts by weight of block composition.

**Assignees:** AHN SANG PYO

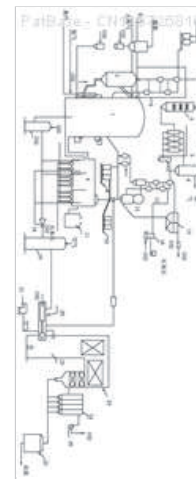
## 392. Family 96130836 (CN115725810 A)

[View in PatBase](#)

**Title**  
[EN] DEVICE AND METHOD FOR PREPARING CEMENT CLINKER THROUGH INTEGRATION AND COUPLING OF ULTRA-LOW CO<sub>2</sub> STEELMAKING AND GAS MAKING

### Abstract

[EN] The invention discloses a device and a method for preparing cement clinker by integrating and coupling ultra-low CO<sub>2</sub> steelmaking and gas making, which are characterized in that one-carbon chemistry is taken as a main line, unit process optimization integration is taken as a way, heat is released by oxidation reaction of coal coke and O<sub>2</sub>, reaction heat is provided for a plurality of reactions, and energy consumption and CO<sub>2</sub> emission are greatly reduced. By integrating coal gasification and direct reduction and electromagnetic melt separation of iron ore powder in one device, the invention relates to the technical field of steel smelting, coal gasification and cement clinker. According to the ultra-low CO<sub>2</sub> steelmaking and gas making integrated and coupled cement clinker preparation device and method, the processes of heating, decomposition, reduction, melting, slag iron melting and the like of furnace charge are guaranteed, the high-temperature calcination process of the cement clinker is omitted, and high-temperature decomposition of carbonate minerals is completed through generated blast furnace gas. The integrated technology of pulverized coal gasification, ironmaking and steelmaking, heat energy power generation, coal gasification production and cement clinker sintering is achieved.



### 1st Main Claim

[MT] 1. Ultra-low Co<sub>2</sub> Apparatus for steel making, gas making integrated and coupled to cement clinker, characterized in that it comprises an integrated system of coal gasification, molten reduction and melting division of iron ore fines, an integrated continuous steel making system, The solvent limestone suspension decomposition system, the cement clinker-forming system of liquid slag, steel slag and the residual heat recovery system are capable of simultaneously producing molten iron, (CO+H)<sub>2</sub> Gas, molten steel, cement clinker and steam of at least 85 Score, said coal gasification, molten reduction of iron ore fines and melting fraction integrated into an integrated device comprising a feed system, Gasification, direct reduction and melting shaft furnace (1), high-temperature cyclone (2), 4-stage suspension cyclone preheater (3), waste heat boiler (4), bag dust collector (5) and sulfur removal. Decarburization means (6);

The gasification, direct reduction and melting shaft furnace (1) is provided with, in turn, an accident iron discharge port, an iron water flow port (117), a slag discharge port (116), an inclined lance (105), from bottom to top, A drawer-type waste steel addition device (118), a lower gasification nozzle (104), a direct feed back blow nozzle (106) separated by a high temperature cyclone (2), a solvent nozzle (107), an upper gasification nozzle (108), A suspension preheated ore spray inlet (109), a roof temperature regulating oxygen gun (111), a horizontal flue (110) at the furnace outlet, a natural gas and steam spray outlet (112) at the furnace outlet;

The feed system communicates with the gasification, direct reduction and electromagnetic melting shaft furnace (1) via pneumatic conveying ducts, nozzles, and the gasification, direct reduction and electromagnetic melting shaft furnace (1) communicates with the high temperature cyclone (2) via the top hearth outlet horizontal flue (110), The top gas outlet of the high-temperature cyclone (2) communicates with a 4-stage suspension cyclone preheater (3), and the bottom solids outlet of the high-temperature cyclone (2) is fed back through a return valve to a direct feed back jet (106) of the gasification, direct reduction and electromagnetic melting shaft furnace (1), The primary preheater outlet of the 4-stage suspension cyclone preheater (3) is connected to a waste heat boiler (4), and the preheated iron ore powder is separated into gasification via the bottom of the powder-stage preheater cyclone drum. A suspension preheated ore powder injection inlet (109) of a direct reduction and electromagnetic melting shaft furnace (1), said waste heat boiler (4) gas outlet communicating with a bag dedusting apparatus (5) via a sulfur, decarburization unit (6), and a sulfur, decarburized coal gas removed via pipeline transport to produce, Carbon dioxide gas is pressurized as a transport gas;

The feeding system consists of iron ore powder metering feeding means (16), fine powder and coal powder pneumatic conveying means, suspension preheated ore powder, solvent and reduced ore powder spraying means;

The gasification, direct reduction and smelting shaft furnace (1) consists, from bottom to top, of a furnace cylinder (115), an electromagnetic melting fraction, a pulverized coal gasification and melt reduction part, a coal gasification and iron ore fine direct reduction part;

The superstructure of the gasification, direct reduction and melting shaft furnace (1) consists of an outer shell subjected to static pressure, a submerged water-cooled wall (113) and a membrane water-cooled wall (114) water-cooled structure, the inner elements of which form a gasification, a molten reduction space (101) and a gasification, A direct reduction space (102) between which the gasification, fusion reduction space (101) and the gasification, direct reduction space (102) is a convergent structure in the form of a Venturi, and a Venturi-convergent throat dividing the space into upper and lower parts, The bottom part is a submerged water-cooled wall (113) and the top part is a membrane water-cooled wall (114) structure, The bottom of the gasification, direct reduction and smelting shaft furnace (1) is a furnace cylinder (115) formed by an electromagnetic division space consisting of an electromagnetic induction water-cooled coil (103) and a thin-walled furnace lining and a copper-cooled wall and a lining of a brick;

The continuous steelmaking apparatus (8) is constituted by a rectangular bath, the rectangular bath melt section being divided into three bath tanks consisting of a refractory retaining wall and a clear bridge, the upper space of the bath being in communication, and the melt between the two tanks being connected by means of a flow hole which is a channel in the lower part of the retaining wall and the clear bridge, An up-dip design, with a molten iron inlet and a molten steel outlet (810) respectively provided in front and rear cell walls, the molten iron inlet being provided with a water port, the water port being opened or closed by a stopper (802), the molten iron inlet being in communication with the molten iron flow port of the shaft furnace through a horizontal flow channel and an

upflow channel. An electromagnetic brake (801) is provided at the horizontal flow path to control the flow rate and flow rate of the molten iron, and the divided molten pool is divided from front to rear into three molten pools: Desilicium, sulfur phosphorus molten pool, decarbonated molten pool, Decarburization and sulfur de, phosphorus melts and deoxygenation function zones for the three melts fitted with different numbers of oxygen nozzles at the bottom, corresponding to the initial, mid and late smelting stages of the converter steel. The nozzle is an inner and outer sleeve, the inner tube being sparged with oxygen, the inner tube being looped with a protective medium between the inner and outer tubes, and the refractory sealing the roof of the cell, the roof of the cell being provided with a bellless blast furnace applicator (803) for a first phosphorus phase. A second de-phosphorus stage belowless blast furnace distributor (804) and a steelmaking gas outlet (809), the steelmaking gas outlet conduit communicating with the bottom of the lime decomposition furnace (12) and a composite bubble atomizing nozzle (20) of the slag residue heat recovery system, temperature measurement, composition of the molten steel, flow rate, and the wall bridge. A flow rate detection apparatus for automatic control, a ceiling tube (812) is installed below the roof of the pool, heating carbon dioxide gas as blown liquid slag and protecting the ceiling tube (812) of the pool, a sidewall of the pool being provided with a first slag inlet (805), and a flow rate detection apparatus for detecting the flow rate of the pool. A second slag outlet (807), a first slag outlet (806), and a second slag outlet (808);

The gasification, direct reduction and electromagnetic melting shaft furnace (1) enters a continuous steelmaking unit (8) via a horizontal flow path and an ascent flow path through an iron flow port (117), and the continuous steelmaking unit (8) is connected to a roof bin (9) and a waste steel, iron ore and flux metering uploading unit (10), The steelmaking bath molten steel outlet (810) flows into the tapping deoxygenation device (11), The gas outlet (809) at the top of the steel-making bath pool is flared into the bottom of the decomposition furnace (12) and the flue gas is passed through a lime stage 5 cyclone suspension preheater (13), a dust collecting unit (14), a separation purification unit (15), and a pressure unit (15) for gas delivery and blending. Limestone powder is passed from the silo via the metering feed device (16) to stages 1-4 of the 5 stage cyclone suspension preheater (13) and passed to the decomposition furnace (12) via stage 4 gas-solid separation, after decomposition via the 5th stage gas-solid separation, separated lime powder enters the silo and is conveyed to the gasification via gas-solid separation. A solvent spray tube (107) of a direct reduction and electromagnetic melting shaft furnace (1), an oxygen nozzle (811) and a clinker-generating tank (19) of a continuous steelmaking apparatus (8), a composite bubble atomizing nozzle (20);

The slag tapping (116) of the gasification, direct reduction and electromagnetic melting shaft furnace (1) flows into and out of the molten slag overflow tank (17), and flows out of the molten slag, which flows in communication with the slag inlet (805) and the slag inlet (807) of the continuous steelmaking unit (8), With a continuous steelmaking unit (8) slag outlet (806), The slag liquid outlet (808) enters the mixed liquid venturi (18), mixes, mixes, mixes and enters the clinker-generating tank (19), a compound bubble atomizing nozzle (20), and is injected into the waste heat boiler furnace (22). Heat droplets are solidified by cooling, heat exchange blower (21) in the hearth, and the solidified gas flows through the heating surface (23) of the afterheat boiler, and the solidified gas flows into the clinker dust collector (24) and the dust is collected into the clinker silo (25), and the dust is collected into the clinker silo (25). The exhaust gases are evacuated by a fan (26).

**Assignees:** SHANGHAI CHICHUN ENERGY SAVING TECH CO LTD

393. Family 90912051 (KR102386364 B1)

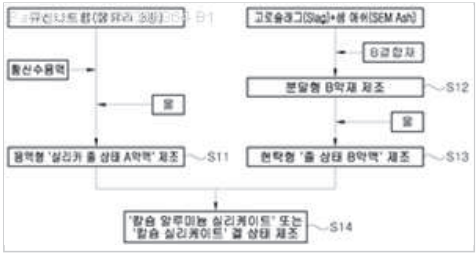
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Title

[EN] MANUFACTURING METHOD OF LOW-CARBON RESOURCES CIRCULATION TYPE GROUT INGREDIENT WITHOUT USING CEMENT AND GROUTING METHOD USING THE SAME

Abstract

[EN] The present invention relates to a manufacturing method of a low-carbon resource circulation type grout material and a grouting construction method using the same. An objective is to prevent environmental pollution due to the toxicity of cement by not using cement and to reduce the amount of carbon dioxide generated during cement manufacturing. In the manufacturing method of a grout material used when grouting construction is performed to form a barrier wall in the ground during construction work or civil engineering work, the manufacturing method comprises: (a) a step of preparing a solution-type medicine solution A by mixing sodium silicate, an aqueous solution of sulfuric acid at a concentration of 5 to 10 percent, and water (S11); (b) a step of preparing a powdered medicine B by mixing blast furnace slag, SEM ash, and a binder B (S12); (c) a step of mixing the powdered medicine B prepared in step S12 with water to prepare a suspension type medicine solution B (S13); and (d) a step of preparing calcium aluminum silicate or calcium silicate in a gel state by mixing the silica sol medicine solution A prepared in step S11 and the sol medicine solution B prepared in step S13 (S14).



1st Main Claim

[MT] 1. A method of manufacturing a grout material used when performing grouting to form a water barrier in an architectural or civil offshore ground, comprising the steps of, (a) mixing sodium silicate, a sulfuric acid aqueous solution having a concentration of 5~10%, and water to prepare a solution-type A chemical solution (S11), (b) mixing blast furnace slag (Slag), B binder to prepare a powdery B drug (S12), (c) mixing the powdery B drug prepared in step S12 with water to prepare a suspensory B drug (S13), (d) mixing the A drug in the silica sol state prepared in step S11 with the B drug in the sol state prepared in step S13, And a step (S14) of preparing calcium aluminum silicate in a gel state or calcium silicate, wherein in step S11, sodium silicate 25 to 50 wt%, sulfuric acid aqueous solution having a mass concentration of less than 10% 10 to 25 wt%, water 40 to 50 wt% are mixed to prepare a solution A chemical solution in a silica sol state, In the step S12, a pulverulent slag (Slag) 50 to 70 wt%, leaky ash (SEM Ash) 5 to 20 wt%, B binder 10 to 45 wt% are mixed to prepare a powdery B chemical, wherein the B binder comprises calcium oxide (CaO), calcium hydroxide (CaOH), calcium carbonate (CaCO<sub>3</sub>), calcium sulfate (CaSO<sub>4</sub>), and the powdery B chemical prepared in the step S12 and water are mixed at a weight ratio of 1: 1 to 2 to prepare a sol-gel suspension B chemical solution.

Assignees: JO A RA

## 394. Family 92057229 (CN114656207 A)

[View in PatBase](#)

### Title

[EN] FOAM CONCRETE BASED ON CALCIUM SLAG CARBONIZATION AND PREPARATION METHOD THEREOF

### Abstract

[EN] The invention discloses foam concrete based on calcium slag carbonization, which is mainly composed of the following components in percentage by mass: 15-25 percent of siliceous raw material, 5-15 percent of calcium slag, 60-80 percent of lightweight aggregate, 60-65 percent of water and 10-20 percent of foam, based on the total mass of the siliceous raw material and the calcium slag, the water accounts for 60-65 percent of the total mass of the siliceous raw material and the calcium slag, and the foam accounts for 10-20 percent of the total mass of the calcium slag and the lightweight aggregate. The use amount of the foam is 4-6 percent of the total mass of the two, and the density of the foam is  $4.7-5.3 \times 10^{-2} \text{ g/cm}^3$ . According to the concrete, a large amount of stainless steel slag and steel slag can be consumed, high-value utilization of waste slag is achieved, the use amount of cement is reduced, meanwhile, part of carbon dioxide is solidified through carbonization reaction, and carbon emission reduction can be achieved; the invention further discloses a preparation method of the foam concrete. The method is simple in process, low in production cost and short in production period.

### 1st Main Claim

[MT] 1. A foamed concrete based on calcium slag carbonization, characterized by consisting essentially of siliceous feedstock, calcium slag, light aggregate, water and foam, wherein the weight percentages of said siliceous feedstock, calcium slag and light aggregate are respectively 15~ 25%: 5~ 15% And 60 to 80%, based on the total mass of siliceous raw material and calcium slag, water is used in an amount of 60 to 65%, foam is used in an amount of 4 to 6%, and foam has a density of 4.7 to  $5.3 \times 10^{-2} \text{ g/cm}^3$ .

**Assignees:** GUANGDONG INST OF BUILDING MAT CO LTD

## 395. Family 94434312 (CN115340165 A)

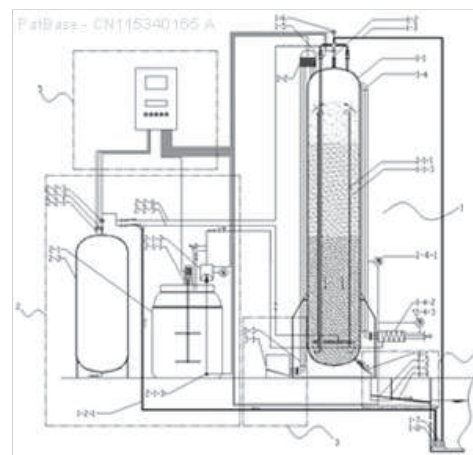
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### Title

[EN] COAL CHEMICAL INDUSTRY WASTEWATER PELLET PCR HARDNESS REMOVAL COUPLING CARBON CAPTURE DEVICE AND METHOD

### Abstract

[EN] The invention relates to the technical field of coal chemical industry wastewater treatment, and particularly discloses a coal chemical industry wastewater pellet PCR hardness removal coupling carbon capture device and a coal chemical industry wastewater pellet PCR hardness removal coupling carbon capture method. The device comprises a PCR (Polymerase Chain Reaction) module, a dosing module, a crystal feeding module, a crystal discharging module and an intelligent control module, the PCR module comprises a reaction tank filled with pellets, a medicament mixer, a first water inlet pump, a second water inlet pump and a water outlet pipe; the chemical dosing module comprises a chemical storage tank, a metering pump and a CO<sub>2</sub> storage tank; according to the pellet PCR hardness removal coupling carbon capture method, a designed pellet PCR hardness removal coupling carbon capture device is utilized, gasification ash water to be treated and ammonia distillation wastewater are introduced into a reaction tank, then a certain weight of special pellet seed crystals prepared according to the component proportion are added, CO<sub>2</sub> gas is synchronously introduced, and a PCR reaction is performed to enable  $\text{Ca}^{2+}$  to continuously generate CaCO<sub>3</sub> crystals, the CaCO<sub>3</sub> crystals are gathered and attached to the surfaces of pellets, so that the pellet PCR hardness removal coupling carbon capture method is realized. And continuously crystallizing and growing, so that the large-particle seed crystal continuously moves downwards, and large-particle pellet crystals are discharged out of the reaction tank after reaching the bottom of the tank body, thereby completing the hardness removal coupling carbon capture process.



### 1st Main Claim

[MT] 1. A coal chemical waste water pellet PCR decoupled hard-coupled carbon capture device, characterized by comprising a PCR module (1), a dosing module (2), a dosing module (3), a seeding module (4) and a smart control module (5);

The PCR module (1) comprises a reaction tank (1-1) vertically disposed and internally filled with pellets (1-1-3), a medicament mixer (1-4-2), a first water inlet pump (1-7), a second water inlet pump (1-8) and an outlet pipe (1-4). A flow guide cylinder (1-1-1) is provided in the reaction tank (1-1), the outlet pipe (1-4) is connected to an upper end of the reaction tank (1-1), and the medicament mixer (1-4-2) is provided on the outlet pipe (1-4). A top end of said reaction tank (1-1) is provided with a gasification ash water inlet pipe a (1-2) and an ammonia-distilled wastewater inlet pipe (1-3), said gasification ash water inlet pipe a (1-2) having one end connected to the first water inlet pump (1-7), and the other end projecting into the lower end of the reaction tank (1-1). An aerator (1-1-2) at the bottom of the reaction tank (1-1) is connected with a gasification ash water inlet pipe b (1-2-1), and an end of the gasification ash water inlet pipe b (1-2-1) is connected with a second water inlet pump (1-8);

The administration module (2) comprises a medicament storage tank (2-1), a metering pump (2-1-2), and a CO<sub>2</sub> storage tank (2-2), one end of the metering pump (2-1-2) being connected to the medicament storage tank (2-1) by tubing. The other end is connected to the medicament mixer (1-4-2) through a pipe, and two gas pipes are provided on the CO<sub>2</sub> storage tank (2-2), and the two gas pipes are respectively connected to the gasification ash water inlet pipe a (1-2) and the gasification ash water inlet pipe b (1-2-1);

The seed dosing module (3) comprises a seed transfer tank (3-1) and a seed transfer device (3-2), the seed transfer device (3-2) being disposed at an upper end of the reaction tank (1-1) and electrically connected to an output end of the smart control module (5), the seed transfer device (3-2) being connected to the seed transfer tank (3-1) through a seed transfer pipe (3-3);

The seed seeding module (4) comprises a seed discharge pipe (4-1), the seed discharge pipe (4-1) being connected at a lower end of the reaction tank (1-1), and a seed discharge tank (4-2) being disposed below the seed discharge pipe (4-1) for receiving discharged material.

**Assignees:** GONGDA ENV CO LTD

## 396. Family 88016513 (CN113636808 A)

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### Title

[EN] SELF-CLEANING CEMENT-BASED COMPOSITE MATERIAL AND PRODUCTION METHOD THEREOF

### Abstract

[EN] The invention discloses a self-cleaning cement-based composite material and a production method thereof, and the production method comprises the following steps: aramid fibers containing 18-38 percent wt of inorganic basalt fibers, glass fibers and ceramic fibers, fibers, aramid fibers, a photocatalytic material, nylon fibers, vinylon fibers are input in a fiber twisting machine for being knitted to 64 fiber threads; the obtained fiber lines can be input into a fiber cloth knitting machine to be knitted into net-shaped fiber cloth with the mesh being 1 m\*1 m and the breadth being 2.00 m; a large amount of CO<sub>2</sub> can be sucked in the curing process of fresh concrete, calcium silicate and a small amount of hydration products in cement clinker react with CO<sub>2</sub> to generate calcium carbonate and silica gel, high early strength can be obtained, the concrete curing time is greatly shortened, good size stability and other performance are achieved, the process of emission reduction is achieved by introducing tailings as a modifying component, the nano-modified concrete component can continuously absorb carbon dioxide in the atmosphere, and meanwhile, the overall mechanical property and durability of the building material can be improved.

### 1st Main Claim

[MT] 1. A self-cleaning cement-based composite material and a production method, characterized by comprising the steps of:

Step 1: knitting aramid, fiber, aramid fiber, photocatalytic material, nylon fiber, veneer fiber and input fiber into a twisting machine containing 18~ 38% wt inorganic basalt fiber, glass fiber, ceramic fiber and aramid fiber;

Step 2: weaving the resulting fiber thread input fiber cloth weaving machine into a mesh fiber cloth having a mesh 1mx1m and a mesh width of 2.00 m;

Step 3: Poly ethylene fiber, polypropylene fiber, polyester fiber, polyphenylene sulfide fiber, poly acrylonitrile staple fiber and the resulting web fiber cloth containing 8~ 18% wt ceramic fiber or type e glass fiber, basalt inorganic fiber are input into a thermal insulation tunnel by a conveyor belt;

Step 4: Place cement, water, fine aggregate, fly ash, silica ash, granulated blast furnace slag, metakaolin and water reducer in a blender to stir;

Step 5: adding staple fibers to agitate a combination of PVA staple fibers and steel fibers;

Step 6: a graphene oxide suspension is added, wet-mixed in a cement sand blender, after the end of the wet-mixing, the semiconductor photocatalyst and the naphthalene-based high efficiency water reducer and the cement sand blender are mixed;

Step 7: Place powders such as silicate cement, fly ash and fine sand in a blender to pre-mix uniformly to obtain cementitious powder;

Step 8: Place nanometer silica aerogel composite material, blend water of 30% -50%, efficient water reducer in a blender to mix to form nanometer silica aerogel composite suspension;

Step 9: pouring the nanometric silica aerogel composite suspension into a ready-mixed uniformly cementitious material powder, adding the remaining amount of water of blending, and stirring uniformly to obtain a fresh blend;

Step 10: pouring the mixture obtained above into a mould;

Step 11: Moisture maintenance of cement, taking care to observe changes in the state and temperature of the cement.

**Assignees:** SUZHOU KUOPING ENVIRONMENTAL PROTECTION TECH CO LTD

397. Family 98141203 (CN116425481 A)

[View in PatBase](#)

Title

[EN] REINFORCING STEEL BAR SLEEVE GROUTING MATERIAL AND PREPARATION METHOD THEREOF

Abstract

[EN] The invention discloses a reinforcing steel bar sleeve grouting material and a preparation method thereof. The reinforcing steel bar sleeve grouting material comprises the following components in parts by mass: 550-700 parts of cement clinker powder; 40 to 80 parts of silica fume; 200 to 400 parts of regenerated micro powder; 900 parts to 1100 parts of reclaimed sand; 12 to 20 parts of an additive; and 12 to 24 parts of an alkali solubilizing activator. The preparation method of the reinforcing steel bar sleeve grouting material comprises the following steps: 1) preparing the silicon mortar material; 2) preparing reclaimed sand-silica fume mixed mortar; and 3) mixing the cement clinker powder, the regenerated micro powder, the additive, the alkali solubilizing activator and the regenerated sand-silica fume mixed mortar. The reinforcing steel bar sleeve grouting material is excellent in performance and low in price, the mixing amount of the regenerated sand and the regenerated micro powder is large, the using amount of the cement and the quartz sand is small, and the problems of small mixing amount and low additional value utilization existing in resource utilization of the construction waste are well solved.

1st Main Claim

[MT] 1. Reinforcement sleeve grout, characterized by comprising the following components in mass parts:

Cement clinker powder: 550 to 700 parts;

Silica ash: 40 to 80 parts;

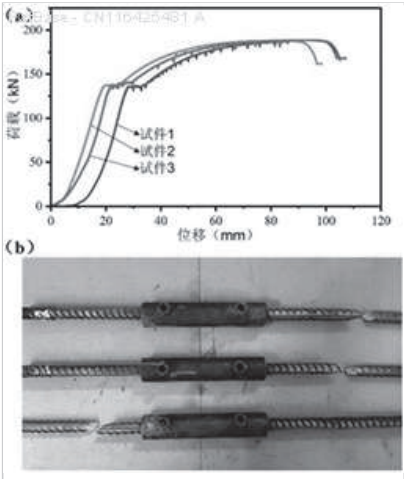
Recycled powder: 200 parts to 400 parts;

Recycled sand: 900 parts to 1100 parts;

Adjugates: 12 to 20 parts;

Alkali solubilizing activator: 12 to 24 parts.

**Assignees:** SOUTH CHINA UNIV OF TECHNOLOGY; UNIV SOUTH CHINA TECH



398. Family 11306173 (WO9744295 A1)

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Title (EP0839123 A1)

[EN] CALCIUM HYDROXIDE RE-ALKALIZATION METHOD

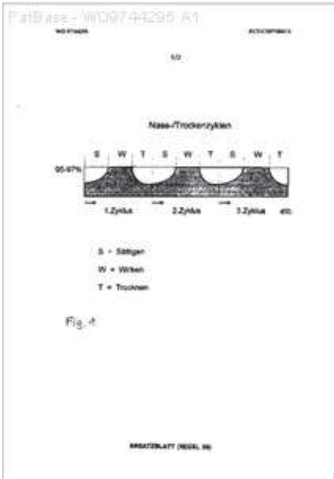
Abstract (EP0839123 A1)

[EN] A method is presented for restoring the alkaline environment in carbonatized top layers of concrete, by activating the calcium hydroxide contained in the concrete. By analogy to observed natural processes, an electrochemical method is described that is intended to re-alkalize the carbonatized top layer, and re-passivate the steel reinforcements that are no longer protected from corrosion by an alkaline environment by means of drying/humidification cycles. This method presupposes parts made of conventional concrete, having the components hardened cement paste, rock aggregate, and capillary pores. The alkaline cement paste, with a pH value of 11-13, is altered chemically over time to carbonatized cement paste with a pH value below 9-10, under the influence of atmospheric carbon dioxide. In contrast to alkaline cement paste, the latter offers no protection against corrosion to the steel reinforcing rods that are immersed in the concrete in reinforced-concrete structures. Increasing risks of corrosions result for civil and structural engineering constructions such as bridges and in industrial constructions. Early recognition of the problem, and restoration of the alkaline environmental conditions for the concrete reinforcements, which protect them from corrosion, contribute to preserving the durability of the construction material.

1st Main Claim

[MT] 1

Assignees: HANS JOACHIM BADZONG DIPL ING; BADZONG HANS JOACHIM



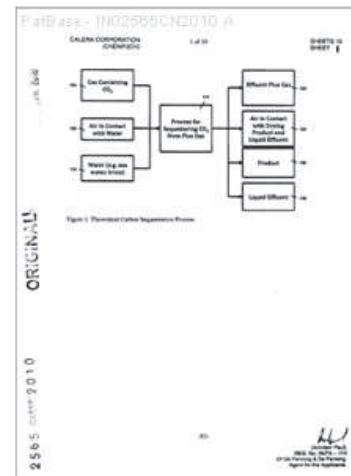
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### Title

## Abstract

[EN] Methods of characterizing and producing compositions with negative delta 13C values are provided. Aspects of the invention include characterizing source materials and process products. Aspects of the invention also include compositions that contain carbon with negative delta 13C values.

[EN] 1. A synthetic composition comprising carbonates, bicarbonates, or a combination thereof, wherein the carbon in the composition has a relative carbon isotope composition ( $\delta^{13}\text{C}$ ) value less than -22.00 percent o.



400. Family 99642966 (WO25025815 A1)

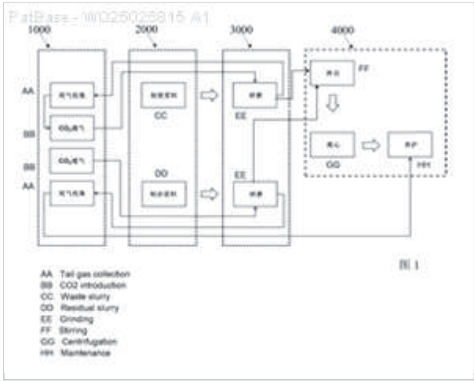
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Title

[EN] METHOD AND SYSTEM FOR PREPARING MULTIFUNCTIONAL CEMENTING MATERIAL BY USING CO<sub>2</sub> IN PIPE PILE FACTORY, AND PIPE PILE

Abstract

[EN] Disclosed in the present invention are a method and a system for preparing a multifunctional cementing material by using CO<sub>2</sub> in a pipe pile factory, and a pipe pile. The method comprises: S1, mixing solid waste, water and a first industrial auxiliary, so as to obtain a first slurry; S2, adding the first slurry in a continuous feeding manner, and subjecting the first slurry to first wet ball-milling in a first CO<sub>2</sub>-containing gas medium; S3, recycling CO<sub>2</sub>-containing tail gas generated in step S2 as the next batch of first CO<sub>2</sub>-containing gas medium, and repeating step S2 so as to obtain a fiber-toughened ultrahigh-activity cementing material; T1, mixing pipe pile residual slurry cement and a second industrial auxiliary, so as to obtain a second slurry; and T2, adding in an intermittent feeding manner the next batch of second slurry after the preparation of a batch of products is finished, subjecting the second slurry to second wet ball-milling in a second CO<sub>2</sub>-containing gas medium to obtain a gel-toughened super-early-strength cementing material, and recovering the generated CO<sub>2</sub>-containing hot tail gas. A CaCO<sub>3</sub> precipitate is generated during the preparation process of the present invention, and CO<sub>2</sub> gas can be solidified, thereby realizing the cementing material utilization of CO<sub>2</sub>.



1st Main Claim

[MT] A pipe pile plant uses CO<sub>2</sub>Process for preparing a multifunctional gum, characterized in that it comprises, in parts by mass,

S1 , 100 parts of solid waste, 18 to 566 parts of water, and 0.59 to 3.33 parts of the first industrial auxiliary are mixed to obtain the first slurry,

S2, using continuous feeding, continuously add the first slurry, the first slurry in the first containing CO<sub>2</sub>Performing a first wet ball milling under a gaseous medium;

S3, the step S2 will produce CO-containing<sub>2</sub>The exhaust gas is used as the first CO in the next batch<sub>2</sub>The gas medium is recycled and the next batch is guaranteed to contain CO in the first batch<sub>2</sub>CO in gas medium<sub>2</sub>Above 5%, repeating step S2 to obtain a fiber toughened ultra-high activity gelling material;

And ,

T1, 100 parts of pipe pile residue slurry, 0 to 40 parts of cement and 1 to 2 parts of second industrial auxiliary agent are mixed to obtain a second slurry,

T2, the intermittent feeding method, in one batch of product preparation is completed and then the next batch of second slurry, the second slurry in the second containing CO<sub>2</sub>A second wet ball mill under gas medium gives a gel toughening super early strong gelling material and recovers the resulting CO-containing material<sub>2</sub>Hot exhaust gases.

**Assignees:** HUBEI UNIV OF TECHNOLOGY; UNIV HUBEI TECHNOLOGY

## 401. Family 67457374 (KR20170124127 A)

[View in PatBase](#)

### Title

[EN] HYDRAULIC LIME MORTAR COMPOSITION USING LOW GRADE DOLOMITE AND MANUFACTURING METHOD THEREOF

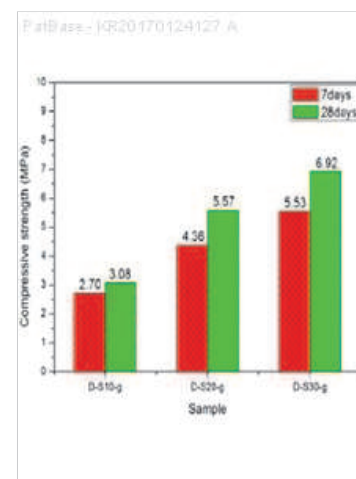
### Abstract

[EN] The present invention relates to a hydraulic lime mortar composition using a low-grade dolomite and a method for preparing the same. In the present invention, by utilizing a domestic low-grade dolomite, a hydraulic dolomite lime, having minerals capable of complexly expressing carbonation reaction and hydration reaction, which are hydraulic lime curing mechanisms composed of  $\text{Ca(OH)}_2$ ,  $\text{Mg(OH)}$ ,  $\text{C}_2\text{S}$  and  $\text{C}_3\text{S}$ , is prepared; a 3-component system hydraulic dolomite lime paste composed of the hydraulic dolomite lime, a blast furnace slag, and an anhydrite is prepared; along with the formation of  $\text{CaCO}_3$  by carbonation reaction through hydration reaction, it was confirmed that an Al-based compound such as an ettringite was prepared in the early age; and it was confirmed that the mortar prepared by using the paste exhibited a physical property equal to or higher than a medium-graded hydraulic lime in accordance with the EU standard in terms of stability, compressive strength and settling time. Therefore, the hydraulic dolomite mortar composition of the present invention has improved stability compared with the conventional non-hydraulic lime mortar composition, and has the hydraulic lime quality equal to or higher than that of a medium-graded hydraulic lime in accordance with the EU standard of the European Standardization Organization, so that commercialization can be immediately attained. If the preparing process of a lime binder and the preparing process of a mortar using the low-grade dolomite of the present invention are industrialized, it is expected that a high value-added industrial market can be newly formed as an effective resource conversion method of waste resources.

### 1st Main Claim

[MT] 1. As lime), and (dolomitic hydraulic circuit of the hydraulic dolomite lime blast furnace slag (slag can chain and gypsum is characterized in that it comprises a hydraulic dolomite lime mortar composition.

**Assignees:** KOREA INST OF LIMESTONE AND ADVANCED MAT



## 402. Family 103171061 (CN118206306 A)

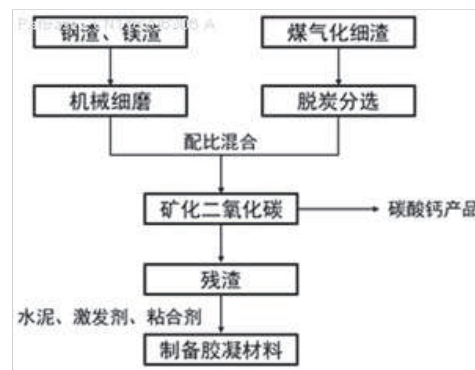
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### Title

[EN] METHOD FOR PREPARING GELLING MATERIAL FROM MULTI-ELEMENT SOLID WASTE MINERALIZED CARBON DIOXIDE AND RESIDUES OF MULTI-ELEMENT SOLID WASTE MINERALIZED CARBON DIOXIDE

### Abstract

[EN] The invention discloses a method for preparing a cementing material from multi-element solid waste mineralized carbon dioxide and residues thereof, and belongs to the technical field of industrial solid waste and fixed carbon utilization. The method comprises the following steps: mechanically and finely grinding and activating steel slag and magnesium slag in advance, and pre-sorting coal gasification fine slag to obtain decarburized coal gasification fine slag; then  $\text{Ca}^{2+}$  in the three raw materials is leached out by utilizing an alcohol amine solution and is used for mineralizing  $\text{CO}_2$  to prepare high-purity nano calcium carbonate; and finally, preparing the binding material from the residual residues. According to the method, the comprehensive utilization value of the multi-element solid waste is effectively improved, and meanwhile, the high-purity nano calcium carbonate product is produced. The method has potential economic, social and environmental benefits.



### 1st Main Claim

[MT] 1. A method for preparing a cementitious material comprising the steps of: Forming a plurality of solid waste mineralized carbon dioxide and its residues;

(1) the steel slag and magnesium slag are activated separately by mechanical fine milling to obtain high reactivity steel slag and magnesium slag powder, the steel slag is then subjected to magnetic separation and deferation, and the iron-rich steel slag is subjected to secondary recycling, and the coal gasification fine slag is subjected to decarburization by recarsation or flotation to obtain decarburized coal gasification fine slag and high carbon fine slag, The high carbon fine slag is recycled and the decarburized coal gasification fine slag is used to mineralize carbon dioxide and prepare gelling materials;

(2) To the deferated steel slag, magnesium slag, decarburized coal gasification fine slag obtained in step (1), add an alkanolamine solution to the alkanolamine solution as the medium to extract  $\text{Ca}^{2+}$  in the sample<sup>2+</sup>To obtain a  $\text{Ca}^{2+}$ -rich<sup>2+</sup>Of alkaline leachate and leachate residues;

(3) placing the leachate obtained in step (2) in a bubble column to carry out a mineralization reaction by passing carbon dioxide through the bubble column, measuring the pH of the solution, until the solution reaches neutrality indicating the completion of the reaction, filtering to obtain a high purity nano-calcium carbonate product, and the reacted alcohol amine solution is used for recycle leaching;

(4) mixing the leaching residue obtained in step (2), cement, excitator and binder to prepare multi-component solid waste cementitious material.

**Assignees:** CHINA UNIV OF MINING AND TECHNOLOGY BEIJING; UNIV CHINA MINING AND TECHNOLOGY BEIJING; CHINA UNIV OF MINING AND TECHNOLOGY

403. Family 34568454 (CN1966443 A)

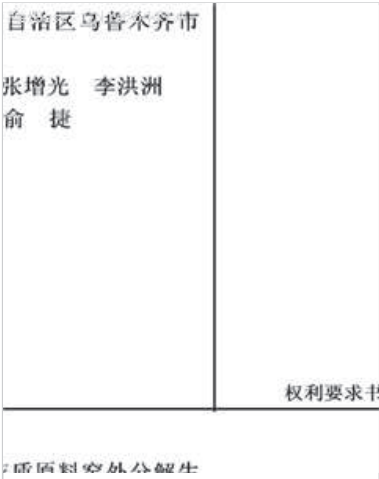
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**Title**  
[EN] CEMENT CHAMOTTE PRODUCTION METHOD OF CALCIUM CARBIDE 100 PERCENT SUBSTITUTING FOR NATURAL CALCIC MATERIAL AND DECOMPOSED OUT OF KILN

**Abstract**  
[EN] The invention relates to a technology to produce cement processed material by acetylene sludge that has totally substituted natural calcareous infarct materials. The technology includes the following steps: pulverizing the raw material: feed the filter pressed acetylene sludge into the beater, exchange heat with hot smoke, the acetylene sludge powder enters the rotoclone collector with the hot smoke, then it's sent to the powder house; the acetylene sludge powder and stove ash is sent to the powder selecting machine, the silex, pulverized coal ash and steel dregs are sent to the drier/pulverizer, the raw material powder is sent to the powder selecting machine and the selected fine powder is sent to the continuous leveling house; burning to the processed materials; the fine powder is sent to the first, second and third wind-spout tube and exchange heat with hot smoke; it is sent to the tubing decomposing stove and then is calcinated in the turning stove, the processed material is discharged from the stove end. The invention has managed to make full use of the industrial wastes which can decrease the cost, energy expenditure and the discharge of CO2. The invention has a high automaticity and the quality of the products in the invention is stable.

**1st Main Claim**  
[MT] 1, an electrical Gravel 100 percent instead of natural calcareous material for manufacturing cement clinker kiln decomposition process, characterized in that: it is composed of the following raw materials in percentage by weight: 75.05 percent silica carbide slag 11.84 ash percent 4.80 percent 8.31 percent slag.

**Assignees:** XINJIANG CONSTRUCTION MATERIAL



## 404. Family 68023369 (CN107522438 A)

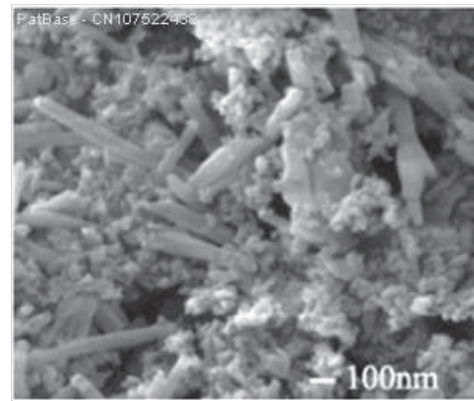
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### Title

[EN] FIBER-REINFORCED COMPOSITE INSULATING MATERIAL AND PREPARATION METHOD THEREOF

### Abstract

[EN] The invention discloses a fiber-reinforced composite insulating material and a preparation method thereof. The preparation method comprises the following steps: firstly, supporting a three-dimensional netty structure of halloysite to prepare a halloysite aerogel by means of a method of coating halloysite with a polymer; introducing a silicon dioxide aerogel to obtain a silicon dioxide-halloysite compound aerogel; and compounding the silicon dioxide-halloysite compound aerogel with foam concrete to obtain the high-strength insulating material. According to the technical scheme, the condition that existing foam concrete is low in strength and poor in insulating and heat-isolating properties is improved. The invention provides the fiber-reinforced composite insulating material and the preparation method thereof. The high strength and insulating and heat-isolating properties of a foam concrete material are improved obviously.



### 1st Main Claim

[MT] 1. A fiber-reinforced composite insulation materials, characterized in that, according to the following steps:

#### Step 1, Preparation

of airgel halloysite 80-100 parts by weight of 500-800 parts by weight of the halloysite added to ethanol, ultrasonic dispersion for 0.5-1h, to which was added 1-3 parts by weight of 2-acrylamido-2-methyl propane sulfonic acid, and stirred at 70-80 degrees centigrade waters thermostatic 0.5-1h, followed by addition of 20-50 parts by weight of amino-terminated poly methyl vinyl siloxane and 0.1-0.5 parts by weight of dibenzoyl peroxide, stirring polymerization reaction 8-24h, to obtain a gel-like product, which is transferred to CO<sub>2</sub> supercritical drying apparatus, the carbon dioxide as a medium, at a temperature of 30-50 degrees Celsius, and pressure 7-10MPa under a supercritical drying 2-5h, to obtain a halloysite airgel; In said step 1, said amino terminated poly methyl vinyl siloxane as a weight average molecular weight vinyl content of 0.1-20wt% of 100000-500000, amino double-terminated or mono- terminated poly methyl vinyl siloxane.

#### Step 2, the silica - halloysite composite airgel preparation

of 80-150 parts by weight of tetraethyl orthosilicate, 100-170 parts by weight of anhydrous ethanol, 80-100 parts by weight of the halloysite airgel obtained in step 1, at 50-70 degrees centigrade under mixing, adding 0.1-1 parts by weight of 12mol / l of an aqueous solution of hydrogen chloride (i.e., hydrochloric acid), room temperature 20-25 degrees Celsius mixed after standing reaction 30-180min, then kept at room temperature 20-25 degrees Celsius 0.01-0.2 parts by weight of solid sodium hydroxide was added and stirred until completely dissolved and mixed evenly, the above solution was allowed to stand 2-6h to obtain a wet gel, the wet gel is placed in the high-pressure supercritical CO<sub>2</sub> extraction device, with CO<sub>2</sub> as the medium at a temperature of 35-50 degrees centigrade and gas pressure 7-10MPa under dried to obtain a silica-3-10h, halloysite composite airgel

#### foam concrete preparation step 3,

the blowing agent is added to 20-80 parts by weight of protein 0.1-1 parts by weight of deionized water, stirring to form a stable foam and the bottom of the container does not appear bleeding phenomenon, resulting protein foaming agent solution; 5-30 parts by weight of cement, 1-20 parts by weight of 0.1-5 parts by weight of raw stone ash, gypsum, mixing 5-60min, so that the dry powder evenly mixed, then add 20-60 parts by weight of deionized water, mixing 10-60min, to obtain a mixed slurry flow state; Step 2 was 10-100 parts by weight of silica - halloysite composite airgel, prepared by mixing a slurry with a protein foaming agent solution mixing evenly to obtain foam concrete; In step 3, the blowing agent is saponin protein plant protein foaming agent, the lime is calcium lime, gypsum building plaster, cement is Portland cement, strength class 42.5 P · O.

**Assignees:** UNIV TIANJIN CHENGJIAN; TIANJIN CHENGJIAN UNIV

405. Family 29070677 (CN1443712 A)

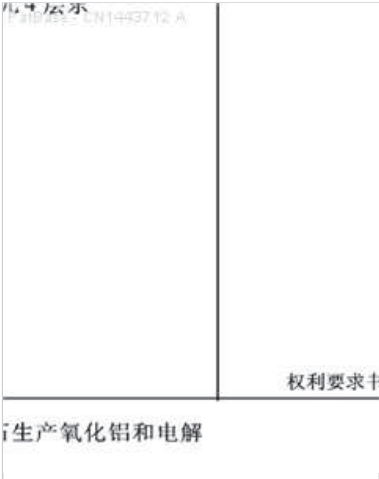
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**Title**  
[EN] Comprehensive utilization of coal gangue for producing alumina and electrolytic aluminium

**Abstract**  
[EN] The present invention discloses a method for comprehensively-utilizing coal gauge to produce alumnia and electrolytic aluminium, and its technical scheme is that the coal gangue power generation process, electrolytic aluminium process and improved production proces sof Al2O3 by using flyash are combined together, the lectricity produced by coal gangue power plant, can be used as energy source forproducing electrolytic aluminium and other power equipments, and the flyash produced by power plant can be used as raw material for producing Al2O3, and the Al2O3 also can be used as raw material forproducing electrolytic aluminium.

**1st Main Claim**  
[MT] Claim 1, coal gangue production of alumina and electrolytic method of utilization of molybdenum, wherein: the existing technical solution is to process coal gangue power generation, aluminum technology and improved powder a process made of coal ash power combine gangue power plants as aluminum and other power electricity energy fly ash produced as a raw material for the production of a l2O3, AlzO3 raw material is aluminum, so enter the system Coal is the main raw material, through a variety of processes, the main products from the system out of the argon alumina, alumina and aluminum.

**Assignees:** KANG REN



406. Family 80580887 (US2021381078 AA)

[View in PatBase](#)

Title (EP3919638 A1)

[EN] MULTI-STAGE REACTION AND SEPARATION SYSTEMS OF A CO<sub>2</sub>-BASED HYDROMETALLURGICAL PROCESS

Abstract (EP3919638 A1)

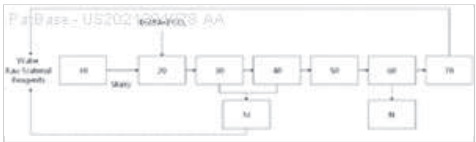
[EN] The present invention is a CO<sub>2</sub> based hydrometallurgical multistage reaction and separation system comprising: a pre-washing device configured to fully mix the feedstock, such as industrial solid waste, mineral and mine tailings with auxiliary reagents and water at specific ratio, a reactor configured to treat the washed slurry with CO<sub>2</sub> bubbling and discharge the treated slurry to the next stage, multistage separators configured to separate solid particles from treated slurry and recycle the unreacted solids back into the pre-washing device, a byproduct preparation device configured to generate calcium and magnesium based products from filtrate containing target elements, a water recirculating device configured to recycle the remaining liquor back to the system. The present invention ensures the whole system is able to continuously and consistently react at maximum capacity through continuous slurry feeding and CO<sub>2</sub> bubbling into the reactors which also enables multistage circulating reaction. Moreover, compared to the current three-phased batch reactions, CO<sub>2</sub> loss and unnecessary time loss derived from repetitive feeding and discharging can be minimized.

1st Main Claim (EP3919638 A1)

[EN] 1. A CO<sub>2</sub> based hydrometallurgical multistage reaction and separation system comprising:

- a pre-washing device, wherein feedstock, such as industrial solid waste, mineral and mine tailings, is continuously added and fully mixed with auxiliary reagents and water at a specific ratio into the pre-washing device;
- a reactor, wherein a washed slurry from the pre-washing device is continuously transferred into the reactor by a pump unit, CO<sub>2</sub> is bubbled into the reactor under a specific pressure in order to be fully mixed and reacted with the washed slurry, a CO<sub>2</sub> treated slurry is continuously discharged from the reactor;
- a multistage separators, wherein the CO<sub>2</sub> treated slurry is filtered by the multistage separators, and unreacted solids are recycled as feedstock into a next stage of the reaction and separation system;
- a by-product preparation device, wherein a filtrate from the multistage separators containing target elements of calcium and magnesium is continuously transferred into the by-product preparation device to form calcium and magnesium based products; and
- a water recirculating device, wherein remaining liquor is recirculated back to the reaction and separation system after a by-product is collected.

**Assignees:** RONGKUANG ENVIRONMENTAL PROTECTION TECH SHANGHAI CO LTD; GREENORE CLEANTECH SHANGHAI CO LTD



## 407. Family 68022957 (CN107522502 A)

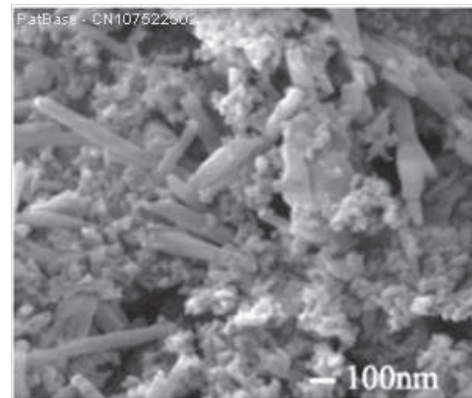
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### Title

[EN] COMPOSITE HIGH-STRENGTH THERMAL INSULATION MATERIAL AND PREPARATION METHOD THEREOF

### Abstract

[EN] The invention discloses a composite high-strength thermal insulation material and a preparation method thereof. The method comprises the following steps: supporting a halloysite three-dimensional meshed structure to prepare halloysite aerogel by utilizing a method for penetrating halloysite through a polymer; introducing silica aerogel to obtain silica-halloysite composite aerogel; and compounding the silica-halloysite composite aerogel with foam concrete, thereby obtaining the high-strength thermal insulation material. According to the technical scheme disclosed by the invention, the defects in some existing technologies are overcome, the performance that the conventional foam concrete is low in strength and poor in heat-insulating property is improved, the composite high-strength thermal insulation material and the preparation method thereof are provided, and the high strength and heat-insulating property of a foam concrete material are obviously improved.



### 1st Main Claim

[MT] 1. A high-strength composite insulation materials, characterized in that, according to the following steps:

#### Step 1, Preparation

of airgel halloysite 80-100 parts by weight of 500-800 parts by weight of the halloysite added to ethanol, ultrasonic dispersion for 0.5-1h, to which was added 1-3 parts by weight of methyl acryloyloxyethyl trimethyl ammonium chloride, at 70-80 degrees centigrade with stirring, and then added into the waters thermostatic 0.5-1h 20-50 parts by weight of amino-terminated poly methyl vinyl siloxane and 0.1-0.5 parts by weight of dibenzoyl peroxide, maintaining the vacuum degree in the 3000-4000pa 10-30min raised to atmospheric pressure, under stirring polymerization 8-24h, to obtain a gel-like product, which is transferred to CO<sub>2</sub> supercritical drying apparatus, the carbon dioxide as a medium, at a temperature of 30-50 degrees Celsius, and pressure 7-10MPa under a supercritical drying 2-5h, to obtain a halloysite airgel; In said step 1, said amino terminated poly methyl ethyl siloxane alkenyl is the weight average molecular weight vinyl content of 0.1-20wt% of 100000-500000, amino double-terminated or mono- terminated poly methyl vinyl siloxane.

#### Step 2, the silica - halloysite composite airgel preparation

of 80-150 parts by weight of tetraethyl orthosilicate, 100-170 parts by weight of anhydrous ethanol, 80-100 parts by weight of the halloysite airgel obtained in step 1, at 50-70 degrees centigrade under mixing, adding 0.1-1 parts by weight of 12mol / l of an aqueous solution of hydrogen chloride (i.e., hydrochloric acid), room temperature 20-25 degrees Celsius mixed after standing reaction 30-180min, then kept at room temperature 20-25 degrees Celsius 0.01-0.2 parts by weight of solid sodium hydroxide was added and stirred until completely dissolved and mixed evenly, the above solution was allowed to stand 2-6h to obtain a wet gel, the wet gel is placed in the high-pressure supercritical CO<sub>2</sub> extraction device, with CO<sub>2</sub> as the medium at a temperature of 35-50 degrees centigrade and gas pressure 7-10MPa under dried to obtain a silica-3-10h, halloysite composite airgel;

#### Step 3, preparation of

the foam concrete foaming agent 0.1-1 parts by weight of the protein is added to 20-80 parts by weight of deionized water, stirring to form a stable foam and the bottom of the container does not appear bleeding phenomenon, resulting protein foaming agent solution; 5-30 parts by weight of cement, 1-20 parts by weight of 0.1-5 parts by weight of raw stone ash, gypsum, mixing 5-60min, so that the dry powder evenly mixed, then add 20-60 parts by weight of deionized water, mixing 10-60min, to obtain a mixed slurry flow state; Step 2 was 10-100 parts by weight of silica - halloysite composite airgel, prepared by mixing a slurry with a protein foaming agent solution mixing evenly to obtain foam concrete; In step 3, the blowing agent is saponin protein plant protein foaming agent, the lime is calcium lime, gypsum building plaster, cement is Portland cement, strength class 42.5 P · O.

**Assignees:** UNIV TIANJIN CHENGJIAN; TIANJIN CHENGJIAN UNIV

408. Family 58417411 (TW201504373 A)

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Title

[EN] ADHESIVE AGENT, FIREPROOF SHEET MATERIAL STRUCTURE, TEMPERATURE INSULATION DEVICE OF INNER AND EXTERNAL PIPES AND ADHESIVE MANUFACTURING METHOD

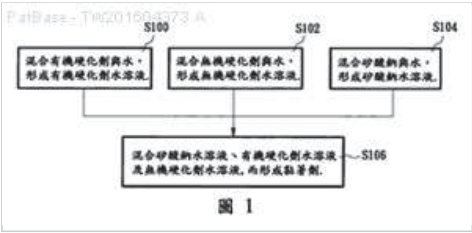
Abstract

[EN] A kind of adhesive agent, which includes: sodium silicate, organic hardener and inorganic hardener; wherein, the said sodium silicate, organic hardener and inorganic hardener are mutually mixed.

1st Main Claim

[MT] 1 an adhesive, including: silicon, sodium, organic and inorganic hardening agent hardening agent; wherein the sodium silicate, the organic hardener and the hardener are mixed inorganic, organic hardening agent is selected Since glyceryl triacetate ((CH<sub>3</sub> COOCH<sub>2</sub>)<sub>2</sub> CHOOCCH<sub>3</sub>), ethylene glycol acetate ester (C<sub>4</sub> H<sub>8</sub> O<sub>3</sub>), butyl acetate (CH<sub>3</sub> COO (CH<sub>2</sub>)<sub>3</sub> CH<sub>3</sub>), amyl acetate (CH<sub>3</sub> COO (CH<sub>2</sub>)<sub>4</sub> CH<sub>3</sub>), butyrate (CH<sub>3</sub> (CH<sub>2</sub>)<sub>2</sub> COOCH), amyl butyrate (CH<sub>3</sub> (CH<sub>2</sub>)<sub>2</sub> COO (CH<sub>2</sub>)<sub>4</sub> CH<sub>3</sub>), dimethyl succinate (CH<sub>3</sub> OOC (CH<sub>2</sub>)<sub>2</sub> COOCH<sub>3</sub>), n-propyl acetate (CH<sub>3</sub> COOC<sub>3</sub> H<sub>7</sub>), acetate (CH<sub>3</sub> COOCH<sub>3</sub>), dimethyl glutarate (CH<sub>3</sub> OOC (CH<sub>2</sub>)<sub>3</sub> COOCH<sub>3</sub>), adipic acid dimethyl ester (CH<sub>3</sub> OOC (CH<sub>2</sub>)<sub>4</sub> COOCH<sub>3</sub>), acetic acid 2- (2-ethoxyethoxy) ethyl (C<sub>8</sub> H<sub>16</sub> O<sub>4</sub>), glycol ether acetate (CH<sub>3</sub> COOCH<sub>2</sub> CH<sub>2</sub> OC<sub>2</sub> H<sub>5</sub>), ethylene glycol butyl ether acetate resin (CH<sub>3</sub> COOCH<sub>2</sub> CH<sub>2</sub> CH<sub>2</sub> CH<sub>2</sub> OC<sub>2</sub> H<sub>5</sub>), isooctyl acrylate (C<sub>11</sub> H<sub>20</sub> O<sub>2</sub>), propyl acetate, butyl glycol ester (Diethylene Glycol Monobutyl Ether Acetate (Butyl Carbitol Acetate), 1,2- propylene carbonate (C<sub>4</sub> H<sub>6</sub> O<sub>3</sub>), ethyl acetate, diethylene glycol (Diethylene Glycol Monoethyl Ether Acetate (Ethyl Carbitol Acetate)), glycol ether acetate (CH<sub>3</sub> COOCH<sub>2</sub> CH<sub>2</sub> OC<sub>2</sub> H<sub>5</sub>), carbon dioxide (CO<sub>2</sub>) and a group consisting of an organic acid in at least one of the inorganic hardening agent selected from inorganic acids, ammonium chloride (NH<sub>4</sub> Cl), aluminum (AlCl<sub>3</sub> Chloride 3), polyvalent metal oxides, hydroxides, alkali metal silicate fluoride, ammonium fluoro silicate, silica silica (SiO<sub>2</sub>), silane (Silane), quaternary ammonium silicate, Portland cement, light calcium, calcium ash, gypsum, calcium halide, aluminum sulfate (Al<sub>2</sub> (SO<sub>4</sub>) Group 3), slag, slag, ash and carboxyl or hydroxyl-containing polymer composed of at least one, but above excluding the higher fatty acids, inorganic acid-free hot phosphoric acid.

Assignees: LIN CHENG CHUEH



409. Family 99704253 (CN118290068 A)

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Title

[EN] COLD-MIXED AND COLD-PAVED NEW AGGREGATE PAVING FABRIC AND MANUFACTURING METHOD THEREOF

Abstract

[EN] The invention relates to a cold-mixed and cold-paved new aggregate paving material and a manufacturing method thereof, and the manufacturing method comprises the following steps: mixing a medicament into common gravel, coating and curing gravel concrete by adding a coagulant of the medicament, and adding water-based light-hardened resin of the medicament for cold mixing, so as to obtain the cold-mixed and cold-paved new aggregate paving material. According to the present invention, the raw materials are combined so as to harden and slow down the pre-cold mixing curing speed of the gravel concrete, such that the cold-mixing and cold-paving new aggregate paving material is completed through the pre-cold mixing, and the cold-mixing and cold-paving new aggregate paving material does not need to be subjected to heating treatment, i.e., is paved on the predetermined road surface in the cold paving manner so as to achieve the purposes of reducing the emission of carbon dioxide, heat and the like, and reducing the energy consumption; and therefore, the energy-saving and carbon-reducing effects are achieved, and the environment-friendly demand can be met.

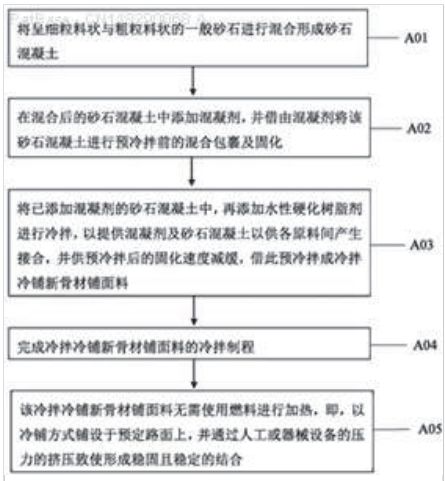
1st Main Claim

[MT] 1. A cold mix cold spread new bone decking material comprising sandstone concrete and a medicament, characterized in that the composition comprises a mixture of a first and a second polymer, a second polymer, a second polymer, and a second polymer.

The sand concrete is a fine-grained and coarse-grained general sand mix of paving material; and

The medicament is an aqueous photohardener resin added to the sandstone concrete, comprising a coagulant for forming the sandstone concrete into a wrap and cure for the sandstone concrete, the coagulant being a material comprising calcium carbonate, magnesium carbonate, lime, glass powder and carbon ash, And the aqueous photohardener resin agent is a material raw material comprising a hardener, a blowing agent, a retarder, and an aqueous photohardener resin, While the aqueous photo-hardener resin agent is a material feedstock comprising the hardener providing the paving material forming hardening, the blowing agent providing the paving material forming finer, the setting retarder providing the paving material forming slowing the curing speed, and the aqueous photo-hardener resin providing the paving material creating a bond with an aqueous material, And the hardener is a material raw material mixed with an epoxy resin and water, the blowing agent is a material raw material containing ammonium carbonate, The retarder is a material containing a mixture of sea vegetable flour and water.

Assignees: TANG BOYU; TANG PO YU



## 410. Family 88016458 (CN113636806 A)

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### Title

[EN] IMPERVIOUS CORROSION-RESISTANT CONCRETE PREPARED FROM METALLURGICAL SOLID WASTE AND PREPARATION METHOD OF IMPERVIOUS CORROSION-RESISTANT CONCRETE

### Abstract

[EN] The invention discloses impervious corrosion-resistant concrete prepared from metallurgical solid waste and a method of the impervious corrosion-resistant concrete. The concrete comprises the following components: 100 parts of a cementing material, 196-370 parts of coarse aggregate, 132-325 parts of fine aggregate, 0.5-2.2 parts of a high-efficiency water reducing agent, an additive prepared from 0.1 to 4 parts of nano calcium carbonate powder, 0.5 to 20 parts of cold rolling waste emulsion, 0.00625 to 0.0125 part of ferric oxide powder, 0.0125 to 0.025 part of sodium sulfate and 0.0125 to 0.025 part of ethylene glycol, and 32-62 parts of water. The preparation method comprises the steps of mixing the coarse aggregate and the fine aggregate according to the raw material ratio, adding the cementing material, mixing, adding the high-efficiency water reducing agent and the water, uniformly stirring, and adding the dispersed nano calcium carbonate powder before adding the water reducing agent and the water or simultaneously adding the dispersed nano calcium carbonate powder, the water reducing agent and the water. The concrete has the characteristics of few harmful pores, high strength, impermeability, chloride ion absorption, corrosion resistance and the like, the mixing amount of metallurgical solid wastes in the concrete is greater than or equal to 75 percent, high-value utilization of the metallurgical solid wastes is realized, and CO<sub>2</sub> emission is reduced.

### 1st Main Claim

[MT] 1. A method of preparing a permeation resistant corrosion resistant concrete using metallurgical solid waste, characterized in that the parts by mass of each component are: 100 parts by mass of cement, 196 to 370 parts by mass of coarse aggregate, 132 to 325 parts by mass of fine aggregate, 0.3 to 2.2 parts by high efficiency water reducer, and 0. 1~ 4 parts, 0.5~ 20 parts of cold rolled waste emulsion, 0.00625~ 0.0125 parts of iron oxide powder, 0.0125~ 0.025 parts of sodium sulfate, 0.0125~ 0.025 parts of ethylene glycol, and 32~ 62 parts of water.

**Assignees:** ANGANG STEEL CO LTD

## 411. Family 96294557 (CN115784702 A)

[View in PatBase](#)

### Title

[EN] PREPARATION METHOD OF CARBON NEGATIVE GYPSUM-BASED CHARCOAL THERMAL INSULATION PLASTERING MORTAR

### Abstract

[EN] The invention relates to a preparation method of carbon negative gypsum-based charcoal thermal insulation plastering mortar. Belongs to the field of building construction materials. The preparation method solves the problems that the production cost is high, the carbon dioxide emission in the production process is high, and the thermal insulation performance and the fireproof performance of the prepared plastering mortar cannot be considered at the same time in the preparation of the existing thermal insulation plastering mortar. The preparation method comprises the following steps: (1) drying and pyrolyzing biomass wastes; (2) putting the granular biochar into a container, adding the biochar modified solution, vacuumizing, and continuously stirring during the period; filtering redundant solution to obtain modified biochar; and (3) preparing a mixture A and a mixture B from the modified biochar, and uniformly mixing the mixture A and the mixture B to obtain the carbon negative gypsum-based biochar thermal insulation plastering mortar. The invention has the advantages of low production cost, thermal insulation and fireproof performance, low carbon dioxide emission in the production process, realization of negative carbon emission and convenience in construction.

### 1st Main Claim

[MT] 1. A method for preparing a carbasic gypsum-based bio-carbon insulated wipe mortar comprising the steps of:

(I) preparation of biochar: Biomass waste is oven-dried under 50-70 degrees centigrade and pyrolyzed under 350-650 degrees centigrade anaerobic conditions for 1-3 hours to obtain particulate biochar;

(II) Modification of biochar: The particulate biochar obtained in step (I) is placed in a container, the biochar modification solution is added until the particulate biochar is completely soaked, the container is sealed and the internal pressure thereof is reduced to below 0.5 MPa and maintained for 0.5-2 hours. Stirring is continued using a magnetic stirrer during the period, The biochar modification solution is a mixed solution of alkali, oxidizing agent, pore former, and pore former;

(III) preparation of the insulated wipe mortar: 100 to 200 parts of the modified biochar obtained in step (ii), 400 to 800 parts of de-sulfur gypsum, 200 to 400 parts of phosphorus gypsum, 100 to 200 parts of slag powder, 50 to 150 parts of shell powder, 50 to 200 parts vermiculite powder, 100 to 250 parts fine aggregate and 20 to 60 parts crack resistant fibers are placed in a blender and mixed for 2-5 minutes. To obtain mix a, 1 to 5 parts of gypsum retarder, 1 to 5 parts of redispersible latex, and 2 to 6 parts of plant gum powder are thoroughly mixed for 5 to 8 minutes to obtain mix B, mix a and mix B are uniformly mixed, i.e. , to obtain a carbnegative gypsum-based bio-carbon insulated wipe slurry.

**Assignees:** BIOCARBON BUILDING GMBH; COLD CARBON BUILDING MAT CO LTD

412. Family 52133699 (KR20120113476 A)

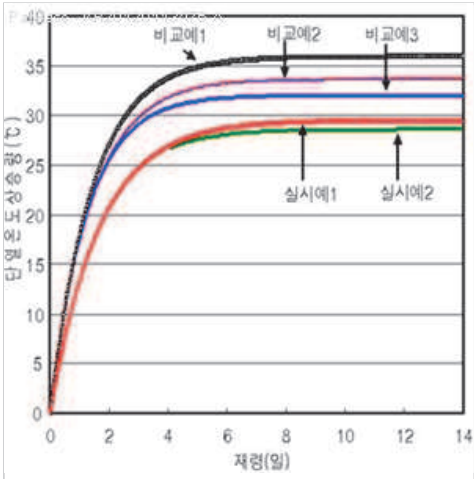
[View in PatBase](#)

Title

[EN] ENVIRONMENTALLY FRIENDLY LOW HEAT MIX CEMENT COMPOSITION, ENVIRONMENTALLY FRIENDLY LOW HEAT CONCRETE USING THEREOF, AND MANUFACTURING METHOD THEREOF

Abstract

[EN] PURPOSE: An environmentally-friendly low-heat mixed cement composition, environmentally-friendly low-heat concrete using the same and a method of manufacture thereof are provided to reduce hydration heat and to enhance early strength manifestation. CONSTITUTION: An environmentally-friendly low-heat mixed cement composition is composed of 20-55.9 wt percent of ground granulated blast-furnace slag, 20-35 wt percent of fly ash, 20-33 wt percent of normal Portland cement, 3-6 wt percent of polymer blast furnace slag, 1-5 wt percent of polymer anhydrous gypsum and 0.1-1 wt percent of alkali activation reagent. The fineness of waste concrete micro powder is 2,500-3,500cm<sup>2</sup>/g. The fineness of polymer blast furnace slag is 4,500-5,500cm<sup>2</sup>/g. The fineness of the polymer anhydrous gypsum is 8,000-12,000cm<sup>2</sup>/g. The environmentally-friendly low-heat mixed cement composition additionally includes 3-10 parts by weight of the waste concrete micro powder based on 100 parts by weight of the mixed cement composition. [Reference numerals] (AA) Heat insulation temperature increasing amount(deg. Celsius); (BB) Comparative example 1; (CC) Comparative example 2; (DD) Comparative example 3; (EE) Practical example 1; (FF) Practical example 2; (GG) Age(day)



1st Main Claim

[MT] 1. In the eco-friendly low exothermic mixing cement composition and 20~55.9 blast furnace slag, 65% by weight and 50% by weight and 20 to 35 parts by weight of fly ash; ordinary Portland cement 20~33%;; the 3-6% by weight of blast furnace slag powder and powder 1-5% by weight and, anhydrite; alkali activator, 0.1 to 1% by weight, and characterized in that it comprises a mixing cement composition with eco-friendly low heat generation.

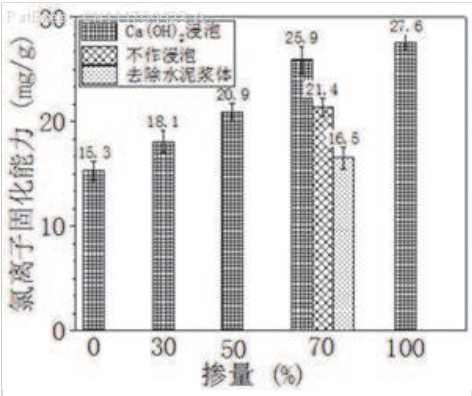
Assignees: HANIL CEMENT CO LTD; DAEWOO ENG AND CONSTR CO LTD

413. Family 81164533 (CN111704423 A)

[View in PatBase](#)

**Title**  
[EN] GREEN CONCRETE WITH HIGH CHLORIDE ION CURING CAPACITY

**Abstract**  
[EN] The invention belongs to the technical field of concrete preparation, and particularly relates to green concrete with high chloride ion curing capacity and a preparation method of the green concrete. The green concrete comprises the following raw materials: 460 to 550 parts of a cementitious material; 175 to 200 parts of water; 1,000 to 1,100 parts of coarse aggregate; 650 to 750 parts of fine aggregate; and 3 to 6 parts of a polycarboxylic acid water reducing agent. According to the green concrete disclosed by the invention, the curing capacity of chloride ions is improved; the service life of the concrete is prolonged; Ca(OH)<sub>2</sub> soaking pretreatment is carried out on the recycled aggregate; a calcium hydroxide solution enters pores of the recycled fine aggregate and reacts with CO<sub>2</sub> in air to generate a large amount of calcium carbonate; according to the method, the recycled fine aggregate is used as a raw material, so that strength support can be provided, the hardened slurry contained in the recycled fine aggregate can be prevented from being further carbonized by external CO<sub>2</sub>, hydration products in the recycled fine aggregate are protected, and the curing effect of concrete chloride ions is improved.



**1st Main Claim**  
[MT] 1. having a high chlorine ionic curing capabilities of green concrete, characterized in that it comprises the following raw materials in parts by weight:

胶凝材料	460-550 份；
水	175-200 份；
粗骨料	1000-1100 份；
细骨料	650-750 份；
聚羧酸减水剂	3-6 份；

The fine aggregate of natural fine aggregate and recycled fine aggregate mixture;  
Wherein the gelling material for cement;  
The coarse aggregate is natural coarse aggregate.

**Assignees:** UNIV SHANDONG; SHANDONG HI SPEED GROUP CO LTD; SHANDONG UNIV

## 414. Family 99290238 (WO23190372 A1)

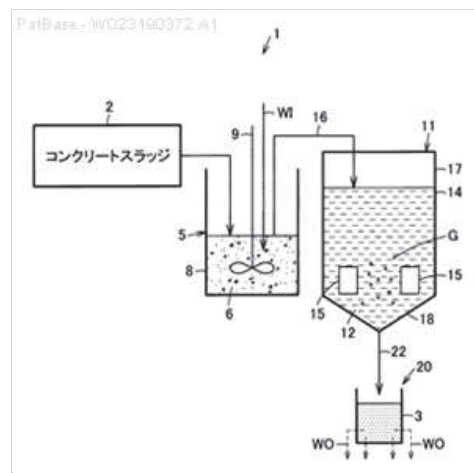
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### Title (EP4501434 A1)

[EN] CARBON DIOXIDE FIXATION APPARATUS AND CARBON DIOXIDE FIXATION METHOD

### Abstract (EP4501434 A1)

[EN] To provide a carbon dioxide fixation apparatus and a method for fixing carbon dioxide, which can inexpensively fix carbon dioxide and also can inexpensively produce powder having carbon dioxide fixed therein in large quantities. The carbon dioxide fixation apparatus (1) includes water addition means (5) for adding water to concrete sludge (2) from which coarse aggregate and fine aggregate have been removed with stirring, supply means (11) for supplying a carbon dioxide-containing gas (G) to a first intermediate (6) which has passed through the water addition means (5), and water drain means (20) for draining water from a second intermediate (12) which has passed through the supply means (11) to produce powder containing precipitated calcium carbonate, which is calcium carbonate crystals, cement carbonatized powder in which calcium components in cement particles are carbonatized on the surface of the cement particles, and unreacted cement particles.



### 1st Main Claim (EP4501434 A1)

[EN] 1. A carbon dioxide fixation apparatus, comprising

- water addition part for adding water to cement paste sludge, which is concrete sludge from which coarse aggregate and fine aggregate have been removed, with stirring to obtain a first intermediate,
- supply part for supplying a carbon dioxide-containing gas to the first intermediate to obtain a second intermediate, and
- water drain part for draining water from the second intermediate to produce powder containing precipitated calcium carbonate, which is calcium carbonate crystals, cement carbonatized powder in which calcium components in cement particles are carbonatized on the surface of the cement particles, and unreacted cement particles.

[MT] Water addition means for obtaining a first intermediate obtained by adding water to a cement paste sludge, which is a concrete sludge from which coarse aggregate and fine aggregate have been removed,  
 Supplying means for supplying a gas containing carbon dioxide to the first intermediate to obtain a second intermediate;  
 Draining means for draining the second intermediate to produce a powder comprising light calcium carbonate, which is a crystal of calcium carbonate, a cement partial carbonate chloride powder in which a calcium component of the cement particles is carbonated on the surface of the cement particles, and unreacted cement particles,  
 And a carbon dioxide fixing unit that fixes carbon dioxide to the carbon dioxide fixing unit.

**Assignees:** IDEMITSU KOSAN CO LTD; NIPPON CONCRETE IND CO LTD; IDEMITSU KOSAN CO; ISHIKAWAJIMA CONSTRUCTION MAT CO LTD

## 415. Family 54985687 (CN103351076 A)

[View in PatBase](#)

### Title

[EN] COMPREHENSIVE INDUSTRIAL WASTEWATER PROCESSING METHOD

### Abstract

[EN] The invention discloses a comprehensive industrial wastewater processing method which comprises the following steps: utilizing a porous structure of coal ash to adsorb and remove pollutants in industrial wastewater, utilizing desulfurated smoke from a coal-fired boiler to perform comprehensive carbonization on secondary alkaline water and third-time alkaline water acquired during the disposal process of the industrial wastewater so as to remove CO<sub>2</sub>, SO<sub>2</sub> and NO<sub>x</sub> in the smoke from the coal-fired boiler, finally acquiring fourth-time alkaline water, and heating or filtering the fourth-time alkaline water to acquire standard discharge water meeting the discharging requirement. Therefore, according to the comprehensive industrial wastewater processing method, the industrial pollutants including coal ash and smoke from the coal-fired boiler are reasonably reused to process industrial wastewater and the industrial pollutants including coal ash and smoke from the coal-fired boiler reasonably, so the waste is turned into wealth and a bane is turned into a boon, many things are achieved at one stroke, the purposes of treatment of wastes with processes of wastes against one another and comprehensive utilization of industrial pollutants are realized, the need for national economic construction and development is met, and a reasonable choice for administrating industrial pollution is achieved.

### 1st Main Claim

[MT] claim, comprising the steps of: 1) the transport of industrial sewage to a high temperature boiler slag, making industrial effluent temperature rose 5 (T10 (TC; 2) The industrial sewage warmed by filtration to obtain particle size and gt; filtered sewage residue and coarse particles 0. 05cm; and 3) the sewage is blown into the filter after temperature sensor:, pressure of 0.02 fluidized fly ash 1MPa of harmful substances in sewage oxidation and adding water the filter after the iron salts, aluminum or magnesium absorption sewage suspension matter and heavy metal ions to obtain a mixture containing fly ash; 4) reacting the mixture flowing through the magnetic field of fly ash containing a magnetic substance extracted and purified, sterilized in a magnetic field, and filtered to give a particle size and gt; 0. coarse ash and alkaline water a 3mm; and 5) make primary alkaline water into the magnetic field purification to obtain particle size and amp filtered; gt; 0. 02Mffl of fine ash and secondary alkaline water; 6) pressure is 0. 1100KPa through desulfurization of coal-fired boiler flue gas is introduced into the secondary comprehensive alkaline water carbonation, the reaction of alkaline water through the flue gas of coal-fired boiler flue gas desulphurization and secondary in the CO<sub>2</sub>, SO<sub>2</sub> and NO<sub>x</sub> removal to give CaCO<sub>3</sub>, heavy metal compound particles and three alkaline water after precipitation; 7) coal-fired boiler flue gas is introduced into the untreated three alkaline water, coal-fired boiler flue gas of the untreated and three basic water reaction in the flue gas SO<sub>2</sub> and NO<sub>x</sub> removal obtained after precipitation of gypsum and four water; 8) after four or filtered water heating emissions.

Assignees: LI DEZHI

## 416. Family 57102594 (CN103964391 A)

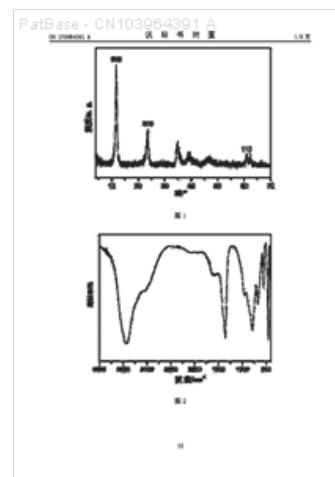
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### Title

[EN] FLAKY STRUCTURE LAYERED COMPOSITE HYDROXIDE AND PREPARATION METHOD THEREOF

### Abstract

[EN] The present invention provides a flaky structure layered composite hydroxide and a preparation method thereof. According to the preparation method, a metal hydroxide, an oxide, a basic carbonate, a metal soluble salt and an alkali are adopted as raw materials, the addition speed of the alkali solution is controlled to prepare the flaky LDH, and the space confinement effect of the metal hydroxide, the oxide or the basic carbonate exists, such that the produced LDH flakes do not easily aggregate so as to finally obtain the LDH with a large specific surface, wherein the BET specific surface area is 130-200 m<sup>2</sup>/g and is much larger than the specific surface area of the ordinary LDH. According to the invention, the preparation method has characteristics of simpleness, no requirement of high temperature, high pressure and special equipment, rich raw material source and low cost; and the flaky structure layered composite hydroxide can be widely used in the fields of absorption separation, catalysis, polymer materials and the like.



### 1st Main Claim

[MT] 1 A sheet-like structure of the layered double hydroxide, the sheet-like structure referred to as LDH, the chemical formula:  $M^{x+}_x M^{y+}_y (OH)_2 (An)_z \cdot nH_2O$ , (I) wherein  $0 < x \leq 0.4$ ,  $0 < y \leq 0.7$ ,  $0 < z \leq 0.5$ ,  $0 < n \leq 0.5x + 2z$  less than or equal to 1,  $x, y, z$  are not simultaneously 0,  $n$  is the number of interlayer crystal water molecules,  $0.4 \leq m \leq 1$ ;  $M$  is a monovalent metal ions  $Li$ ;  $M_2$  is a divalent metal ion  $Mg^{2+}, Zn^{2+}, Ni^{2+}, Co^{2+}, Ca^{2+}, Fe^{2+}, Mn^{2+}, Cd^{2+}, Pd^{2+}, Pt^{2+}, Be^{2+}, Cu^{2+}$  one or more;  $M_3$  is a trivalent metal ion  $Al^{3+}, Cr^{3+}, Ti^{3+}, Fe^{3+}, Ga^{3+}, Ni^{3+}, V^{3+}, Mn^{3+}, Rh^{3+}, Ir^{3+}, Ru^{3+}, La^{3+}, Sc^{3+}, In^{3+}$  in any one or more;  $M_4$  is a tetravalent metal ion  $Sn^{4+}, Ti^{4+}, Zr^{4+}$  one or more;  $An^-$  is  $F^-, Cl^-, Br^-, ClO_4^-, NO_3^-, ClO_3^-, IO_3^-, CO_3^{2-}, SO_4^{2-}, H_2PO_4^-, SO_3^{2-}, S_2O_3^{2-}, WO_4^{2-}, CrO_4^{2-}, PO_4^{3-}$   $Fe(CN)_6^{4-}$ ,  $Fe(CN)_6^{3-}$ ,  $MoO_4^{2-}$ ,  $V_10O_{28}^{6-}$ ,  $PW_{12}O_{40}^{3-}$ ,  $PMo_{12}O_{40}^{3-}$ ,  $PW_{11}CuO_{39}^{6-}$ ,  $SiW_9V_3O_{41}^{5-}$ , ethylene, malonate, terephthalic acid root, dodecyl sulfonate in one or more of; the layered sheet structure The specific surface area of the composite hydroxide 130 -200 m<sup>2</sup> / g, the specific surface area than normal LDH larger 60 percent.

**Assignees:** UNIV BEIJING CHEMICAL; BEIJING UNIV OF CHEMICAL TECHNOLOGY

417. Family 98187718 (CN116444242 A)

[View in PatBase](#)

**Title**  
[EN] SOLID WASTE-BASED CONCRETE LIGHTWEIGHT WALLBOARD AND PREPARATION METHOD THEREOF

**Abstract**  
[EN] The invention belongs to the technical field of comprehensive utilization of lightweight concrete wall materials and solid wastes, and particularly relates to a solid-waste-based concrete lightweight wallboard and a preparation method thereof. The thickness of the solid waste based concrete lightweight wallboard prepared by the invention is 90-120mm, and the solid waste based concrete lightweight wallboard is prepared from the following components in parts by weight: 5-10 parts of cement, 5-10 parts of waste shell powder, 25-50 parts of building desulfurization gypsum, 10-50 parts of a composite admixture, 5-15 parts of aggregate, 30-50 parts of water, 1-5 parts of a grinding aid, 0.1-2 parts of a waterproof agent, 0.1-2 parts of a foam stabilizer, 0.05-2 parts of a foaming agent and 1-5 parts of an alkali activator. The building block has the characteristics of light volume weight, high strength, low cost, heat insulation, convenience and quickness in installation in the construction process and the like, and can solve the problem of energy consumption of traditional building materials, reduce CO2, reduce environmental pollution and the like.

**1st Main Claim**  
[MT] 1. A solid waste-based concrete lightweight wallboard, characterized in that the solid waste-based concrete lightweight wallboard has a thickness of 90 to 120 mm, The following weight components are included in the solid waste-based concrete lightweight wallboard: Cement 5 to 10 parts, waste shell powder 5 to 10 parts, construction sulfur gypsum 25 to 50 parts, composite blend 10 to 50 parts, aggregate 5 to 15 parts, Water 30 to 50 parts, grinding aid 1 to 5 parts, waterproofing agent 0.1 to 2 parts, foaming agent 0.1 to 2 parts, blowing agent 0.05 to 2 parts, alkali trigger 1 to 5 parts.

**Assignees:** SHENYANG UNIV OF TECHNOLOGY; UNIV SHENYANG TECHNOLOGY



418. Family 99337751 (US2023322623 AA)

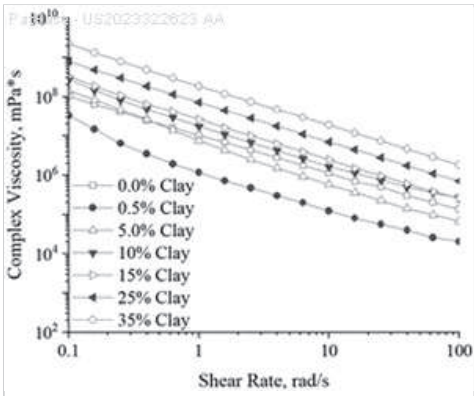
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**Title**  
[EN] MODIFIABLE HARDENED POZZOLANIC MATERIAL

**Abstract**  
[EN] The present disclosure relates to formulations for cementitious materials and/or mortar prepared with minimal components. The present disclosure relates to formulations for cementitious materials and/or mortar that are low carbon dioxide (CO<sub>2</sub>) emitting formulations having tailorable rheology, controllable set times, and that can be prepared with pozzolanic materials. The present disclosure relates to formulations solidified with a silicate solution to form a hardened material.

**1st Main Claim**  
[EN] 1. A pozzolanic mixture for combination with an alkali metal silicate activator solution to produce a cementitious composition, wherein said pozzolanic mixture is devoid of calcined lime and comprises  
an inert, fine aggregate selected from the group consisting of natural sand, manufactured sand, soil, stone, spent foundry sand, plastic shavings, recycled consumer plastics, or a combination thereof, wherein said aggregate has a size ranging from about 75 micro m to about 4.75 mm; and 0.15 mm to about 2.36 mm; and 0.3 mm to about 1.18 mm.  
a pozzolanic material selected from the group consisting of calcined diatomaceous earth, volcanic ash, volcanic tuff, volcanic pumicite, opaline chert, silica fume, fly ash, metakaolin and blast furnace slag or combinations thereof; and  
a viscosity modifying agent, wherein the viscosity agent is a clay having a mesh size selected from a range of about 375 to about 150 mesh.

**Assignees:** BATTELLE MEMORIAL INST; GOVERNMENT OF UNITED STATES REPRESENTED BY SECRETARY OF AIR FORCE AS; US GOV AIR FORCE



419. Family 104871913 (WO24214833 A1)

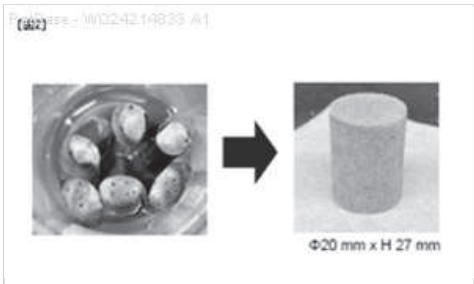
[View in PatBase](#)

**Title**  
[EN] METHOD FOR PRODUCING SiO<sub>2</sub> HARDENED BODY

**Abstract**  
[EN] [Problem] To provide a novel method for producing an SiO<sub>2</sub> hardened body that can be a concrete substitute without using a cement in the manufacturing process of which a large amount of carbon dioxide is emitted. [Solution] It was newly found that a large-sized SiO<sub>2</sub> hardened body can be obtained using a general-purpose facility compared with a conventional method, by adding an alcohol compound and a catalyst compound to an SiO<sub>2</sub>-containing material, heat-treating the resultant mixture at a relatively low temperature, and then hot-pressing and heat-firing. Thus, the SiO<sub>2</sub> hardened body having a high compressive strength can be efficiently obtained.

**1st Main Claim**  
[MT] SiO<sub>2</sub>A method for producing a cured body, the method comprising:  
A-Asio<sub>2</sub>Preparing a mixture of a raw material containing the catalyst compound, an alcohol compound, and a catalyst compound, wherein the catalyst compound is an alkali metal salt or an alkaline earth metal salt, Step  
B subjecting the mixture obtained in step a to heat treatment,  
C) hot pressing the product obtained in step b; and  
Depending on the case d, the treated product obtained in step c is heated and fired  
Wherein  
The SiO<sub>2</sub>The cured body is SiO<sub>2</sub>SiO present on the surface of a raw material containing<sub>2</sub>The SiO has a structure in which at least some of the components are bonded to each other<sub>2</sub>And (C) a step of preparing a mixture of raw materials comprising:  
Manufacturing method.

**Assignees:** UNIV TOKYO; UNIV OF TOKYO



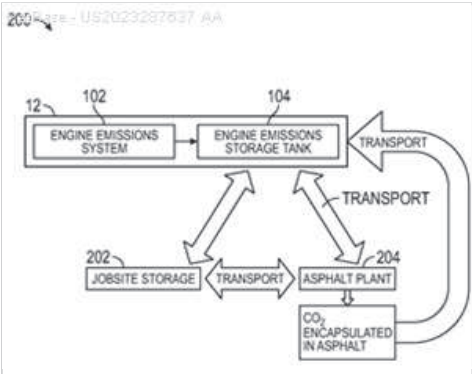
420. Family 98978545 (US2023287637 AA)

[View in PatBase](#)

**Title**  
[EN] ENGINE EMISSIONS ENCAPSULATION IN ASPHALT

**Abstract**  
[EN] The present disclosure includes various methods systems and apparatuses for carbon dioxide capture and utilization such as for encapsulation in asphalt. For example, a method can include combusting fuel to generate a flow of exhaust from a working machine operating to perform one or more asphalt related tasks, capturing CO<sub>2</sub> from the exhaust, storing the CO<sub>2</sub> in a storage unit onboard the working machine, forming asphalt that includes an amount of the CO<sub>2</sub> from the storage unit by selectively mixing the amount of the CO<sub>2</sub> from the storage unit with calcium, and using the asphalt that is formed that includes the amount of the CO<sub>2</sub> from the storage unit encapsulated therein at a jobsite.

**1st Main Claim**  
[EN] 1. A method comprising:  
combusting fuel to generate a flow of exhaust from a working machine operating to perform one or more asphalt related tasks;  
capturing CO<sub>2</sub> from the exhaust;  
storing the CO<sub>2</sub> in a storage unit onboard the working machine;  
forming asphalt that includes an amount of the CO<sub>2</sub> from the storage unit by selectively mixing the amount of the CO<sub>2</sub> from the storage unit with calcium; and  
using the asphalt that is formed that includes the amount of the CO<sub>2</sub> from the storage unit encapsulated therein at a jobsite.



**Assignees:** CATERPILLAR PAVING PRODUCTS INC; CATERPILLAR INC

## 421. Family 45018133 (WO10057825 A1)

[View in PatBase](#)

### Title

[EN] METHOD FOR PRODUCING CEMENT CLINKER

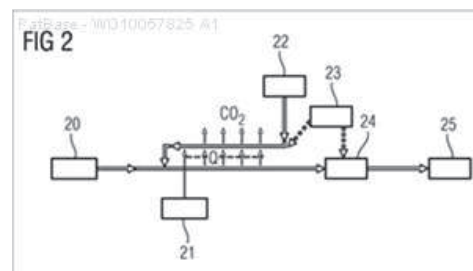
### Abstract

[EN] In the prior art, cement clinker is produced by the calcination of limestone with the addition of sand and clay in a rotary kiln. Then, the resultant product (clinker) is mixed with granulated cinder ash. According to the invention, the cinder is not added to the clinker, but to the limestone/CaO in liquid form, which results in considerable energy savings and an improved carbon footprint.

### 1st Main Claim

[MT] 1. Method for the production of cement clinker, the hydraulic properties significantly by the mass ratio of alkali metal oxide ( $\text{CaO}+\text{MgO}$ ), and silicon oxide ( $\text{SiO}_2$ ) may be determined, where the mixture of the starting materials, such as, in particular, limestone with calcium carbonate ( $\text{CaCO}_3+\text{MgCO}_2$ ) as the base for calcium oxide ( $\text{CaO}/\text{MgO}$ ) and sand as basis for silicon oxide ( $\text{SiO}_2$ ) and further alumina (clay) as a basis for aluminum oxide ( $\text{Al}_2\text{O}_3+\text{SiO}_2$ ) and further additives as well as Deacidified milled acidified (calcined) and solid state reaction, and wherein the mixture of a durchreagierte originating from other metallurgical processes slag is substantially the same components as cement clinker, but a higher CaO-content, comprising the following method steps: the production of cement clinker is in an on fifty thermal cycle by adding the slag in the liquid state, whereby not only the content, but also raw material The heat content of the liquid slag for the cement production.

**Assignees:** SIEMENS AG; MATSCHULLAT THOMAS; LANDES HARALD



## 422. Family 66936295 (US2017260096 AA)

[View in PatBase](#)

### Title (EP3426619 B1)

[EN] HAZING CONTROL FOR CARBONATABLE CALCIUM SILICATE-BASED CEMENTS AND CONCRETES

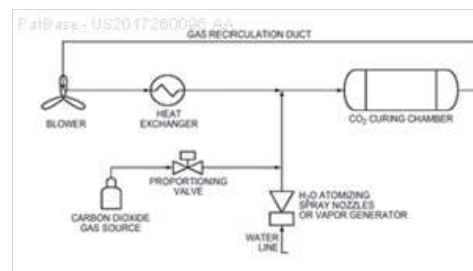
### Abstract

[EN] The invention provides novel methods and compositions that mitigate the occurrence of hazing of products made from carbonatable calcium silicate-based cements. The methods and compositions of the invention may be applied in a variety of cement and concrete components in the infrastructure, construction, pavement and landscaping industries.

### 1st Main Claim (EP3426619 B1)

[EN] 1. A method for mitigating or reducing hazing on a concrete product, comprising:

- prior to curing a concrete mixture to form the concrete product, adding to the concrete mixture an admixture comprising one or more components capable of reacting with one or more of soluble alkali, alkaline earth, sulfate or chloride ions to form a low solubility material, wherein the admixture comprises a liquid admixture which is an aqueous solution comprising one or more highly soluble calcium salts, wherein the highly soluble calcium salt is selected from calcium nitrate, calcium nitrite and calcium chloride; and
- wherein the concrete mixture is a carbonatable calcium silicate-based concrete mixture which comprises:
  - one or more discrete crystalline calcium silicate phases selected from CS (wollastonite or pseudowollastonite), C3S2 (rankinite), C2S (belite, larnite, bredigite), and
  - an amorphous calcium silicate phase at 30 percent or more by mass of the total phases.



**Assignees:** SOLIDIA TECHNOLOGIES INC; HOLCIM TECHNOLOGY LTD; SOLIDIA TECH INC

423. Family 44919173 (US2011287198 AA)

[View in PatBase](#)

Title

[EN] ALKALI-ACTIVATED BINDER, ALKALI-ACTIVATED MORTAR, CONCRETE PRODUCTS AND WET RED CLAY PAVING MATERIAL USING BINDER

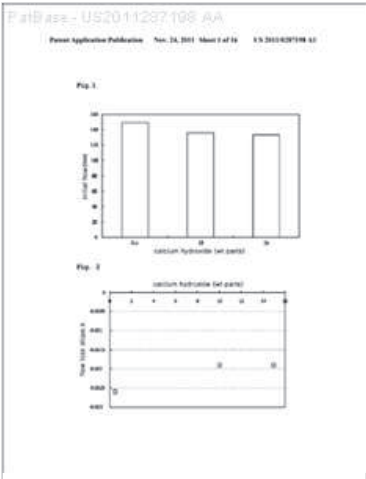
Abstract

[EN] The present invention relates to an alkali-activated binder which can be used as a binder for replacing cement, and more particularly, to an alkali-activated binder, and to mortar, concrete, concrete products, and wet loess paving material comprising the binder, in which inorganic sodium-free alkaline materials are contained to reduce the total amount of Na<sub>2</sub>O and K<sub>2</sub>O in concrete, thus improving the workability and the strength stability and inhibiting the alkali-aggregate reaction.

1st Main Claim

[EN] 1. An alkali-activated binder, comprising: slag or fly ash; and a sodium-free inorganic alkaline material.

**Assignees:** UNIV NAT CHONNAM IND FOUND; SONG JIN KYU; YANG KEUN HYEOK



424. Family 102849502 (CN118084439 A)

[View in PatBase](#)

Title

[EN] LOW-CARBON ISLAND REEF FULL-CORAL SEAWATER CONCRETE AND PREPARATION METHOD THEREOF

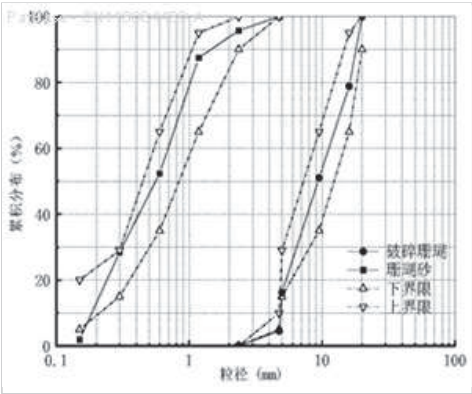
Abstract

[EN] The invention discloses a low-carbon island reef full-coral seawater concrete and a preparation method thereof, and the low-carbon island reef full-coral seawater concrete is prepared on site by adopting a method of taking abundant waste coral (sand) as coarse (fine) aggregate, taking coral micro powder as a main cementing material to replace part of cement, mixing seawater and curing. The concrete comprises the following raw materials: a low-carbon composite cementing material, crushed coral, coral sand, a high-efficiency additive, seawater and the like. The preparation method comprises the following steps: preparing the coral micro powder and preparing the low-carbon composite cementing material. Preparing the low-carbon island reef full-coral seawater concrete; and evaluating the mechanical property and the low-carbon property of the low-carbon island reef full-coral seawater concrete. The use amount of cement in the preparation process is reduced, the carbon emission in the concrete production process is reduced, the used raw materials can be obtained locally, energy consumption and CO2 emission caused by long-distance sea transportation of the raw materials are avoided, and the method has the advantages of being economical, environmentally friendly, convenient to obtain materials and the like.

1st Main Claim

[MT] 1. A low carbon reef full coral seawater concrete, characterized by comprising the following raw materials: Low carbon composite gelling material, crushed coral, coral sand, high efficiency admixture and seawater; wherein the total amount of low carbon composite gelling material is 500 to 1086 kg/m.<sup>3</sup>The amount of crushed coral is 300 to 680 kg/m.<sup>3</sup>The amount of coral sand used is 875 to 1250 kg/m.<sup>3</sup>High-efficiency additive is used in 8 to 20 kg/m.<sup>3</sup>The hydrogel ratio is 0.2 to 0.6.

Assignees: HOHAI UNIV; UNIV HOHAI



425. Family 33359844 (US2006210463 AA)

[View in PatBase](#)

Title (EP1872054 B1)

[EN] REDUCING MERCURY EMISSIONS FROM THE BURNING OF COAL

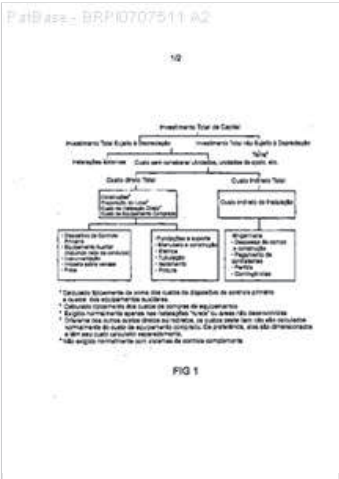
Abstract

[EN] Processes and compositions are provided for decreasing emissions of mercury upon combustion of fuels such as coal. Various sorbent compositions are provided that contain components that reduce the level of mercury and/or sulfur emitted into the atmosphere upon burning of coal. In various embodiments, the sorbent compositions are added directly to the fuel before combustion; are added partially to the fuel before combustion and partially into the flue gas post combustion zone; or are added completely into the flue gas post combustion zone. In preferred embodiments, the sorbent compositions comprise a source of halogen and preferably a source of calcium. Among the halogens, iodine and bromine are preferred. In various embodiments, inorganic bromides make up a part of the sorbent compositions.

1st Main Claim (EP1872054 B1)

[EN] 1. A method for burning coal to reduce the amount of mercury released into the atmosphere comprising  
applying a mercury sorbent composition comprising a halogen compound onto the coal;  
adding a sulfur sorbent composition comprising aluminosilicate clay and a calcium compound onto the coal;  
delivering the coal with the applied sorbents into a coal burning furnace;  
combusting the coal containing the sorbents in the coal burning furnace to produce ash and combustion gases;  
measuring a mercury level in the combustion gases; and  
adjusting the amount of mercury sorbent composition applied to the coal based on the value of the mercury level.

**Assignees:** NOX II INTERNATIONAL LTD; NOX II INT LTD; COMRIE DOUGLAS C; COMRIE DOUGLAS; COMRE DOUGLAS C; NOX II LTD; VELLELLA VINCENT; NOX II INTERNAT LTD; NOKS II INTENEHSHNL EHLTIDI; NOX LL LTD



## 426. Family 66671378 (CN107056202 A)

[View in PatBase](#)

### Title

[EN] ACCELERATOR FOR PREPARATION OF LOW-CARBON CEMENTITIOUS MATERIAL FROM CARBONIZED STEEL SLAG AND CEMENT AND APPLICATION METHOD OF ACCELERATOR

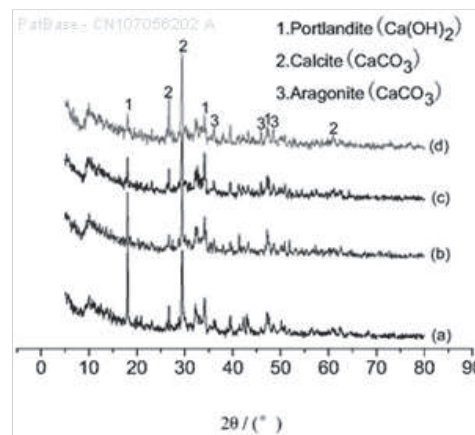
### Abstract

[EN] The invention discloses an accelerator for preparation of a low-carbon cementitious material from carbonized steel slag and cement and belongs to the field of energy saving and emission reduction and ecological building materials. One, two or three of a mineral accelerator fly ash,  $\text{CaCO}_3$  seed crystals, basic accelerators  $\text{Mg}(\text{OH})_2$  and  $\text{Na}_2\text{CO}_3$  and an acid accelerator  $\text{C}_2\text{H}_2\text{O}_4$  are added to a steel slag and cement composite cementitious material, and the accelerator has a better acceleration effect. After the accelerator is added, activity of easily carbonized components in the steel slag and cement composite cementitious material is improved, the components are subjected to a reaction more easily with  $\text{H}_2\text{CO}_3$  formed by dissolving  $\text{CO}_2$  in water vapor, and stable carbonate is formed. The acceleration effect of  $\text{Mg}(\text{OH})_2$  and  $\text{C}_2\text{H}_2\text{O}_4$  is better, the strength of the carbonized steel slag and cement composite cementitious material is improved greatly,  $\text{CO}_2$  is consumed to a larger degree, and the low-carbon cementitious material with good performance is prepared.

### 1st Main Claim

[MT] 1. A carbide slag cement preparation of low carbon gelling material accelerator, characterized in that said accelerator is a fly ash mineral accelerators,  $\text{CaCO}_3$  seed, acidic alkaline accelerator, accelerator a four kinds of one or two or three kinds; The basic promoting agent  $\text{Mg}(\text{OH})_2$  or  $\text{Na}_2\text{CO}_3$ ,  $\text{C}_2\text{H}_2\text{O}_4$  acidic accelerator.

**Assignees:** YANCHENG INST OF TECH; YANCHENG INST OF TECHNOLOGY; YANCHENG INST TECH



427. Family 103301942 (WO24133450 A1)

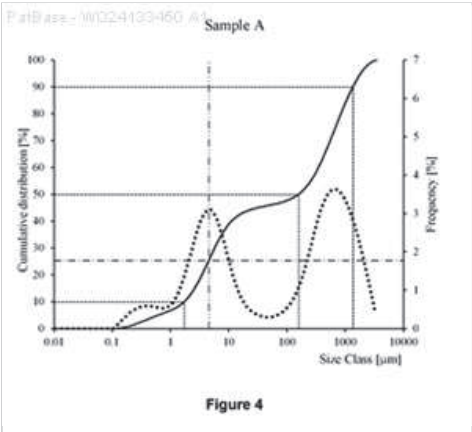
[View in PatBase](#)

**Title**  
[EN] SUPPLEMENTARY CEMENTITIOUS MATERIAL

**Abstract**  
[EN] The invention relates to a method of producing a supplementary cementitious material (SCM) comprising: a) providing a particulate mineral material; b) mixing the mineral material with water to form a mixture; c) milling the mixture in the presence of carbon dioxide to form a slurry, wherein the concentration of carbon dioxide is greater than about 8 vol percent; and; d) drying the slurry to form the SCM.

**1st Main Claim**  
[EN] 1. A method of producing a supplementary cementitious material (SCM) comprising: a) providing a particulate mineral material; b) mixing the mineral material with water to form a mixture; c) milling the mixture in the presence of carbon dioxide to form a slurry, wherein the concentration of carbon dioxide is greater than about 8 vol percent; and; d) drying the slurry to form the SCM.

**Assignees:** CRH NEDERLAND BV



## 428. Family 62536203 (US2017267586 AA)

[View in PatBase](#)

### Title (EP3224219 B1)

[EN] CLINKER REPLACEMENT MATERIAL MADE OF ALUMINIUM SILICATE AND DOLOMITE

### Abstract

[EN] A method for producing a supplementary cementitious material (SCM) that includes providing a starting material containing dolomite and aluminium silicate, converting the starting material to the supplementary cementitious material by burning in the temperature range of >800 to 1100 degrees centigrade or by burning in the temperature range of 725 to 950 degrees centigrade in the presence of a mineralizer and cooling the supplementary cementitious material.

### 1st Main Claim (EP3224219 B1)

[EN] 1. A method for producing a supplementary cementitious material, comprising the steps:

- - Provision of a starting material containing an aluminium silicate constituent and a dolomite constituent, wherein the weight ratio of  $\text{Al}_2\text{O}_3 + \text{SiO}_2$  to  $\text{MgO} + \text{CaO}$  of the starting material is in the range of 0.7 to 6,
- - Conversion of the starting material to the supplementary cementitious material by burning the starting material to a sintered product in the temperature range of 850 degrees centigrade to 1100 degrees centigrade if no mineralizers are contained, and in the temperature range of 725 degrees centigrade to 950 degrees centigrade if mineralizers are contained.

**Assignees:** HEIDELBERGCEMENT AG

429. Family 47878057 (TW201026628 A)

[View in PatBase](#)

Extended Family Number: 42613795

Title

[EN] COMPOSITIONS AND METHODS USING SUBSTANCES WITH NEGATIVE DELTA13C VALUES

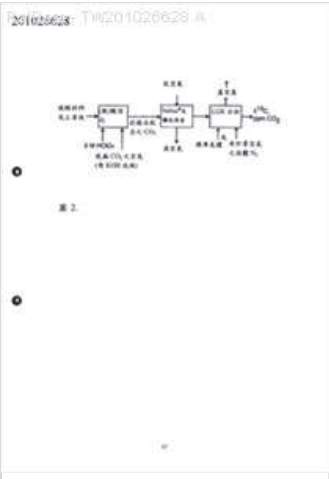
Abstract

[EN] Methods of characterizing and producing compositions with negative delta13C values are provided. Aspects of the invention include characterizing source materials and process products. Aspects of the invention also include compositions that are products of carbon sequestration and verifying that those products have incorporated carbon from a fossil fuel source.

1st Main Claim

[MT] 1. one kind containing carbonate and / or bicarbonate salts of synthetic composition, the composition of carbon in the material has less than -5.00 ‰ relative carbon isotopic composition ( $\delta^{13}\text{C}$ ) value and the composition has a neutral or negative carbon footprint.

Assignees: CALERA CORP



430. Family 99761483 (CN117024013 A)

[View in PatBase](#)

Title

[EN] PREPARATION METHOD FOR PRODUCING CEMENT CLINKER BY USING LOW-GRADE MARBLE LIMESTONE

Abstract

[EN] The invention discloses a preparation method for producing cement clinker by using low-grade marble limestone. The preparation method comprises the following steps: S1, detecting the content of CaO in the low-grade marble limestone; s2, carrying out homogenization treatment; and S3, calcining treatment. Compared with the prior art, the method disclosed by the invention has the advantages that the content of CaO in the low-grade marble limestone is detected by utilizing a coordination titration method, and a small amount of high-grade marble limestone can be doped into the low-grade marble limestone to increase the content of CaO in the low-grade marble limestone so as to reach the required content standard; it is ensured that the low-grade marble limestone can also be put into production of cement clinker, the utilization rate of comprehensive resources is increased, and the low-grade marble limestone can also be utilized.



1st Main Claim

[MT] 1. A method for producing cement clinker using low grade Dali limestone, characterized by comprising the steps of:

- S1 , using coordination titration method to detect the CaO content in low grade Dali limestone, take a certain amount of low grade Dali limestone with sufficient standard molar mass of HCl to fully reflect the CaO and CaCO in limestone<sub>3</sub>Both were reacted with hydrochloric acid and the content of CaO was back calculated with HCl consumed;
- S2, homogenization treatment, take a certain amount of low grade Dali limestone, use a single-stage hammer crusher to crush it, after homogenization the content of CaO in the limestone is 44.5%-47.5%, in low grade Dali limestone incorporate some high grade Dali limestone, Mix limestone, sandstone, Conversion slag, fly ash, iron ore concentration, raw materials are mixed in weight ratio and then ground homogenized into the kiln;
- S3, calcination treatment, the ground homogenized cement raw meal into the rotary kiln for calcination, cement raw meal in the kiln interior such high temperature and high pressure environment, the chemical reaction between the substances will accelerate, some moisture and volatile gases will also be removed, play a catalytic role, Cement clinker can be produced more efficiently, Strength and durability of cement.

Assignees: YIBIN RUIXING IND CO LTD

## 431. Family 56355331 (CN103771776 A)

[View in PatBase](#)

### Title

[EN] RECYCLED MICROPOWDER CONCRETE AND PREPARATION METHOD THEREOF

### Abstract

[EN] The invention relates to a recycled micropowder concrete and a preparation method thereof. The recycled micropowder concrete comprises cement, sand, gravel, water, recycled micropowder and activator  $\text{Ca}(\text{OH})_2$ . The preparation method comprises the following steps: 1) crushing waste concrete into fine aggregate, and screening out the recycled micropowder with the diameter of less than 0.16mm; 2) according to the amounts of materials of the concrete with the water-to-cement ratio of 0.54 and the calculated strength grade of C30, replacing 10 percent of cement with equal mass of recycled micropowder, and adding the activator  $\text{Ca}(\text{OH})_2$  which accounts for 3.5 wt percent of the recycled micropowder; and 3) weighing the cement, recycled micropowder and activator  $\text{Ca}(\text{OH})_2$ , adding into a stirrer, stirring uniformly, adding water, stirring, sequentially adding the sand and gravel, and stirring. The recycled micropowder concrete prepared by the method has higher strength and carbonization resistance than normal concrete with the same mixing proportion, is safely applied to practical engineering, and enhances the utilization ratio of the waste concrete.

### 1st Main Claim

[MT] 1. A concrete powder and preparation method of regenerating the regenerated powder concrete including cement, sand, gravel, water, recycled powder, activator  $\text{Ca}(\text{OH})_2$ , wherein the regenerated powder concrete The preparation steps are: 1) fine crushed waste concrete aggregate, and then screened out less than 0.16 mm in diameter renewable powder; 2) water-cement ratio of 0.54 calculated according to the intensity level for the amount of material C30 concrete, recycled powder and other quality replace 10 percent of cement, and adding 3.5 percent of regeneration quality powder activator  $\text{Ca}(\text{OH})_2$ ; 3) will join after the cement mixer, recycled powder, activator  $\text{Ca}(\text{OH})_2$  weighing stirring, stir after, add water and stirred, were added successively sand, gravel carried stir.

**Assignees:** UNIV CHINA MINING; CHINA UNIV OF MINING AND TECHNOLOGY

## 432. Family 97816933 (CN116283352 A)

[View in PatBase](#)

### Title

[EN] METHOD FOR PREPARING AERATED CONCRETE THROUGH CARBON DIOXIDE GAS GENERATION AND CONCRETE PRODUCT

### Abstract

[EN] The invention discloses a method for preparing aerated concrete through carbon dioxide gas generation and a concrete product. The preparation method comprises the following steps: 1) adding water and a modifier into aerated concrete raw materials, and stirring and mixing to form slurry; 2) introducing carbon dioxide into the slurry as a gas forming gas, mixing the carbon dioxide with the slurry, and pre-curing to obtain an aerated concrete blank; and 3) carrying out autoclaved curing on the aerated concrete green body to obtain the autoclaved aerated concrete. Carbon dioxide is introduced as a gas forming gas, so that the carbon dioxide is uniformly distributed in the slurry in a hole form, the aerated concrete slurry is subjected to comprehensive and uniform integral carbonation curing, the carbonation degree of the slurry and the strength of a green body are improved, the standing time is shortened, the autoclaved curing pressure is reduced through carbon dioxide curing, and the constant pressure time is shortened; the production efficiency is greatly improved and the production energy consumption is reduced when the same-strength green body is obtained. Due to the low heat conductivity coefficient and negative pressure or vacuum degree of carbon dioxide and the thermal stability of carbonated products, the heat preservation, heat insulation and high-temperature resistance of concrete products are improved.

### 1st Main Claim

[MT] 1. A method for producing aerated concrete by gas-generating carbon dioxide, comprising the steps of: Providing a first gas-containing gas;

1) adding water and a modifier to an aerated concrete raw material to form a slurry by stirring, wherein the aerated concrete raw material comprises a calcium material and a siliceous material, the modifier is a mixture comprising gypsum, and the modifier is present in a mass fraction of 1% to 15% of the slurry;

2) introducing carbon dioxide into the slurry as an exhaust gas, mixing the carbon dioxide with the slurry in a volume ratio of carbon dioxide to slurry of (50:50) to (85:15), and pre-conditioning to obtain an aerated concrete blank;

3) vapor pressure maintenance of aerated concrete body, to prepare vapor-aerated concrete.

**Assignees:** PANZHIHUA RUNZE BUILDING MAT CO LTD

## 433. Family 58447894 (US2015037231 AA)

[View in PatBase](#)

**Extended Family Number:** 42613795

### Title

[EN] GAS STREAM MULTI-POLLUTANTS CONTROL SYSTEMS AND METHODS

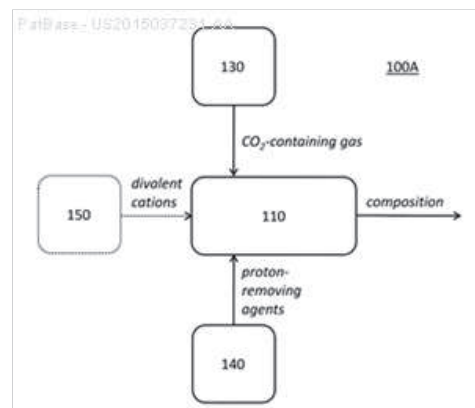
### Abstract

[EN] In some embodiments, the invention provides systems and methods for removing carbon dioxide and/or additional components of waste gas streams, comprising contacting the waste gas stream with an aqueous solution, removing carbon dioxide and/or additional components from the waste gas stream, and containing the carbon dioxide and/or additional components, in one form or another, in a composition. In some embodiments, the composition is a precipitation material comprising carbonates, bicarbonates, or carbonates and bicarbonates. In some embodiments, the composition further comprises carbonate and/or bicarbonate co-products resulting from co-processing SO<sub>x</sub>, NO<sub>x</sub>, particulate matter, and/or certain metals. Additional waste streams such as liquid, solid, or multiphasic waste streams may be processed as well.

### 1st Main Claim

[EN] **115.** A method of treating an industrial waste gas, comprising contacting an industrial waste gas comprising carbon dioxide and at least one other component selected from the group consisting of NO<sub>x</sub>, SO<sub>x</sub>, metal, organic, particulate matter, and a combination thereof with a waste stream from an industrial process comprising divalent cations and hydroxide ions to form a precipitation material comprising metastable carbonate selected from vaterite, aragonite, and a combination thereof and the at least one other component wherein the at least one other component is precipitated, trapped, adsorbed, or a combination thereof; and combining the precipitation material with water to convert the metastable carbonate into stable carbonate.

**Assignees:** CALERA CORP



434. Family 59212212 (CN104556882 A)

[View in PatBase](#)

Title

[EN] METHOD FOR MANUFACTURING CONCRETE PRODUCT WITH CARBON SEQUESTRATION FUNCTION BY USING BUILDING MATERIALS

Abstract

[EN] The invention provides a method for manufacturing a concrete product with a carbon sequestration function by using building materials. The method comprises the following steps: crushing the building materials, so that building material powder is obtained; performing carbonization reaction between the building material powder and carbon dioxide in carbon dioxide containing industrial tail gas; mixing the carbonized building material powder with an adhesive and water so as to form a concrete product; adding the concrete product into a concrete curing chamber, and adding the carbon dioxide containing industrial tail gas into the concrete curing chamber; and further performing carbonization reaction between the concrete product and the carbon dioxide in the carbon dioxide containing industrial tail gas, so that a concrete product subjected to carbon sequestration is obtained. According to the invention, carbon sequestration is realized while building materials are adopted for preparing concrete products, so that carbon dioxide in industrial tail gas is effectively absorbed, the emission of greenhouse gas is reduced, the greenhouse effect is eased, resources are saved, and the environment is protected.

1st Main Claim

[MT] A use of building materials having carbon sequestration capabilities of concrete preparation, characterized in that: the use of building materials made of concrete products having carbon sequestration function the method comprising:

For building materials and building materials pulverization treatment, to obtain a powder;

The building materials powder added to concrete curing concrete curing indoor room, in the industrial exhaust gas containing carbon dioxide is added;

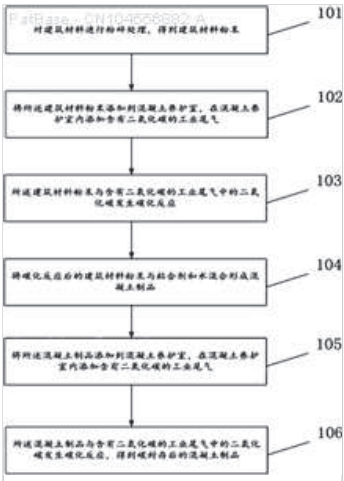
The building material powder containing carbon dioxide from industrial exhaust gas carbon dioxide carbonation reaction;

The carbonation reaction after the powder is mixed with a binder and water are mixed to form a concrete building materials products;

The concrete products added to concrete curing concrete curing indoor room, in the industrial exhaust gas containing carbon dioxide is added;

The concrete products and industrial exhaust gas containing carbon dioxide is carbon dioxide After carbonation reaction, the carbon sequestration of concrete products.

**Assignees:** INST APPLIED ECOLOGY CAS; OF APPLIED ECOLOGY CHINESE ACADEMY OF SCIENCES INST



## 435. Family 97820870 (CN116282979 A)

[View in PatBase](#)

### Title

[EN] METHOD FOR PREPARING CEMENTING MATERIAL BY WET-PROCESS CO<sub>2</sub> CAPTURE AND SYNERGISTIC MINERALIZATION OF SOLID WASTE

### Abstract

[EN] The invention discloses a method for preparing a cementing material by wet trapping of CO<sub>2</sub> and synergistic mineralization of solid waste. The method comprises the following steps: reacting a leaching solution of solid waste red mud in the chemical industry with a CO<sub>2</sub> gas source to realize low-cost trapping of CO<sub>2</sub>, then mixing the trapping solution and steel slag micro-powder according to a certain ratio, carrying out mineralization reaction to generate slurry consisting of CaCO<sub>3</sub> microcrystals and iron and silicon substances, finally drying the slurry, mixing the slurry with solid wastes such as cement clinker, desulfurized fly ash and fly ash, and carrying out solid-liquid separation to obtain a solid-liquid separation product. The low-cost cementing material is prepared. According to the technical route provided by the invention, the cost is lower, the process is simple, the coupling cooperation of the CO<sub>2</sub> capturing and mineralizing processes is realized, and the high-value utilization of solid waste resources is realized while the industrial carbon emission is reduced.

### 1st Main Claim

[MT] 1. A wet process to capture CO<sub>2</sub> And in coordination with mineralization of the solid waste to prepare a cementious material, characterized in that it comprises the following steps:

A, providing a leachate of red mud;

B, the leachate is mixed with CO<sub>2</sub> The gas undergoes a solidification reaction, resulting in a trap liquid;

C , the trap liquid is mixed with the steel slag powder to undergo a mineralization reaction.

**Assignees:** CHINA CITY ENVIRONMENT PROT ENG LTD CO

## 436. Family 105815581 (CN119143452 A)

[View in PatBase](#)

### Title

[EN] TUNNEL GROUTING MATERIAL AND PREPARATION METHOD THEREOF

### Abstract

[EN] The invention relates to the technical field of cement-based building materials, in particular to a tunnel grouting material and a preparation method thereof. The tunnel grouting material is prepared by adopting cement as a cementing material, adding a large amount of industrial solid waste as an admixture, modifying steel slag to prepare semi-carbonized steel slag powder, and matching with phosphorus slag powder, carbide slag and desulfurized fly ash as the admixture. According to the preparation method, the water reducing agent and the SAP particles are added as additives, all the raw materials cooperate with one another, the grouting material which is good in flowability, compactness and mechanical property, has a long-term expansion effect in a humid environment and is good in sealing and anti-seepage effect is prepared, and efficient utilization of industrial solid waste is achieved at the same time.

### 1st Main Claim

[MT] 1. A tunnel pulping material, characterized in that it consists of the following parts by weight of raw material:

Cement 100-120 parts, semi-carbide steel slag powder 40-50 parts, phosphorus slag powder 20-30 parts, electros slag 20-30 parts, degreasted sulfur ash 5-10 parts, fine aggregate 700-800 parts, water reducing agent 7-10 parts, SAP particles 2-4 parts, Water 80-90 parts,

The semi-carbonized steel slag preparation process is:

(1) The aged converter slag particles are coarsely broken to 3-5 mm and immersed in water to saturate the slag.

100 parts of saturated steel slag particles are placed in an autoclave, 100-120 parts of an alcoholamine solution, 5-10 parts of sodium dihydrogen phosphorus acid are added, and pretreated at a temperature of 120-130 degrees centigrade, pressure of 0.2-0.3 MPa for 2-4 hours,

3) The autoclave is charged with carbon dioxide gas for carbon fixing for 30-45 minutes, dried, ball milled, sieved.

**Assignees:** SHIJIAZHUANG TIEDAO UNIV; CHINA STATE RAILWAY GROUP CO LTD; UNIV SHIJIAZHUANG TIEDAO

## 437. Family 34968887 (US2007180835 AA)

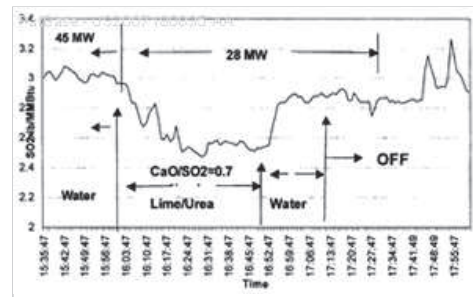
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### Title

[EN] OPTIMIZING POST-COMBUSTION NITROGEN OXIDE AND SULFUR DIOXIDE REDUCTIONS AND IMPROVING COMBUSTION EFFICIENCY IN COAL FIRED BOILERS

### Abstract

[EN] A method for increasing the nitrogen oxide emissions by either removing or modifying fuel rich nitrogen oxide ( $\text{NO}_x$ ) reduction processes thereby improving combustion efficiencies especially with low volatile low sulfur coals, and remove unburned carbon, reduce sulfur dioxide and reducing carbon dioxide emissions, while using post-primary combustion urea or ammonia injection with or without a reburn fuel  $\text{NO}_x$  reducing process to restore  $\text{NO}_x$  to regulated emission levels. Furthermore, adding lime or limestone to the urea or ammonia solution to further reduce  $\text{SO}_2$  and to increase the concentration of the carbon free fly ash to cementitious concentrations. Furthermore, by proper number and disposition of the injectors in the post combustion zone and by further water diluting the mixture, this  $\text{NO}_x$  reduction process is effective at substantially higher gas temperatures than conventional Selective Non-Catalytic  $\text{NO}_x$  Reduction and with no ammonia slip. This method significantly increases the profitability of power plants.



### 1st Main Claim

[EN] **1.** A method for complete combustion of a carbonaceous fuel, low volatile matter, low sulfur coal, in a primary combustion zone of a boiler or furnace operating at about 3000 degrees Fahrenheit gas temperature and near to or at stoichiometric condition of unity in order to increase combustion efficiency and nitrogen oxide,  $\text{NO}_x$ , concentrations, while reducing carbon dioxide,  $\text{CO}_2$ , and sulfur dioxide,  $\text{SO}_2$ , concentrations in the primary combustion zone below levels attainable with more fuel rich combustion and higher sulfur coal, comprising: identifying a post-primary combustion zone within the boiler or furnace having gas temperatures between about 1700 degrees Fahrenheit to 2500 degrees Fahrenheit; injecting an aqueous urea or ammonia solution as dispersed air atomized droplets of varying diameters across a planar spray pattern perpendicular to gas flow direction for reducing  $\text{NO}_x$  to at least 0.3 lb/MMBtu; if required to augment the aqueous urea or ammonia solution to achieve the reduction of the  $\text{NO}_x$ , injecting in the post-primary combustion zone, a solid or liquid carbonaceous fuel to convert by reburn gases to local fuel rich conditions, followed by injection of additional air into a post reburn combustion zone to return the gases to excess air conditions; and adjusting water concentration in the aqueous urea or ammonia solution to levels that are high enough to cool the gases to about 2100 degrees Fahrenheit to 2200 degrees Fahrenheit or below in order to enable urea or ammonia- $\text{NO}_x$  reaction to function at temperatures for effective post combustion  $\text{NO}_x$  reducing reactions.

**Assignees:** ZAUDERER BERT

438. Family 60399878 (US2017073270 AA)

[View in PatBase](#)

Title (EP3119730 B1)

[EN] METHOD FOR MAKING CARBONATE-BONDED CONSTRUCTION PRODUCTS FROM STEEL-MAKING RESIDUES

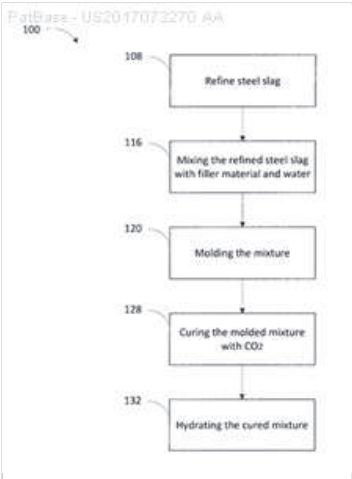
Abstract

[EN] A building product is made from granular material and a binder that includes steel slag. A process for making the building product includes combining the granular material and the binder and then curing the combined granular material and binder with carbon dioxide. A building material includes a mixture of steel slag and a silica-rich material. The steel slag and silica-rich material is treated by heating. The silica-rich material may be waste glass and/or fly ash. A process for making the building material includes mixing the steel slag and silica-rich material and further heating the mixture.

1st Main Claim (EP3119730 B1)

[EN] 1. A method for making a construction block, comprising providing granular material and a binder including steel slag; combining the granular material, and the binder with water to a first water-to-slag ratio; compacting the combined granular material, binder and water at a compaction pressure of less than 20 MPa; reducing the quantity of water in the combined granular material, binder and water to a second water-to-slag ratio that is lower than the first water-to-slag ratio; curing said combined granular material, binder and water having said second water-to-slag ratio with carbon dioxide.

**Assignees:** ROYAL INSTITUTION FOR ADVANCEMENT OF LEARNING MCGILL UNIV; ROYAL INST FOR ADVANCEMENT OF LEARNING MCGILL UNIV; CARBICRETE INC; ROYAL INSITUTION FOR ADVANCEMENT OF LEARNING MCGILL UNIV; UNIV MCGILL



439. Family 46814480 (CA2694989 AA)

[View in PatBase](#)

Extended Family Number: 42613795

Title

[EN] COMPOSITIONS AND METHODS USING SUBSTANCES CONTAINING CARBON

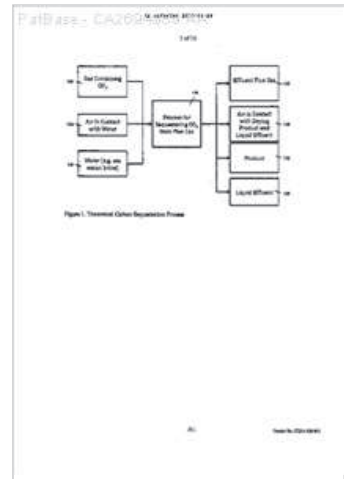
Abstract

[EN] Methods of characterizing and producing compositions with negative. delta13C values are provided. Aspects of the invention include characterizing source materials and process products. Aspects of the invention also include compositions that contain carbon with negative. delta13C values.

1st Main Claim

[EN] 1. A composition comprising carbonates, bicarbonates, or a combination thereof, wherein the carbon in the composition has a relative carbon isotope composition (. delta13C) value less than -26.10 o/oo.

Assignees: CALERA CORP



440. Family 46814496 (US2010077922 AA)

[View in PatBase](#)

Extended Family Number: 42613795

Title

[EN] COMPOSITIONS AND METHODS USING SUBSTANCES CONTAINING CARBON

Abstract

[EN] Methods of characterizing and producing compositions with negative delta13C values are provided. Aspects of the invention include characterizing source materials and process products. Aspects of the invention also include compositions that contain carbon with negative delta13C values.

1st Main Claim

[EN] 1. A composition comprising carbonates, bicarbonates, or a combination thereof, wherein the carbon in the composition has a relative carbon isotope composition (delta<sup>13</sup>C) value less than -26 10 percent.

Assignees: CONSTANTZ BRENT; O NEIL JAMES R; OMELON SIDNEY; CALERA CORP



441. Family 41946231 (JP2008120607 A2)

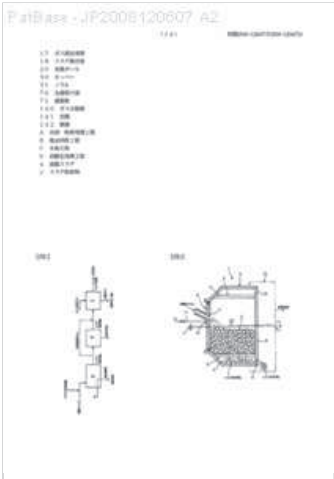
[View in PatBase](#)

**Title**  
[EN] METHOD FOR PROCESSING STEEL SLAG

**Abstract**  
[EN] PROBLEM TO BE SOLVED: To quickly modify and process steel slag, immediately after generation, to the state which can be used as valuable raw materials while processing in a favorable forms and conditions in environmental aspects. SOLUTION: The method for processing steel slag comprises a step A of charging molten slag into a rotating drum which stores metal balls after mixing a slag modifying agent to molten slag, and while cooling slag by allowing it to be in contact with the metal balls rotating in the rotating drum, crushing with the physical action by rotating the metal balls to form crushed slag. Further the method preferably comprises, as a step to follow the step A, at least one step selected from the steps of: a step B of recovering metals, a step C of hydrating a calcium portion in the crushed slag and a step D of carbonating noncarbonated Ca in the crushed slag. According to the use of slag, modified and processed granular slag can be obtained quickly without a crushing process and an aging process for recovery of metals and without the generation of high pH elution water, and thus slag products are prepared under environmentally friendly conditions.

**1st Main Claim**  
[MT] Injected into the rotating drum after steel making process occurs in 1. , molten state, was added to the slag in the slag material reforming in a state of semi-molten state or high-temperature solid phase still, metal ball group is accommodated, with cooling that is brought into contact with the group of metal balls rolling in a rotating drum slag said, characterized by comprising a step (A) and crushed slag and crushed by physical action by the group of metal balls rolling how to handle and steelmaking slag.

**Assignees:** JFE STEEL KK; JFE HOLDINGS INC



442. Family 44107028 (KR100919620 B1)

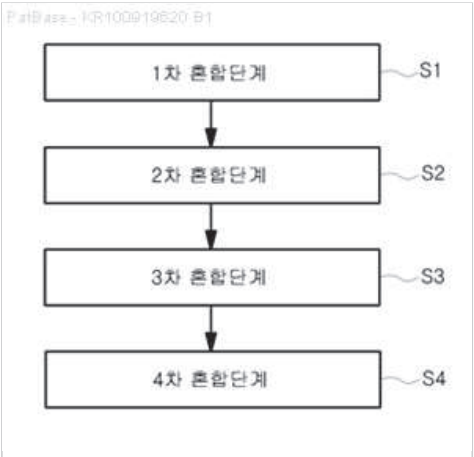
[View in PatBase](#)

Title

[EN] THE ARTIFICIAL SOIL COMPOSITION AND ITS MANUFACTURING METHOD THAT USING THE INDUSTRIAL BY-PRODUCT FOR RECOVERING AN ABANDONED QUARRY MINING

Abstract

[EN] PURPOSE: An artificial soil composition using industrial by-products for recovering an abandoned quarry mining and a manufacturing method thereof are provided to prevent environmental contamination by blocking bad small of end products through the use of a highly functional deodorizing agent. CONSTITUTION: A method for manufacturing artificial soil using industrial by-products for recovering an abandoned quarry mining comprises the steps of: (S1) mixing 30~50 parts by weight of aluminosilicate-based paper sludge incineration ash and 30~50 parts by weight of fly ash to prepare a first mixture, wherein the aluminosilicate-based paper sludge incineration ash has a specific surface area of 2,000 cm<sup>2</sup>/g or more and fly ash has pozzolanic reaction; (S2) mixing 5~10 parts by weight of calcium oxide (CaO), 0.5~3 parts by weight of solidifying promoter, and 5~15 parts by weight of at least one inorganic binder, wherein the inorganic binder is selected from the group consisting of fine blast-furnace slag powder or one kind of Portland cement and three kinds of high early strength cement; (S3) mixing 5~10 parts by weight of a second mixture and inorganic acid and 5~20 parts by weight of H<sub>2</sub>O to 100 parts by weight of sewage/wastewater and sludge to prepare a third mixture; and (S4) mixing 1~5 parts by weight of deodorizing agent and 30~60 parts by weight of waste stone powder to the third mixture to prepare a forth mixture, wherein the forth mixture are transferred to a curing tank.



1st Main Claim

[MT] 1. Quarrying end are many industrial by-products using the composition recovery section for the artificial soil

and water treatment sludge / waste water, based on 100 parts by weight, the

specific surface area is greater than or equal to 2,000 cm<sup>2</sup>/g paper sludge ash;

calcium oxide (CAO) 30 to 40 parts by weight and 5 to 10 parts by weight;

pozzolanic fly ash having the activity of 30 to 40 parts by weight and

5 to 10 parts by weight of an inorganic acid;

and; 0.5-3 parts by weight and

5 to 20 parts by weight of promoter; water (H<sub>2</sub>O);

deodorant;

tailings minutes (enk-clean air) 1-5 parts by weight, 30 to 60 parts by weight

5 to 15 parts by weight of an inorganic binder; and; characterized in that it comprises a by-product of industry is quite a few recovery for the artificial soil of quarrying termination composition.

Assignees: YOU JONG HEE

443. Family 46814477 (WO10091029 A1)

[View in PatBase](#)

Extended Family Number: 42613795

Title (EP2352574 A1)

[EN] CO2 SEQUESTERING SOIL STABILIZATION COMPOSITION

Abstract (EP2352574 A1)

[EN] CO2 sequestering soil stabilization compositions are provided. The soil stabilization compositions of the invention include a CO2 sequestering component, e.g., a CO2 sequestering carbonate composition. Additional aspects of the invention include methods of making and using the CO2 sequestering soil stabilization composition. The invention also comprises the method of stabilizing soil and producing a soil stabilized structure utilizing such compositions.

1st Main Claim (EP2352574 A1)

[EN] 1. A soil stabilization composition comprising a CO<sub>2</sub> sequestering component.

Assignees: CALERA CORP; CONSTANTZ BRENT R; YOUNGS ANDREW



444. Family 104779680 (JP2024144178 A2)

[View in PatBase](#)

Title

[EN] CEMENT ADMIXTURE AND PRODUCING METHOD THEREOF, CEMENT COMPOSITION, CEMENT-CURED MATERIAL AND PRODUCING METHOD THEREOF

Abstract

[EN] To provide a cement admixture that secures a sufficient usable time and has excellent strength developability, and to realize energy saving and CO2 reduction in the production of the cement admixture.SOLUTION: A cement admixture containing a calcium aluminate powder. Here, the powder contains a calcium aluminate slag having an inclusion molar ratio (CaO/Al2O3) of 0.9-1.5 between CaO and Al2O3 as a chemical component generated as a by-product during metal refining, and at least a part of the powder is subjected to a hydration treatment.SELECTED DRAWING: None

1st Main Claim

[MT] 1. A cement admixture comprising a powder of a calcium aluminate-based material, wherein the powder is produced as a by-product during metal refining, and as chemical components, CaO and Al<sub>2</sub>O<sub>3</sub>Of (Cao/Al)<sub>2</sub>O<sub>3</sub>) Is 0.9-1.5, and at least a portion of the powder is water-added.

Assignees: TAIHEIYO MATERIAL KK; TAIHEIYO MATERIALS CORP

## 445. Family 9978167 (CN1100190 A)

[View in PatBase](#)

### Title

[EN] Prefabricated magnesium plate for top of kitchen range

### Abstract

[EN] The prefabricated magnesium plate for top of kitchen range is made up of magnesium oxide, magnesium chloride, calcium carbonate, flyash and aluminium sulfate as gas lead-out agent by chemical reaction to lead out CO<sub>2</sub> gas, and features light weight, high strength, thermal insulation, no thermal cracking and deformation and smooth surface.

### 1st Main Claim

[MT] Claim preformed cookstoves platen Chu application magnesia, magnesium chloride, calcium carbonate and fly ash can be issued and force tendons and other bamboo composite made of carbon dioxide gas.

**Assignees:** LIU ZHAOMIN

446. Family 98309513 (US2025115517 AA)

[View in PatBase](#)

Title (EP4466239 A1)

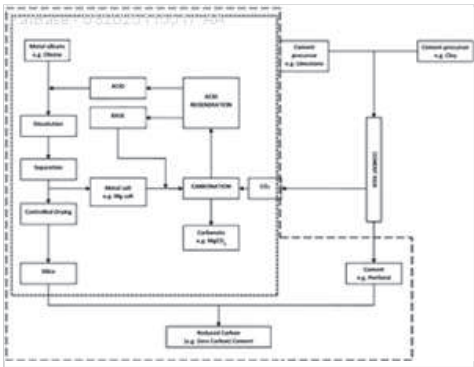
[EN] SILICA SUPPLEMENTARY CEMENTITIOUS MATERIALS

Abstract (EP4466239 A1)

[EN] Described herein are silica supplementary cementitious materials, composite cements and processes for their preparation. Also described herein are processes for preparing a composite cement comprising cement (e.g. Portland cement), a silica material (e.g. as an SCM), and optionally a carbonate material (e.g. as a filler), wherein said processes include the preparation of the silica material.

1st Main Claim (EP4466239 A1)

[EN] 1. A process for preparing a composite cement comprising a silica material, cement, and optionally a carbonate material; wherein the process comprises the steps: a) preparing the silica material by: i) contacting a metal silicate material with an aqueous acid to form a mixture comprising a silica component and a metal salt component; ii) extracting the silica component from the metal salt component, to obtain the silica material, wherein the extraction comprises contacting the mixture with an organic solvent and separating the silica component from the metal salt component; or wherein the extraction comprises separating the silica component from the metal salt component; and washing the silica component with water, followed by an organic solvent; b) carbonating the metal salt component to produce a carbonate material; and c) blending the silica material, cement, and optionally a carbonate material to obtain the composite cement.



Assignees: IMP COLLEGE INNOVATIONS LTD

447. Family 54848134 (CN103328405 A)

[View in PatBase](#)

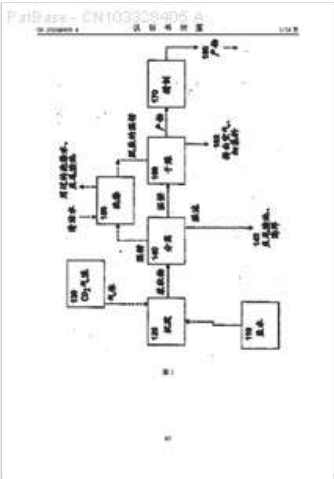
Extended Family Number: 42613795

Title  
[EN] FORMED BUILDING MATERIALS

Abstract  
[EN] Formed building materials comprising a sequestered CO2 are provided. The building materials of the invention include a composition comprising a carbonate/bicarbonate component. Additional aspects of the invention include methods of making and using the formed building materials.

1st Main Claim  
[MT] 1. A dry wall products, which contain = CO2- sequestering component, wherein the CO2-sequestering component selected from the group comprising amorphous calcium carbonate contains, vaterite and metastable carbonate of calcium carbonate composition, wherein the CO2-sequestering component of less than -15 percent of S 13C, and wherein the drywall product having a porosity of 5 percent -90 percent and 500 3000psi compressive strength.

Assignees: CALERA CORP



## 448. Family 95708095 (WO24084247 A1)

[View in PatBase](#)

### Title

[EN] CONSTRUCTION PRODUCT

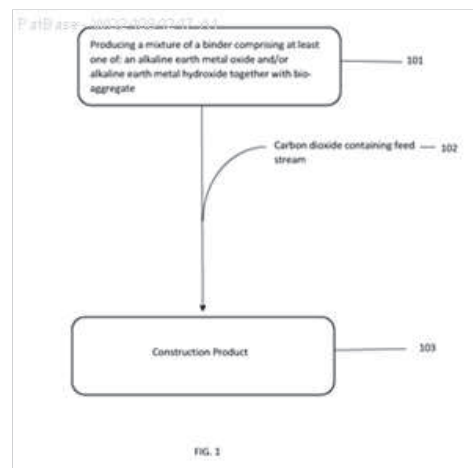
### Abstract

[EN] A construction product comprising an accelerated carbonation-cured mixture and a method of manufacturing the construction product is provided. The method comprises: producing a mixture of bio-aggregate and a binder, the binder comprising an alkaline earth metal oxide or alkaline earth metal hydroxide; and exposing the mixture to a carbon dioxide containing feed stream for accelerated carbonation of the mixture. The method further comprises: forming the mixture into a predetermined geometric shape; and providing a planar lining material on one or more outer faces of the predetermined geometric shape.

### 1st Main Claim

[EN] 1. A method of manufacturing a construction product, wherein the construction product is an internal board comprising an accelerated carbonation-cured mixture, the method comprising: producing a mixture of bio-aggregate and a binder, the binder comprising an alkaline earth metal oxide or alkaline earth metal hydroxide; exposing the mixture to a carbon dioxide containing feed stream for accelerated carbonation of the mixture; forming the mixture into a predetermined geometric shape; and providing a planar lining material on one or more outer faces of the predetermined geometric shape.

**Assignees:** ADAPTAVATE LTD



449. Family 104516474 (WO24187344 A1)

[View in PatBase](#)

Title

[EN] COLD-MIXING COLD-PAVING NEW AGGREGATE PAVING MATERIAL, AND MANUFACTURING METHOD THEREFOR

Abstract

[EN] A cold-mixing cold-paving new aggregate paving material, and a manufacturing method therefor. Agents are mixed into general gravel, such that gravel concrete is coated and cured with a coagulant as an added agent, and a water-based photo-hardenable resin agent, as an agent, is then added for cold mixing, so as to provide jointing among the raw materials to form hardening and reduce the curing speed of the gravel concrete for pre-cold-mixing; the manufacture step of a cold-mixing cold-paving new aggregate paving material is finished in a pre-cold-mixing method; and the cold-mixing cold-paving new aggregate paving material does not need to be heated, namely, the cold-mixing cold-paving new aggregate paving material is paved on a preset pavement in a cold-paving manner, such that the aims of reducing emissions of carbon dioxide, heat, etc., and saving electricity consumption are achieved, such that the cold-mixing cold-paving new aggregate paving material has the effects of energy conservation and carbon reduction and can meet environmental protection demands.

1st Main Claim

[MT] A cold mix cold-laid new bone-laying material comprising sandstone concrete and a medicament, characterized in that:

The sand concrete is a fine-grained and coarse-grained general sand mix of paving material; and

The agent is added to the sandstone concrete and contains a coagulant for the sandstone concrete to form a wrap and cure for the sandstone concrete, the coagulant being an aqueous photo-hardener resin agent for making a joint between the raw materials, And the coagulant is a material containing calcium carbonate, magnesium carbonate, stone powder, glass powder and carbon ash, And the water-borne photohardener resin agent is a material containing hardener, blowing agent, retarder and water-borne photohardener resin.

Assignees: TANG PO YU



450. Family 100438575 (JP2023184407 A2)

[View in PatBase](#)

Title

[EN] GROUND-IMPROVING MATERIAL AND METHOD FOR PRODUCING THE SAME

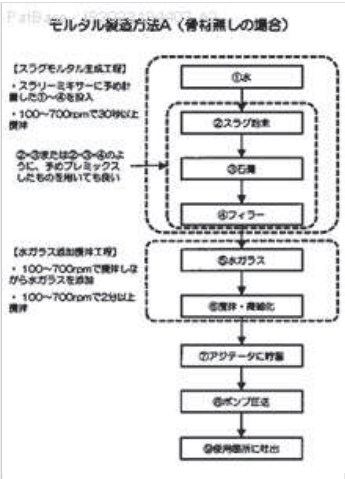
Abstract

[EN] To provide a method for producing a high viscosity slag mortar, capable of maintaining a long usable time while reducing bleeding and material separation during pumping by performing instant thickening.SOLUTION: A high viscosity slag mortar comprises at least slag powder, gypsum powder, a filler, water glass, and water, does not contain cement, and is used by pumping. A method for producing the high viscosity slag mortar includes: a slag mortar-producing step of adding water to the slag powder, gypsum powder, and filler to produce a slag mortar; and a water glass addition and agitation step of adding water glass to the slag mortar produced in the slag mortar-producing step to produce a flocculated heterogeneous gel, and then agitating the resultant slag mortar to break up the flocculated heterogeneous gel to make it finer while promoting its gelation.SELECTED DRAWING: Figure 2

1st Main Claim

[MT] 1. Containing at least a slag powder, a gypsum powder, a filler, water glass and water, and free of cement; A thickening slag mortar used by pumping, which satisfies the following conditions (1) and (3): (1) the bleeding rate of the thickening slag mortar after 1 hour of production is within 6 percents; (2) the table flow test value of the thickening slag mortar after 1 hour of shaking and 3 hours of shaking immediately after production is 250 mm or more; and (3) the uniaxial compression test value of the thickening slag mortar after 28 days of production is 0.2 MN/m.<sup>2</sup>Or more

Assignees: KONOIKE CONST; KONOIKE CONSTR LTD; TOUSO SANGYO KK



## 451. Family 81844564 (CN111892363 A)

[View in PatBase](#)

### Title

[EN] MAGNESIUM SLAG CEMENTING MATERIAL AND FORMING PROCESS METHOD THEREOF

### Abstract

[EN] The invention discloses a technological method for improving the forming capacity and strength of a magnesium slag cementing material. Calcium salt in the magnesium slag reacts to generate calcium carbonate by adopting a method of adding baking soda ( $\text{NaHCO}_3$ ) into the magnesium slag;  $2\text{C}_2\text{S} + 4\text{H}^+ = 4\text{Ca}^{2+}(\text{aq}) + 2\text{SiO}_4^{4-}(\text{aq}) + 4\text{H}^+$  is the hydrolysis process of the main component dicalcium silicate of the magnesium slag,  $\text{H}^+$  introduced by baking soda is used for reaction, and meanwhile, the magnesium slag contains a certain amount of  $\text{CaO}$  and  $\text{Ca}^{2+}$ ;  $\text{CaCO}_3$  is generated through two reactions, the forming capacity and strength of the magnesium slag material are improved, meanwhile,  $\text{CaCO}_3$  has high compactness, the porosity of the material can be reduced, and therefore the durability of the material is improved under the condition that steel is not added internally; production can be carried out without special materials and equipment; the method has the advantages of being controllable in cost, simple in process and excellent in performance, and the problem that the magnesium slag cementing material is low in strength is well solved.

### 1st Main Claim

[MT] 1. A magnesium slag cementitious material, characterized in that: Its raw materials, including water, sodium bicarbonate, potassium bicarbonate, sodium bicarbonate and magnesium magnesium slag, the slag mass ratio of 1 ~ 8%, water and overall dry material mass ratio of 0.25 to 0.35.

**Assignees:** UNIV XI AN JIAOTONG; XI AN JIAOTONG UNIV

452. Family 91854501 (CN114605166 A)

[View in PatBase](#)

Title

[EN] CARBON-IMMOBILIZED BIOLOGICAL FOAM CONCRETE AND PREPARATION METHOD THEREOF

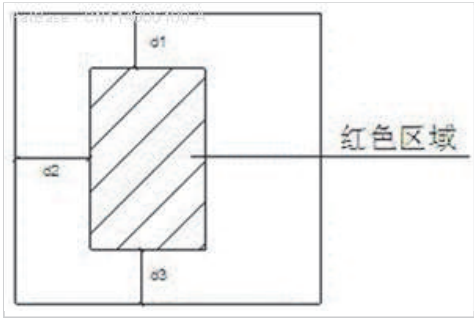
Abstract

[EN] The invention discloses a carbon immobilization biological foam concrete and a preparation method thereof, the concrete comprises the following components in parts by weight: 500-850 parts of cement, 700-1200 parts of river sand, 220-500 parts of water, 25-50 parts of foaming agent and 20-45 parts of bacillus tequilensis, the cement adopts ordinary Portland cement with grade 525, the river sand adopts ordinary Portland cement with grade 525, and the water adopts ordinary Portland cement with grade 525. The quality of the river sand meets the national standard of General Portland Cement GB175-2017, the particle size of the river sand is smaller than 1 mm, tap water is adopted as the water, the quality of the river sand meets the domestic water standard, a composite foaming agent is adopted as the foaming agent, the main component of the composite foaming agent is microbial protein, a natural plant foaming agent is compounded, the appearance of the composite foaming agent is dark brown viscous liquid, the density of the composite foaming agent is 1.05-1.20 g/cm<sup>3</sup>, and the foaming times of the composite foaming agent is 40-70 times. According to the method, bacillus tequilensis is used as a natural carbonization accelerating factor, carbonic anhydrase and urease are generated by the bacillus tequilensis, absorption of CO<sub>2</sub> is accelerated, CaCO<sub>3</sub> precipitates are generated, and therefore the purpose of carbon immobilization is achieved.

1st Main Claim

[MT] 1. Carbon-storing bio-foam concrete characterized in that the concrete consists of cement, river sand, water, foaming agent and Bacillus terkieae, the components of which are cement 500-850 parts, river sand 700-1200 parts, water 220-500 parts, foaming agent 25-50 parts and Bacillus terkieae 20-45 parts.

**Assignees:** SHANGHAI DIJIANG GROUP CO LTD; SHANGHAI DIJIANG BUILDING TECH CO LTD



## 453. Family 46814475 (WO10039909 A1)

[View in PatBase](#)

**Extended Family Number:** 42613795

**Title (EP2203067 A1)**

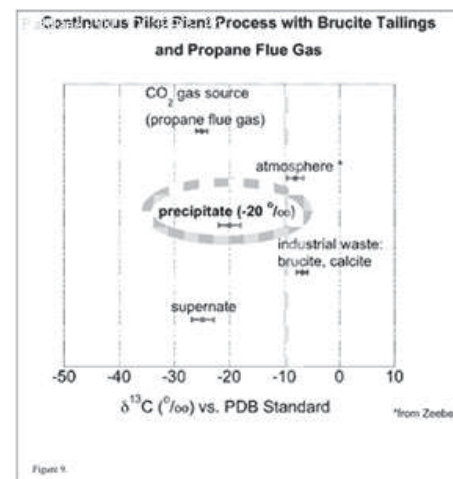
[EN] COMPOSITIONS AND METHODS USING SUBSTANCES CONTAINING CARBON

**Abstract (EP2203067 A1)**

[EN] Methods of characterizing and producing compositions with negative  $\delta^{13}\text{C}$  values are provided. Aspects of the invention include characterizing source materials and process products. Aspects of the invention also include compositions that contain carbon with negative  $\delta^{13}\text{C}$  values.

**1st Main Claim (EP2203067 A1)**

[EN] 1 A composition comprising carbonates, bicarbonates, or a combination thereof, wherein the carbon in the composition has a relative carbon isotope composition ( $\delta^{13}\text{C}$ ) value less than -26 ‰ 2 The composition of claim 1 wherein the composition is a synthetic composition 3 The composition of claim 1 wherein the carbonates, bicarbonates, or combination thereof make up at least 50 percent of the composition 4 The composition of claim 1 wherein the composition has a mass of greater than 100 kg 5 The composition of claim 1 wherein the  $\text{CO}_2$  content of the composition is at least 10 percent 6 The composition of claim 1 wherein the composition has a negative carbon footprint 7 The composition of claim 1 further comprising boron, sulfur, or nitrogen wherein the relative isotopic composition of the boron, sulfur, or nitrogen is indicative of a fossil fuel origin 8 The composition of claim wherein the carbonates, bicarbonates, or combination thereof comprise calcium, magnesium or a combination thereof 9 The composition of claim 8 wherein the calcium to magnesium (Ca/Mg) molar ratio is between 1/200 and 200/1 10 The composition of claim 8 wherein the calcium to magnesium (Ca/Mg) molar ratio is between 12/1 to 1/15 11 The composition of claim 8 wherein the calcium to magnesium (Ca/Mg) molar ratio is between 5/1 to 1/10 12 The composition of claim 1 further comprising  $\text{SOx}$  or a derivative thereof 13 The composition of claim 12 wherein the composition comprises a  $\text{SOx}$  derivative and wherein the  $\text{SOx}$  derivative is a sulfite, a sulfate, or a combination thereof 14 The composition of claim 1 further comprising a metal 15 The composition of claim 14 wherein the metal comprises lead, arsenic, mercury, or cadmium or a combination thereof 16 A building material comprising a component comprising carbonates, bicarbonates, or a combination thereof, wherein the carbon in the carbonates, bicarbonates, or combination thereof has a relative carbon isotope composition ( $\delta^{13}\text{C}$ ) value less than -1000 ‰ 17 The building material of claim 16 wherein the component comprising carbonates, bicarbonates, or combination thereof is carbon-neutral or carbon negative 18 The building material of claim 16 wherein the component comprising carbonates, bicarbonates, or combination thereof is synthetic 19 The building material of claim 16 wherein the carbonates, bicarbonates, or combination thereof make up at least 50 percent of the component comprising carbonates, bicarbonates, or combination thereof 20 The building material of claim 16 wherein the  $\text{CO}_2$  content of the component comprising carbonates, bicarbonates, or combination thereof is at least 10 percent 21 The building material of claim 16 further comprising boron, sulfur, or nitrogen wherein the relative isotopic composition of the boron, sulfur, or nitrogen is indicative of a fossil fuel origin 22 The building material of claim 16 wherein the carbonates, bicarbonates, or combination thereof comprise calcium, magnesium or a combination thereof 23 The building material of claim 22 wherein the calcium to magnesium (Ca/Mg) molar ratio is between 1/200 and 200/1 24 The building material of claim 22 wherein the calcium to magnesium (Ca/Mg) molar ratio is between 12/1 to 1/15 25 The building material of claim 16 wherein the component comprising carbonates, bicarbonates, or combination thereof constitutes at least 20 percent of the building material 26 The building material of claim 16 wherein the building material is a cementitious material 27 The cementitious building material of claim 26 wherein the building material is cement or concrete 28 The building material of claim 16 wherein the building material is a non-cementitious material 29 The building material of claim 28 wherein the building material is an aggregate 30 The building material of claim 28 wherein the building material is a roadway material 31 The building material of claim 28 wherein the building material is a brick, a board, a conduit, a beam, a barm, a column, a tile, a fiber siding product, a slab, an acoustic barrier, plaster, dry-wall, stucco, a soil stabilization composition, or insulation or combinations thereof 32 The building material of claim 16 wherein the component comprising carbonates, bicarbonates, or combination thereof further comprises  $\text{SOx}$  or a derivative thereof 33 The building material of claim 32 wherein the component comprises a derivative of  $\text{SOx}$  and wherein the derivative is a sulfate, a sulfite, or a combination thereof 34 The building material of claim 16 wherein the component comprising carbonates, bicarbonates, or combination thereof further comprises a metal 35 The building material of claim 32 wherein the metal comprises lead, arsenic, mercury or cadmium or combinations thereof 36 A flowable composition comprising carbonates, bicarbonates, or a combination thereof wherein the carbon in the carbonates, bicarbonates, or combination thereof has a relative carbon isotope composition ( $\delta^{13}\text{C}$ ) value less than -500 ‰ and the viscosity of the composition is between 1 and 2000 cP 37 The composition of claim 36 wherein the viscosity is between 10 and 1000 cP 38 The composition of claim 36 wherein the composition is a synthetic composition 39 The composition of claim 36 wherein the carbonates, bicarbonates, or combination thereof make up at least 10 percent w/w of the composition 40 The composition of claim 36 wherein the  $\text{CO}_2$  content of the composition is at least 10 percent 41 The composition of claim 36 wherein the composition has a negative carbon footprint 42 The composition of claim 36 further comprising boron, sulfur, or nitrogen wherein the relative isotopic composition of the boron, sulfur, or nitrogen is indicative of a fossil fuel origin 43 The composition of claim 36 wherein the carbonates, bicarbonates, or combination thereof comprise calcium, magnesium or a combination thereof 44 The composition of claim 43 wherein the calcium to magnesium (Ca/Mg) molar ratio is between 1/200 and 200/1 45 The composition of claim 43 wherein the calcium to magnesium (Ca/Mg) molar ratio is between 12/1 to 1/15 46 The composition of claim 43 wherein the calcium to magnesium (Ca/Mg) molar ratio is between 5/1 to 1/10 47 The composition of claim 36 further comprising  $\text{SOx}$  or a derivative thereof



**Assignees:** ARELAC INC; CALERA CORP; CONSTANTZ BRENT R; O NEIL JAMES R; OMELON SIDNEY

454. Family 93705737 (US2024166566 AA)

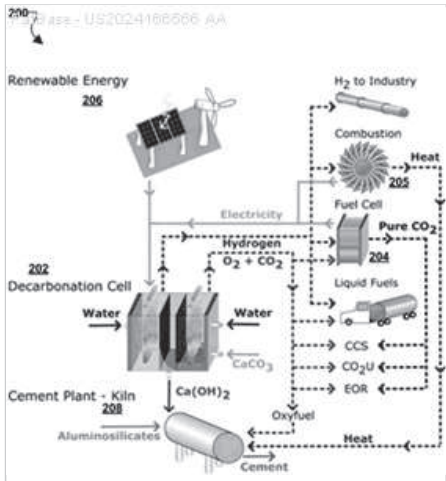
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**Title (EP4320290 A1)**  
[EN] ELECTROCHEMICAL MATERIALS PRODUCTION AND PROCESSING

**Abstract (EP4320290 A1)**  
[EN] Various embodiments include a system or platform that uses electrochemistry to upcycle waste products and low-value minerals into valuable, carbon dioxide (CO<sub>2</sub>)-neutral materials. Various embodiments may include systems and/or methods for processing material inputs using an electrochemical reactor. Various embodiments may include systems, methods, and/or devices for capturing and sequestering carbon dioxide (CO<sub>2</sub>) while producing valuable co-products.

**1st Main Claim (EP4320290 A1)**  
[EN] 1. A method comprising: providing a source of electricity; selecting an input material to be processed; using the source of electricity to power an electrochemical reactor that converts a salt solution into at least one acid and/or at least one base solution; using the acid solution and/or base solution to process the input material; and producing one or more products.

**Assignees:** SUBLIME SYSTEMS INC; NOBLE SYSTEMS INC



## 455. Family 93622669 (CN115141935 A)

[View in PatBase](#)

### Title

[EN] METHOD FOR DEPLETING COPPER REFINING SLAG

### Abstract

[EN] The invention discloses a copper refining slag dilution method, and belongs to the field of environment, slag metallurgy and comprehensive utilization of resources. According to the method, after a copper fire refining oxidation period is finished, a novel dilution agent is directly added into copper refining slag in a copper fire refining furnace, or the dilution agent and the copper refining slag are added into a high-temperature furnace, and oxidizing gas is introduced, so that reduction of a copper component in the copper refining slag and deep dilution of the slag are realized; the deep depletion slag is used as a raw material for reduction ironmaking or a cement raw material or a raw material for flotation separation of copper. The novel dilution agent has the advantages of large specific gravity, controllable reaction, small addition amount, no need of heating, no need of adding equipment, cleanliness, low cost, good dilution effect and the like, and is a composite dilution agent.

### 1st Main Claim

[MT] 1. A copper refining slag depletion process, characterized in that it comprises, in particular, the following steps:

#### Step (1) Reduction and depletion of agents

After the end of the oxidation period of the copper-pyrotechnic refining, directly adding the lean agent and the reducing agent to the copper refining slag in the copper-pyrotechnic refining furnace; or adding the lean agent, the reducing agent and the copper refining slag to the high-temperature furnace for heating; then subjecting the copper oxides in the copper refining slag to metallic copper are reduced by means of an oxidizing gas, and subjecting the copper oxides in the copper refining slag to reduced to metallic copper, and obtaining a copper-rich phase and a depleted slag after the sedimentation is depleted;

The reduction depletion temperature is 1150~ 1450 degrees centigrade;

#### Step (2) Deep depletion of slag cupric after depletion

Adding ice copper to the depleted slag in step (1) for deep depletion, converting residual copper oxides in the slag to metallic copper, and immersing depleted to obtain a copper-rich phase and a deep depleted slag;

The depletion agent has a specific gravity greater than 2.6 g/cm<sup>3</sup>.

**Assignees:** NORTHEASTERN UNIV; UNIV NORTHEASTERN; TOHOKU UNIV

456. Family 53806995 (WO13074252 A1)

[View in PatBase](#)

Extended Family Number: 42613795

Title

[EN] FORMED BUILDING MATERIALS

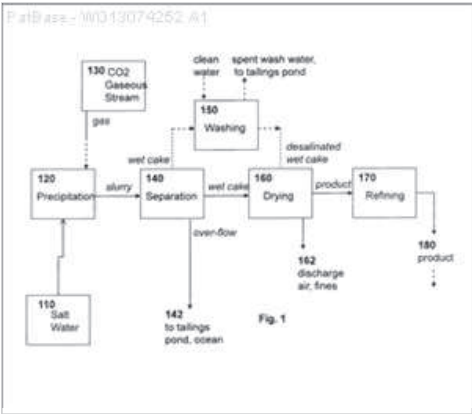
Abstract

[EN] Formed building materials comprising a sequestered CO<sub>2</sub> are provided. The building materials of the invention include a composition comprising a carbonate/bicarbonate component. Additional aspects of the invention include methods of making and using the formed building materials.

1st Main Claim

[EN] 1. A drywall product, comprising: a sequestered-CO<sub>2</sub> component, wherein the sequestered- CO<sub>2</sub> component comprises calcium carbonate comprising a metastable carbonate selected from the group consisting of amorphous calcium carbonate, vaterite, and combinations thereof,

Assignees: CALERA CORP



457. Family 46711545 (US2010219373 AA)

[View in PatBase](#)

Extended Family Number: 42613795

Title (EP2250127 A1)

[EN] GAS STREAM MULTI-POLLUTANTS CONTROL SYSTEMS AND METHODS

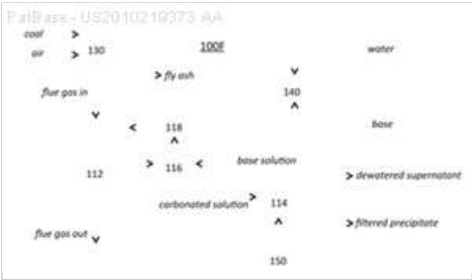
Abstract (EP2250127 A1)

[EN] In some embodiments, the invention provides systems and methods for removing carbon dioxide and/or additional components of waste gas streams, comprising contacting the waste gas stream with an aqueous solution, removing carbon dioxide and/or additional components from the waste gas stream, and containing the carbon dioxide and/or additional components, in one form or another, in a composition. In some embodiments, the composition is a precipitation material comprising carbonates, bicarbonates, or carbonates and bicarbonates. In some embodiments, the composition further comprises carbonate and/or bicarbonate co-products resulting from co-processing SO<sub>x</sub>, NO<sub>x</sub>, particulate matter, and/or certain metals. Additional waste streams such as liquid, solid, or multiphasic waste streams may be processed as well.

1st Main Claim (EP2250127 A1)

[EN] 1. A method of treating an industrial waste gas, wherein the gas comprises carbon dioxide and at least one other component selected from the group consisting of (a) SO<sub>x</sub>; (b) NO<sub>x</sub>; (c) a metal; (d) a non-carbon dioxide acid gas; (e) an organic; and

**Assignees:** CALERA CORP; ARELAC INC; CONSTANTZ BRENT; SEEKER WILLIAM RANDALL; KHOSLA VINOD; CONSTANTZ BRENT R



## 458. Family 68022969 (CN107522503 A)

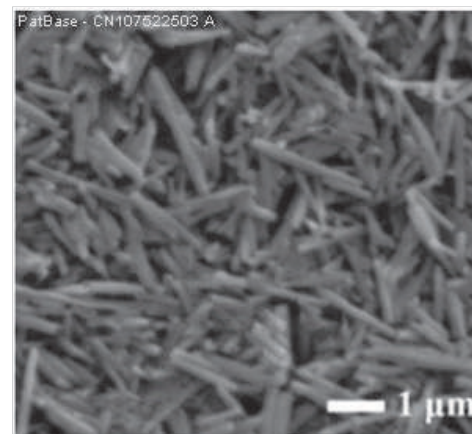
[View in PatBase](#)

### Title

[EN] HIGH-STRENGTH HEAT INSULATING MATERIAL AND PREPARATION METHOD THEREOF

### Abstract

[EN] The invention discloses a high-strength heat insulating material and a preparation method thereof. The preparation method comprises the following steps: firstly supporting a three-dimension net-shaped structure of halloysite by utilizing a method in which the halloysite penetrates into polymers to prepare halloysite aerogel, then compounding with foam concrete and preparing the high-strength heat insulating material. The high-strength heat insulating material disclosed by the invention has the advantages that by adoption of the technical scheme, the defects in the prior art are overcome, and the enhancement and high porosity of the foam concrete are simultaneously realized; and the high-strength heat insulating material and the preparation method provided by the invention are beneficial to obviously improving the high strength and the heat-insulating property of the foam concrete material.



### 1st Main Claim

[MT] 1. A high-strength insulation material, characterized in that concrete porosity of 92-96%, the average thermal conductivity of up to 0.01-0.05w/(m · K), compressive properties on average up to 150-250Mpa, according to the following steps:

#### Step 1, Preparation

of airgel halloysite 80-100 parts by weight of 500-800 parts by weight of the halloysite added to ethanol, ultrasonic dispersion for 0.5-1h, to which was added 1-3 parts by weight of methyl acryloyloxyethyl trimethyl ammonium chloride, at 70-80 degrees centigrade with stirring, and then added into the waters thermostatic 0.5-1h 20-50 parts by weight of amino-terminated poly methyl vinyl siloxane and 0.1-0.5 parts by weight of dibenzoyl peroxide, maintaining the vacuum degree in the 3000-4000pa 10-30min raised to atmospheric pressure, under stirring polymerization 8-24h, to obtain a gel-like product, which is transferred to CO<sub>2</sub>supercritical drying apparatus, the carbon dioxide as a medium, at a temperature of 30-50 degrees Celsius, and pressure 7-10MPA under a supercritical drying 2-5h, to obtain a halloysite airgel; In said step 1, said amino terminated poly methyl ethyl siloxane alkenyl is the weight average molecular weight vinyl content of 0.1-20wt% of 100000-500000, amino double-terminated or mono- terminated poly methyl vinyl siloxane;

#### Step 2, preparation of

the foam concrete foaming agent 0.1-1 parts by weight of the protein is added to 20-80 parts by weight of deionized water, stirring to form a stable foam and the bottom of the container does not appear bleeding phenomenon, resulting protein foaming agent solution; 5-30 parts by weight of cement, 1-20 parts by weight of 0.1-5 parts by weight of raw stone ash, gypsum, mixing 5-60min, so that the dry powder evenly mixed, then add 20-60 parts by weight of deionized water, mixing 10-60min, to obtain a mixed slurry flow state; Step 1 to give 10-100 parts by weight airgel, prepared by mixing a slurry with a protein foaming agent solution mixing evenly to obtain foam concrete; In step 2, the protein foaming agent is saponin plant protein foaming agent, the lime is calcium lime, gypsum building plaster, cement is Portland cement, strength class 42.5 P · O.

**Assignees:** UNIV TIANJIN CHENGJIAN; TIANJIN CHENGJIAN UNIV

459. Family 100785050 (US2024018043 AA)

[View in PatBase](#)

Title

[EN] CONSTRUCTION MATERIALS PRODUCED USING WASTE VIA CARBON SEQUESTRATION

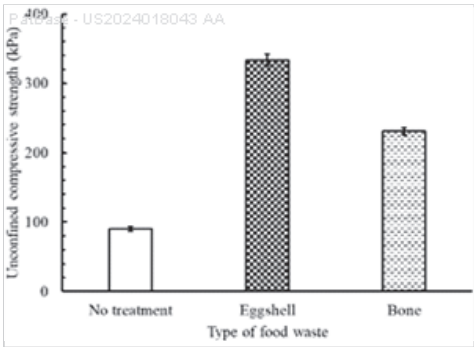
Abstract

[EN] Method for preparing a sustainable construction material, the method including: combining construction waste, food waste comprising calcium, and water thereby forming a waste mixture; optionally moulding the waste mixture; and contacting the waste mixture with CO<sub>2</sub> under conditions in which at least a portion of the calcium present in the waste mixture is converted to calcium carbonate thereby forming a treated waste mixture thereby forming the sustainable construction material.

1st Main Claim

[EN] 1. A method for preparing a sustainable construction material, the method comprising: combining construction waste, food waste comprising calcium, and water thereby forming a waste mixture; optionally moulding the waste mixture; and contacting the waste mixture with CO<sub>2</sub> under conditions in which at least a portion of the calcium present in the waste mixture is converted to calcium carbonate thereby forming a treated waste mixture thereby forming the sustainable construction material.

**Assignees:** UNIV HONG KONG SCIENCE AND TECH; HONG KONG UNIV OF SCIENCE AND TECHNOLOGY



## 460. Family 68022982 (CN107522504 A)

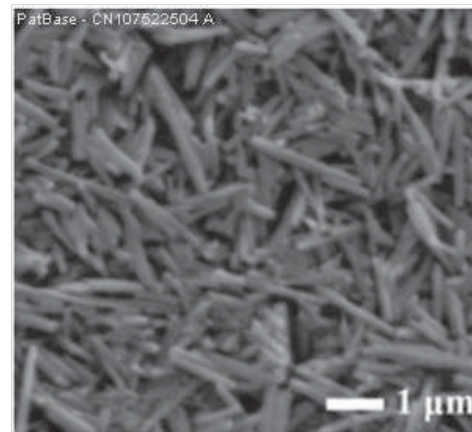
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### Title

[EN] FIBER-REINFORCED COMPOSITE INSULATING MATERIAL AND PREPARATION METHOD THEREOF

### Abstract

[EN] The invention discloses a fiber-reinforced composite insulating material and a preparation method thereof. The preparation method comprises the following steps: firstly, supporting a three-dimensional netty structure of halloysite to prepare a halloysite aerogel by means of a method of coating halloysite with a polymer; and compounding the halloysite aerogel with foam concrete to obtain the high-strength insulating material. According to the technical scheme, the defects in the prior art are overcome, and the condition that existing foam concrete is low in strength and poor in insulating and heat-isolating properties is improved. The invention provides the fiber-reinforced composite insulating material and the preparation method thereof. The high strength and insulating and heat-isolating properties of a foam concrete material are improved obviously.



### 1st Main Claim

[MT] 1. A fiber-reinforced thermal insulation material, characterized in that the porosity of 92-96%, preferably 94-95%, the average thermal coefficient 0.01-0.05w/(m · K), compressive properties up to an average of up to 150-260MPa according to the following steps:

#### Step 1, Preparation

of airgel halloysite 80-100 parts by weight of 500-800 parts by weight of the halloysite added to ethanol, ultrasonic dispersion for 0.5-1h, to which was added 1-3 parts by weight of 2-acrylamido-2-methyl propane sulfonic acid, and stirred at 70-80 degrees centigrade waters thermostatic 0.5-1h, followed by addition of 20-50 parts by weight of amino-terminated poly methyl vinyl siloxane and 0.1-0.5 parts by weight of dibenzoyl peroxide, stirring polymerization reaction 8-24h, to obtain a gel-like product, which is transferred to CO<sub>2</sub> supercritical drying apparatus, the carbon dioxide as a medium, at a temperature of 30-50 degrees Celsius, and pressure 7-10MPa under a supercritical drying 2-5h, to obtain a halloysite aerogel. In said step 1, said amino terminated poly methyl vinyl siloxane as a weight average molecular weight vinyl content of 0.1-20wt% of 100000-500000, amino double-terminated or mono- terminated poly methyl vinyl siloxane;

#### Step 2, preparation of

the foam concrete foaming agent 0.1-1 parts by weight of the protein is added to 20-80 parts by weight of deionized water, stirring to form a stable foam and the bottom of the container does not appear bleeding phenomenon, resulting protein foaming agent solution; 5-30 parts by weight of cement, 1-20 parts by weight of 0.1-5 parts by weight of raw stone ash, gypsum, mixing 5-60min, so that the dry powder evenly mixed, then add 20-60 parts by weight of deionized water, mixing 10-60min, to obtain a mixed slurry flow state; Step 1 to give 10-100 parts by weight airgel, prepared by mixing a slurry with a protein foaming agent solution mixing evenly to obtain foam concrete; In step 2, the protein foaming agent is saponin plant protein foaming agent, the lime is calcium lime, gypsum building plaster, cement is Portland cement, strength class 42.5 P · O.

**Assignees:** UNIV TIANJIN CHENGJIAN; TIANJIN CHENGJIAN UNIV

461. Family 105621211 (CN119077921 A)

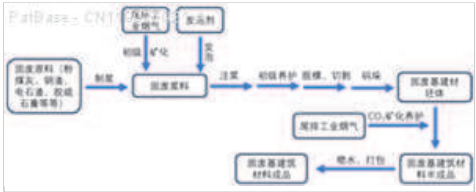
[View in PatBase](#)

Title

[EN] METHOD FOR MULTI-STAGE MINERALIZATION MAINTENANCE OF SOLID WASTE-BASED BUILDING MATERIAL BY UTILIZING TAIL-DISCHARGED INDUSTRIAL FLUE GAS

Abstract

[EN] The invention belongs to the technical field of carbon emission reduction and solid waste resource utilization, and particularly relates to a method for multi-stage mineralization maintenance of a solid waste-based building material through tail-discharged industrial flue gas. The method comprises the following steps: taking calcium-containing solid wastes such as coal gangue, metallurgical slag, desulfurized gypsum and carbide slag as solid waste powder, and mixing the solid waste powder with ordinary portland cement, a foaming agent and water to prepare solid waste slurry; conveying the tail-discharged industrial flue gas into the solid waste slurry for primary mineralization; after primary mineralization is completed, a foaming agent is added into the solid waste slurry and injected into a mold, and primary curing is conducted; after primary curing is completed, demolding and cutting are carried out, and then CO<sub>2</sub> mineralization curing is carried out under tail exhaust industrial flue gas; after CO<sub>2</sub> mineralization maintenance is completed, water is sprayed, and sealing and packaging are conducted. According to the invention, the utilization efficiency of industrial flue gas is improved, the carbon sequestration rate and mechanical strength of the solid-waste-based building material are also improved, the problems of waste of industrial flue gas resources, low carbon sequestration rate of the solid-waste-based building material and the like can be effectively solved, and a positive contribution is made to emission reduction of carbon dioxide.



1st Main Claim

[MT] 1. A method of consolidating waste-based building materials using tail-off industrial flue gas multi-stage mineralization, comprising the steps of: Providing a plurality of flue gas stages;

Step 1, furnish pulping: Formulating a solid waste slurry based on solid waste powder, silica cement, blowing agent and water;

Step 2, Primary mineralization: The tail exhaust industrial flue gas is conveyed into the solid waste slurry for primary mineralization;

Step 3, primary maintenance: After completion of primary mineralization, the blowing agent is added to the solid waste slurry and injected into the mold for primary maintenance;

Step 4, CO<sub>2</sub>Mineralization maintenance: After primary maintenance, demolding, cutting, and subsequent CO under industrial flue gas<sub>2</sub>Mineralization conservation;

Step 5, spray water, packing: Complete the CO<sub>2</sub>Water is sprayed after mineralization and sealed.

**Assignees:** UNIV SHANXI; SHANXI UNIV

## 462. Family 97927254 (US2025051230 AA)

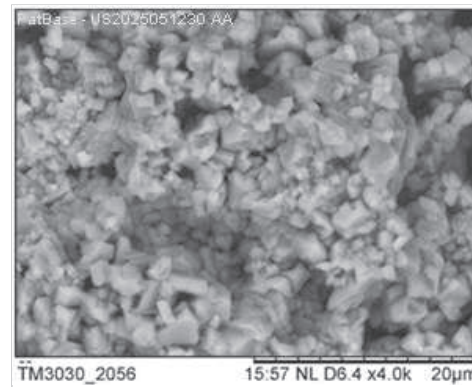
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### Title (EP4452886 A1)

[EN] METHODS OF PRODUCING A BUILDING MATERIAL

### Abstract (EP4452886 A1)

[EN] Methods of producing a building material are provided. Methods of interest include preparing a carbonate precipitate comprising an undifferentiated pluripotent polymorph precursor (i.e., a polymorph precursor) and processing the carbonate precipitate under conditions sufficient to produce the building material. The disclosed polymorph precursors exist in an intermediate state between an disordered state (e.g., amorphous calcium carbonate (ACC)) and an ordered state (e.g., a polymorph of calcium carbonate or of calcium magnesium carbonate). Aspects of the invention also include building materials (e.g., aggregates) as well as compositions (e.g., concrete dry composites, settable compositions and built structures) that include building materials produced via the subject methods.



### 1st Main Claim (EP4452886 A1)

[EN] 1. A method of producing a building material, the method comprising: preparing a carbonate precipitate comprising an undifferentiated pluripotent polymorph precursor; and processing the carbonate precipitate under conditions sufficient to produce the building material.

**Assignees:** BLUE PLANET SYSTEMS CORP; BLUE PLANET SYSTEMS INC

463. Family 106661576 (CN119425708 A)

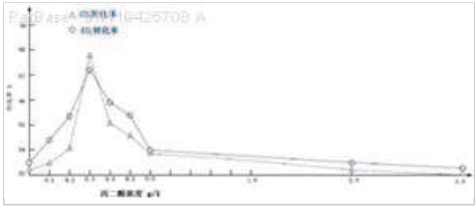
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Title

[EN] PREPARATION METHOD OF ZIRCONIUM-MODIFIED CATALYST FOR GAS-BASED DIRECT REDUCTION IRON

Abstract

[EN] The invention discloses a preparation method of a zirconium-modified catalyst for gas-based direct reduction iron. The preparation method comprises the following steps: S1, preparing a catalyst carrier; step 2, modifying with zirconium dioxide; step 3, dipping the active component nickel; 4, drying, roasting and decomposing the catalyst; 5, evaluating the activity and selectivity of the catalyst; and step 6, carrying out a high temperature resistance test on the catalyst. The catalyst for the gas-based direct reduction iron, which is high in conversion rate, good in catalytic effect and high-temperature-resistant, can be prepared.



1st Main Claim

[MT] 1. A method for preparing a zirconium-modified gas-based catalyst for direct reduction of iron, characterized in that it comprises the following steps:

S1: Preparation of catalyst support:

First, one or more of aluminum nitrate, magnesium nitrate, and calcium nitrate are selected, fully dissolved, and added to a precipitation reaction tank, the temperature of the reaction tank is adjusted, and then a soda ash aqueous solution is slowly added under stirring conditions for neutralization reaction, and the end point PH is controlled to be 7.5-9.5, followed by filtering and washing; the filter cake is dried and then calcined for the first time; the calcined material is added with a release agent and then granulated and formed, and after forming, a second calcination is performed to obtain a catalyst carrier precursor;

Step 2: Zirconium dioxide modification:

The catalyst carrier prepared in step 1 is placed in a prepared zirconium nitrate solution for carrier modification, and after the carrier modification is completed, the catalyst carrier is dried and calcined to decompose to obtain a modified catalyst carrier;

Step 3: Impregnation of active component nickel:

A mixed solution of nickel nitrate, cerium nitrate and lanthanum nitrate is prepared to obtain an impregnation solution, and a small amount of polyol solution is added to the impregnation solution; the catalyst carrier modified in step 2 is impregnated in the impregnation solution, so that the catalyst active component nickel and the catalyst promoter are loaded on the catalyst carrier;

Step 4: Drying and calcination of the catalyst:

The catalyst carrier loaded with nickel nitrate, cerium nitrate and lanthanum nitrate is dried, calcined and decomposed to obtain finished catalyst particles;

Step 5: The finished catalyst particles obtained in step 4 are crushed and sieved in a mortar, loaded into a fixed bed reactor, and the activity and selectivity of the catalyst are evaluated;

Step 6: Conduct a high temperature resistance test on the catalyst in a fixed bed reactor under high temperature conditions to evaluate the high temperature resistance of the catalyst by observing the formation of nickel aluminum spinel and the changes in nickel grains in a high temperature environment.

Assignees: SHAANXI RUILAI SITONG TECH CO LTD

464. Family 86701743 (US2021261428 AA)

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Title (EP4110731 A1)

[EN] METHODS AND SYSTEMS FOR TREATMENT OF LIMESTONE TO FORM VATERITE

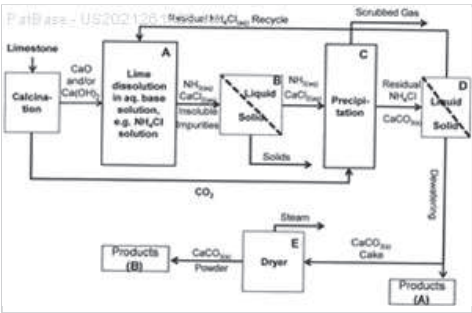
Abstract (EP4110731 A1)

[EN] Provided herein are methods and systems to form calcium carbonate comprising vaterite, comprising dissolving limestone in an aqueous base solution under one or more precipitation conditions to produce a precipitation material comprising calcium carbonate and a supernatant solution, wherein the calcium carbonate comprises vaterite.

1st Main Claim (EP4110731 A1)

[EN] 1. A method to form calcium carbonate comprising vaterite, comprising: (i) dissolving limestone in an aqueous base solution under one or more dissolution conditions to produce a first aqueous solution comprising calcium salt, and a gaseous stream comprising carbon dioxide and ammonia; and (ii) treating the first aqueous solution comprising calcium salt with the gaseous stream comprising carbon dioxide and ammonia under one or more precipitation conditions to form a precipitation material comprising calcium carbonate and a supernatant solution, wherein the calcium carbonate comprises vaterite.

Assignees: ARELAC INC; ARELIC INC



## 465. Family 31985254 (US5100586 A)

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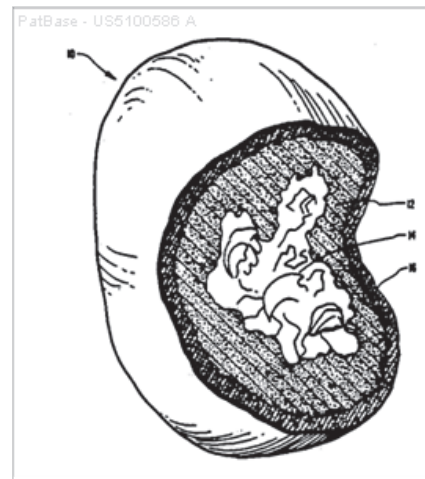
**Extended Family Number:** 32239823

**Title (EP0555238 B1)**

[EN] ENGINEERED CEMENTITIOUS CONTAMINANT BARRIERS AND THEIR METHODS OF MANUFACTURE

**Abstract (EP0555238 B1)**

[EN] Novel engineered cementitious contaminant barriers and containers for storage of hazardous waste are formed by positioning a hydraulic cement composition into a predetermined configuration and then hydrating the cement composition. One or more liquid, ion, or gas getters capable of binding with or absorbing liquids, ions, or gases which may penetrate the barrier may be positioned into the configuration before hydrating. The contaminant barriers of the present invention may be engineered to include mixtures of different getters, single and multiple layers of different getters, multiple layers of cement and getters, and a host of different getter, cement, mixture, and layer combinations. Novel waste containers are also advantageously prepared utilizing contaminant barriers within the scope of the present invention. The waste containers may be prepared by surrounding waste material with at least one getter and with a powdered hydraulic cement composition and then compressing the cement and getter around the waste material. Preformed waste containers may also be prepared within the scope of the present invention. Use of reinforcing fibers and aggregates to improve the mechanical properties of the hazardous waste container is disclosed.



**1st Main Claim (EP0555238 B1)**

[EN] 1. A method of preparing a contaminant barrier from a hydraulically bonded cement composition, comprising the steps of:

- (a) compressing a powdered hydraulic cement composition and at least one getter into a near net final position substantially corresponding to a desired contaminant barrier shape, the getter being capable of preventing passage of a contaminant through the barrier; and
- (b) hydrating the powdered hydraulic cement composition without substantial mechanical mixing of the cement and water.

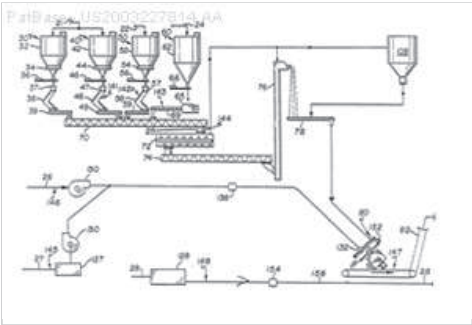
**Assignees:** KHASHOGGI E IND; KHASHOGGI IND E

466. Family 29772974 (US2003227814 AA)

[View in PatBase](#)

**Title**  
[EN] LIGHTWEIGHT AGGREGATE

**Abstract**  
[EN] Producing both colored and noncolored lightweight aggregates. The processes involve mixing a lightweight fine material such as ash with cement, and optionally pigment, then agglomerating the mixture, curing, and sizing the lightweight aggregate. Calcium stearate is added to the lightweight aggregate for reducing the moisture permeability of the lightweight aggregate end product. The colored and noncolored lightweight aggregate may be used in a variety of ways such as to provide a lightweight concrete mix with the same exterior and interior color, and for other asphalt pavement, geotechnical, horticulture, and specialty uses.



**1st Main Claim**  
[EN] 1. A process for producing a colored lightweight aggregate, comprising the steps of:  
(a) mixing a raw material mixture including cement and a lightweight fine material;  
(b) homogeneously mixing a pigment with the raw material mixture from said step of mixing (a);  
(c) agglomerating the material mixture from said step of homogeneously mixing (b); and  
(d) curing the agglomeration from said step of agglomerating (c) in the presence of carbon dioxide to produce the colored lightweight aggregate.

**Assignees:** PRIESNITZ MICHAEL; JOHNSON WILLIAM B; HUBBARD THOMAS D

## 467. Family 64635930 (US2018186695 AA)

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### Title (EP3319923 B1)

[EN] METHOD FOR BINDING OF CARBON DIOXIDE

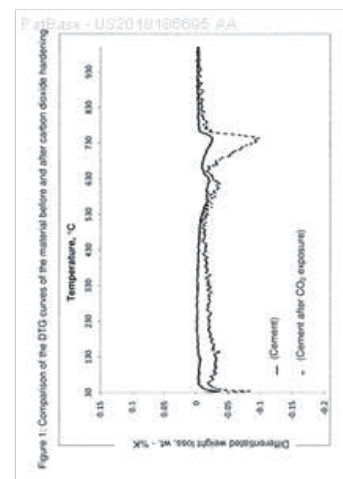
### Abstract

[EN] The invention relates to a method for binding of carbon dioxide, comprising: providing a starting material which comprises sources for CaO and SiO<sub>2</sub> and optionally also Al, Fe and/or Mg, hydrothermally treating the starting material in an autoclave at 50 to 300 degrees centigrade, tempering at 350 to 600 degrees centigrade, and hardening the resulting material with carbon dioxide. The invention further relates to building elements which are obtained by hardening a material according to the method.

### 1st Main Claim (EP3319923 B1)

[EN] 1. Method of binding carbon dioxide, comprising:

- providing a starting material which comprises sources of CaO and SiO<sub>2</sub>,
- hydrothermal treatment of the starting material in an autoclave at 50 to 300 degrees centigrade,
- tempering the material obtained by hydrothermal treatment at 350 to 600 degrees centigrade,
- adding water or other liquids to adjust consistency
- casting in moulds for the production of building elements or processing as mortar or in-situ concrete, and
- hardening of the material obtained by hydrothermal treatment and tempering by treatment with carbon dioxide.



**Assignees:** HEIDELBERGCEMENT AG

## 468. Family 95191676 (KR102481335 B1)

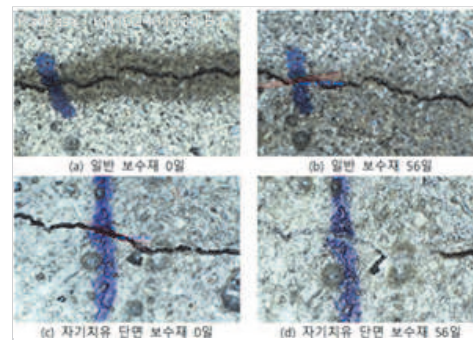
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### Title

[EN] MANUFACTURING METHOD FOR CRACK SELF-HEALING REPAIR MORTARS WITH IMPROVED CARBONATION AND SALT RESISTANCE CAPACITIES

### Abstract

[EN] Disclosed is a method for imparting self-healing effects for cracks, such as thermal expansion and drying shrinkage, which inevitably occur during a curing process of repair materials while improving carbonation and resistance to salt damage in repair materials used in a process of repairing old cross-sections of hydraulic structures, such as culverts and detention ponds, offshore structures, road structures, general facilities, etc. Provided in the present invention is a method for healing cracks through formation of biominerals or hydration reaction when moisture flows into cracks in cross-sections to be repaired, by using, for mixing cross-section repair materials, an inorganic material-based annular aggregate, a biomineral-forming bacteria-based annular aggregate, a superabsorbent fiber-based crack healing annular aggregate, a capsule in which one or more of these aggregates are injected, or a self-healing annular aggregate in which one or more of these aggregates are coated with a biodegradable film.



### 1st Main Claim

[MT] 1. A method for curing cracks through hydration reactions upon ingress of moisture into boring cotton cracks by using inorganic material-based ring agglomerates , capsules into which the inorganic material-based ring agglomerates are dosed or self-healing ring agglomerates in which the inorganic material-based ring agglomerates are coated , in cross-sectional repair media compounding , mortar materials used in cross-sectional repair media cracking , A Portland cement composition comprising 25 to 40% by weight of one-ordinary binder, 15 to 25% by weight of fly ash, 35 to 50% by weight of blast furnace slag, 1 to 10% by weight of sodium carbonate, 1 to 3% by weight of sodium nitrite or sodium phosphate, and 2 to 5% by weight of EVA-based polymer, Characterized in that the inorganic material-based cyclic aggregates comprise 63 to 72 % by weight of blast fine powder or fly ash , 3 to 12 % by weight of calcium hydroxide fine powder , 15 to 25 % by weight of alcohol and 1 to 10 % by weight of quick-setting agent .

**Assignees:** KYONGGI UNIV IND AND ACADEMIA COOPERATION FOUNDATION; PARK SI HWAN; UNIV KYONGGI IND AND ACAD COOP FOUND; INDUSTRIAL ACADEMIC COOPERATION GROUP KYEONGGI UNIV

## 469. Family 103376825 (CN118271019 A)

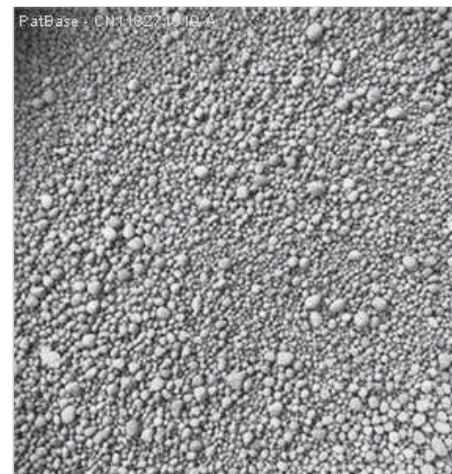
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### Title

[EN] CARBON SEQUESTRATION TYPE IRON TAILING ARTIFICIAL FINE AGGREGATE AND PREPARATION METHOD THEREOF

### Abstract

[EN] The invention discloses a carbon sequestration type iron tailing artificial fine aggregate and a preparation method thereof. The fine aggregate is prepared from iron tailings with the particle size smaller than 0.6 mm as a main raw material, calcium hydroxide, sodium sulfate and calcium nitrite as excitants, ordinary Portland cement as a cementing agent and light calcined magnesite and calcium sulphoaluminate as expanding agents through a one-step method. Grinding, stirring and uniformly mixing the iron tailing powder, the exciting agent, the expanding agent and part of the cementing agent, spraying water, granulating, and adding the rest of the cementing agent to obtain fine aggregate particles; and carrying out carbonization curing and wet curing on the fine aggregate particles to obtain the carbon sequestration type iron tailing artificial fine aggregate. The artificial fine aggregate is prepared from the iron tailings, so that effective resource utilization of the iron tailings is realized, and resource waste is reduced; in addition, the prepared artificial fine aggregate solidifies carbon dioxide, utilization of carbon dioxide and improvement of the compactness of the fine aggregate are achieved, and remarkable environmental and social benefits are achieved.



### 1st Main Claim

[MT] 1. A method for preparing a fine aggregate of carbon-fixed iron tailings, characterized in that the method comprises the steps of:

- 1) drying and sieving the iron tailings to obtain iron tailings powder having a particle size of less than 0.6 mm;
- 2) adding 75-90 wt percent of iron tailings powder, the total amount of cement, an excitator and an expansion agent to a planetary wheel mill mixer in proportion to be roller-agitated to obtain a homogeneous mixture, wherein the excitator is calcium hydroxide, sodium sulfuric acid and calcium nitrite, and the expansion agent is light burned magnesium oxide and calcium sulfur aluminate;
- 3) Pour the homogenous mixture into a disc spheronizer while rolling and spraying water until a fine aggregate pellet core of 1-4 mm diameter is formed, and finally add the remaining auxiliary cement to continue rolling until the surface of the iron tailings microspheres is completely covered by the cement, forming a fine aggregate with a smooth outer shell and no binding;
- 4) subjecting the resulting fine aggregate to carbonization preservation in an atmosphere containing carbon dioxide for 1 day;
- 5) Carbide-preserved fine aggregates placed in an environment of 15-35 degrees centigrade, relative humidity maintained at 90 percent or more, continue to wet-maintain for 1.5-2 days, you can get the carbon-solid iron tailings artificial fine aggregates.

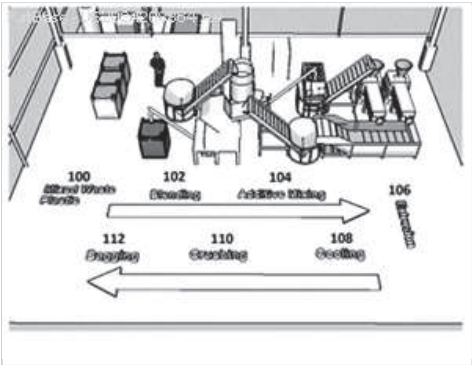
**Assignees:** TIANJIN YEJIAN SPECIAL MAT CO LTD; CENTRAL RES INST OF BUILDING AND CONSTRUCTION CO LTD MCC GROUP; HEBEI GUO PENG BUILDING MAT CO LTD; CENTRAL RES INST BUILDING AND CONSTR CO LTD MCC GROUP; CENTRAL RESEARCH INST OF BUILDING AND CONSTRUCTION CO LTD

470. Family 93904307 (US2024208864 AA)

[View in PatBase](#)

**Title (EP4326686 A1)**  
[EN] HYBRID AGGREGATE

**Abstract (EP4326686 A1)**  
[EN] Systems and methods are provided for making a hybrid aggregate from comingled waste plastics. A supply of granulated mixed waste plastic is treated with a preconditioning agent to improve sanitation and extruded to form an extruded product including waste plastic material. The extruded product is granulated to form a preconditioned resin aggregate and the granules are battered with cement powder or slurry. The battered preconditioned aggregate passes through a reactor to interact the cement powder with flue gases to form the hybrid aggregate with a limestone casing or layer around the preconditioned resin aggregate. The aggregate may also be reinforced with nanoparticles that capture and sequester carbon dioxide in the limestone layer.



**1st Main Claim (EP4326686 A1)**  
[EN] 1. A method of making an aggregate, the method comprising: obtaining a supply of granulated mixed plastic waste treated with a preconditioning agent to improve sanitation of the granulated mixed plastic waste; extruding the granulated mixed plastic waste to form an extruded product including waste plastic material; processing the extruded product to form an aggregate in which the waste plastic material is exposed at exterior surfaces thereof; battering the aggregate with cement powder to form a preconditioned aggregate; and passing the preconditioned aggregate through a reactor to interact the cement powder with flue gases in the reactor and form a hybrid aggregate with a calcium carbonate layer on the waste plastic material.

**Assignees:** CRDC GLOBAL LTD

# 471. Family 87295767 (WO21193571 A1)

[View in PatBase](#)

**Title**  
[EN] TREATMENT METHOD FOR INCINERATOR FLY ASH

**Abstract**  
[EN] Provided is a treatment method for incinerator fly ash, the method enabling suppression of elution of heavy metals contained in the incinerator fly ash and also enabling suppression of elution of chelating agent-derived organic matter. The treatment method for incinerator fly ash comprises: a kneading step S11 in which an additive containing a silicon compound and/or an aluminum compound is kneaded with incinerated fly ash to create a mixture; and a carbonation step S12 in which the mixture is subjected to a carbonation treatment.

**1st Main Claim**  
[MT] Silicon compound and aluminum compound additive contains at least one of the incineration fly ash, it creates a mixture that kneading kneading step relative to the mixture subjected to carbonation step carbonation process, and the processing method of incineration fly ash

**Assignees:** FUJITA CORP



## 472. Family 83254897 (CN112321269 A)

[View in PatBase](#)

### Title

[EN] CARBON DIOXIDE CARBONIZED REGENERATED WATER PERMEABLE BRICK AND PREPARATION PROCESS THEREOF

### Abstract

[EN] The invention belongs to the field of solid waste resource reutilization of civil environmental engineering, and particularly relates to a carbon dioxide carbonized regenerated water permeable brick and a preparation process thereof. Solid-phase components of the recycled water permeable brick are mixed according to the mass percent, the solid-phase components comprise 20 percent -30 percent of fine-grained ash, 5 percent -10 percent of bottom mud, 25 percent -35 percent of recycled aggregate, 0.5 percent -2.0 percent of fiber, 15 percent -30 percent of waste glass powder and 15 percent -35 percent of alkaline materials, and the mass ratio of waste is 70 percent or above. According to the invention, the regenerated water permeable brick with high strength and good crack resistance is formed by uniformly stirring all the components, conducting forming with a brick mold and carrying out vibration pressing and sequentially carrying out conventional curing, steam curing and carbonization curing, and the mechanical property and the water permeability of the brick body are far superior to those of a brick body subjected to independent curing, steam curing or carbonization curing; and in addition, a large amount of carbon dioxide gas is adsorbed in the process, and greenhouse benefits can be reduced. The method overcomes the problems of low comprehensive utilization rate of solid wastes, shortage of traditional brick making raw materials, low efficiency, long period, poor environmental benefits and the like, and has remarkable environmental benefits, social benefits and economic benefits.

### 1st Main Claim

[MT] 1. A carbonized regenerated carbon dioxide permeable brick, characterized in that said regenerated Permeable solid phase component comprises fine ash, sediment, recycled aggregate, fiber, waste glass powder, and an alkaline material, and each solid-phase components by mass percent weighing, wherein fine ash 20% to 30%, the bottom mud 5% to 10%, recycled aggregate 25% to 35%, fiber 0.5% to 2.0%, waste glass powder 15% to 30%, alkaline material 15% to 35%; Permeable regeneration liquid component is water, the water-cement ratio of 0.4 to 0.7.

**Assignees:** UNIV NANJING FORESTRY; NANJING FORESTRY UNIV

473. Family 97651933 (US11673832 BA)

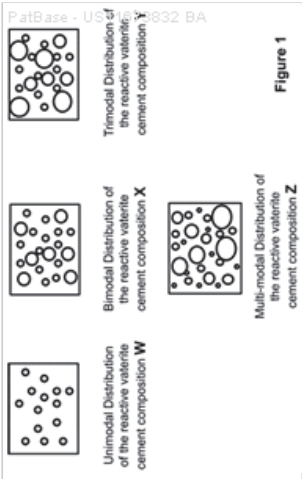
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**Title**  
[EN] COMPOSITIONS, METHODS, AND SYSTEMS RELATED TO MULTI-MODAL DISTRIBUTION OF VATERITE PARTICLES

**Abstract**  
[EN] Provided herein are compositions, methods, and systems related to bimodal, trimodal, and/or multi-modal distribution of reactive vaterite cement particles.

**1st Main Claim**  
[EN] 1. A cement composition, comprising: a bimodal distribution of reactive vaterite cement comprising reactive vaterite cement A having an average particle size of between about 0.1-10 micro m and reactive vaterite cement B having an average particle size of between about 11-50 micro m.

**Assignees:** ARELIC INC; ARELAC INC



474. Family 104117816 (CN118513049 A)

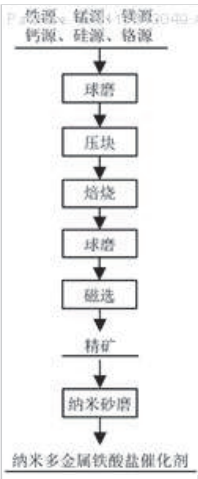
[View in PatBase](#)

**Title**  
[EN] NANOMETER MULTI-METAL FERRITE CATALYST AS WELL AS PREPARATION METHOD AND APPLICATION THEREOF

**Abstract**  
[EN] The invention discloses a nano multi-metal ferrite catalyst as well as a preparation method and application thereof. Raw materials including an iron source, a manganese source, a magnesium source, a calcium source, a silicon source and a chromium source are sequentially subjected to crushing, ball milling, burdening, briquetting, roasting, ball milling, magnetic separation and nano sanding to obtain the nano multi-metal ferrite catalyst, and when the nano multi-metal ferrite catalyst is applied to low-temperature flue gas denitration or carbon dioxide reduction conversion, CO2 can be cyclically and catalytically reduced into solid carbon at the low temperature (200-400 DEG C), and the purpose of reducing CO2 into solid carbon at the low temperature (200-400 DEG C) is achieved. The nano multi-metal ferrite catalyst can be used for continuously and efficiently performing selective catalytic reduction on NOx into N2 in ultralow-temperature (100-150 DEG C) flue gas, and the nano multi-metal ferrite catalyst is low in preparation cost and high in efficiency, can be prepared on a large scale, and has a good application prospect in the field of flue gas treatment.

**1st Main Claim**  
[MT] 1. A process for the preparation of a nano-polymetallic ferrite catalyst, characterized in that a raw material comprising an iron source, a manganese source, a magnesium source, a calcium source, a silicon source and a chromium source is successively subjected to crushing, ball milling, and dosing. Compression, roasting, ball milling, magnetic selection and nano-sanding.

**Assignees:** CENTRAL SOUTH UNIV; UNIV CENTRAL SOUTH



## 475. Family 22018859 (US4350567 A)

[View in PatBase](#)

### Title

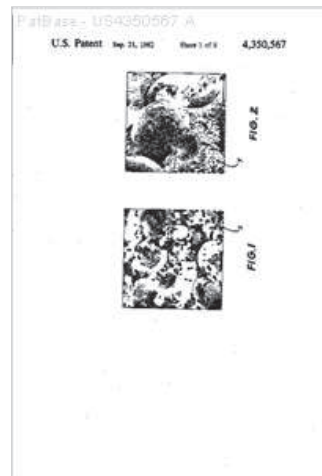
[EN] METHOD OF PRODUCING A BUILDING ELEMENT

### Abstract

[EN] A method for manufacturing a high impact strength carbonate building element is disclosed. Solids and water are mixed to produce a slurry in which the solids consist essentially of at least one alkali earth oxide or hydroxide and an amount of cellulose fibers in the range of 7-40 percent by weight of solids. The slurry is formed into a gas permeable shape having water-containing voids and a porosity in the range of 35-50 percent. Carbon dioxide is then caused to permeate into the shape through the voids to convert the hydroxide to a carbonate, thereby imparting high impact strength to the resulting element. This converting step is performed in a short time period, the duration of which depends on the percentage of carbon dioxide present in the processing atmosphere. This time period is about 30 minutes for an atmosphere of 100 percent carbon dioxide.

### 1st Main Claim

[EN] 1. A method of manufacturing a cellulose fibre reinforced, high impact strength carbonate building element which comprises steps of: (a) mixing solids and water to produce a slurry in which the solids consist essentially of at least one alkali earth oxide or hydroxide and an amount of cellulose fibres in the range 7-40 percent by weight of solids; (b) forming the slurry as a gas permeable shape having voids that contain water and so that the shape has a porosity in the range 35 to 50 percent, where porosity is the volume of the voids within the shape expressed as a percentage of the volume of the whole shape; and (c) causing carbon dioxide gas to permeate into the shape by means of the voids thereby converting the hydroxide(s) to carbonate(s) and imparting high impact strength to the resulting element, this converting step being performed in a short time period dependent on the percentage carbon dioxide present in the processing atmosphere to produce a building element of high impact strength which is not dependent on the presence of aggregate for its impact strength, said period being about 30 minutes for 100 percent carbon dioxide.



**Assignees:** CSR LTD; CRS LTD; CSR LTD AU; CSR LIMETED; CSR LIMITED TE SYDNEY AUSTRALIEE

476. Family 80873106 (CN111635036 A)

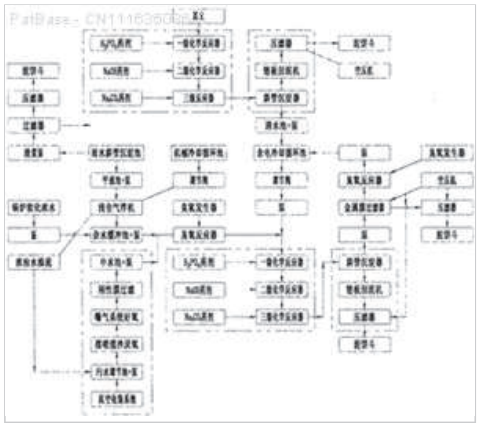
[View in PatBase](#)

Title

[EN] ZERO-DISCHARGE TREATMENT PROCESS FOR CEMENT INDUSTRIAL WASTEWATER

Abstract

[EN] The invention provides a zero-discharge treatment process for cement industrial wastewater, belongs to the field of industrial plant area wastewater treatment, and mainly solves the problem of pollutant discharge of various types of wastewater and rainwater in a plant area. Waste heat power generation cooling wastewater treatment is taken as a base, and the process comprises the following steps: performing directional chemical precipitation reaction on bicarbonate radical, calcium and magnesium ions in water by multistage dosing, performing efficient inclined tube precipitation, filtering by asintered metal filter element and performing ozone disinfection. Initial rainwater is subjected to inclined tube sedimentation and air floatation oil removal and then is converged into the base system, and mechanical equipment cooling wastewater is subjected to oil removal and then is converged into the base system. The removed oil and organic matters are added into a domestic sewage treatment system, and fluid stirring anaerobic treatment is performed so that the treatment of various wastewater in a plant area is organically combined, the system is simplified, the cost is reduced, and the sufficient and guaranteed cyclic utilization is realized. The process is used for zero-discharge treatment of wastewater in the cement industry and the like.



1st Main Claim

[MT] 1. A cement industrial wastewater zero emissions treatment process for building materials and other industrial wastewater zero emissions, characterized in that

it comprises a multi-stage chemical reaction precipitate was filtered cooling cogeneration wastewater treatment system A, raw water treatment system B, swing spray anaerobic sewage treatment system C, rainwater pretreatment system D four basic units.

The cogeneration wastewater treatment system in accordance with the following procedure to run a cooling:

Process A1, from the cooling water circulating tank a circulation return port position near the waste, by adjusting the valve to control the outflow amount;

Process A2, the wastewater by adding a certain amount of medicament for the wastewater containing  $H^+$ ,  $HCO_3^-$ , chemical reaction, the reactor is preferably dispersed so as to generate  $CO_2$  gas into the pipeline with the water discharge;

Process A3, adding a certain amount of medicament containing  $OH^-$ , the wastewater by chemical precipitation of  $Mg^{2+}$  + reaction, the formation of suspended particles of  $Mg(OH)_2$ ; Preferably environmentally friendly  $NaOH$ ,  $NH_4OH$  (or aqueous ammonia),  $Ba(OH)_2$  medicament; Further, using a mixer pipe, hose randomly dispersed multi-point dosing, dosing;

Process A4, the wastewater by adding a certain amount of wastewater containing  $CO_3^{2-}$  agents, for  $GA_2$  + chemical precipitation reaction of  $CaCO_3$  particles in suspension; Preferably environmentally friendly agent  $Na_2CO_3$ ; Further, in the stirred pool using the hose randomly dispersed multi-point dosing, dosing;

Process A5, wastewater added coagulant, used for the formation of  $Mg(OH)_2$ ,  $CaCO_3$  suspension for flocculation; In the stirred pool using the hose randomly dispersed multi-point dosing, dosing;

Process A6, the turbid solution was inclined tube sedimentation, precipitation separation, aggregated particles efficiently concentrated suspension;

Process A7, after precipitation separation, the supernatant was discharged into the sintered metal microfiltration system;

Process A8, or, by the ozone generator ozone, with ozone reactor on-line sterilization of the supernatant;

In the pumping process A9, reflux, cooling water circulating pool water distance point a certain distance close to the circulating water feeding pipe locations to select the return port through the check valve after the confluence of the pool circulating water; Or through check valve direct access to the circulation tank fill pipe;

The procedure A4 may also be selected,

the wastewater by adding a certain amount of  $PO_4^{3-}$  agents, for  $GA_2$  + ion-containing wastewater by chemical precipitation reaction, generate  $Ca_3(PO_4)_2$  suspended particles; Preferably environmentally friendly  $Na_3PO_4$ ,  $H_3PO_4$  medicament; Further, in the stirred pool using the hose randomly dispersed multi-point dosing, dosing;

In the branching process A6-1, efficient sedimentation, by scraper or a mud bucket collection of suspended particles, forming a concentrated slurry through a valve control, intermittent discharge to single-chamber filter press;

In the branching process6-2, closed pressure filter or compressed air assisted under its own weight, mud dehydration; Multiple continuous dewatering a certain time, the filtrate was returned to the nearest discharge collector, filter press dewatering is completed, eventually discharged through the valve solids cake;

The procedure A2 for raw water, a small amount of  $\text{HCO}_3^-$  or not required processing can be deleted; Or whether said process A2 placed in the process after a6;

The process allows omitting a5;

The raw water treatment system B in accordance with the following procedures to reduce turbidity, hardness;

The process B1, from the raw water runoff area, with a pump control the outflow;

Process B2 of raw water by adding a certain amount of medicament containing  $\text{H}^+$ ,  $\text{HCO}_3^-$  for raw water chemical reaction, the reactor is preferably pipeline disperser,  $\text{CO}_2$  gas generated by the reaction with the water discharge;

The process B3, adding a certain amount of medicament containing  $\text{OH}^-$ , the wastewater by chemical precipitation of  $\text{Mg}^{2+}$  + reaction, the formation of suspended particles of  $\text{Mg}(\text{OH})_2$ ; Preferably environmentally friendly  $\text{NaOH}$ ,  $\text{NH}_4\text{OH}$  (or aqueous ammonia),  $\text{Ba}(\text{OH})_2$  medicament; Further, using a mixer pipe, hose randomly dispersed multi-point dosing, dosing;

The process B4, adding a certain amount of raw water raw water containing  $\text{CO}_3^{2-}$  agents, for  $\text{GA}_2$  + chemical precipitation reaction of  $\text{CaCO}_3$  particles in suspension; Preferably environmentally friendly agent  $\text{Na}_2\text{CO}_3$ ; Further, in the stirred pool using the hose randomly dispersed multi-point dosing, dosing;

Procedure B5 to the raw water coagulant is added to the formed suspension,  $\text{CaCO}_3$ ,  $\text{Mg}(\text{OH})_2$  for flocculation; In the stirred pool using the hose randomly dispersed multi-point dosing, dosing;

The process B6, the turbid solution was inclined tube sedimentation, precipitation separation, aggregated particles efficiently concentrated suspension;

The process B7, after precipitation separation, the supernatant was discharged waste water into the clear pool; From the pool to the circulating cooling pool demineralized water supplement;

The process B2 for raw water, a small amount of  $\text{HCO}_3^-$  or not required processing can be deleted; Or whether said process B2 placed in the process after B6;

The process B5 allow the omission;

The sewage treatment system comprising successively C vacuum collection system, the sewage regulation pool, lift pump, mounted a random swing spray fluid processing apparatus stirred anaerobic anaerobic reactor, aeration tank, sludge filtration tank, process as follows:

Process C1, vacuum suction collection system each outfall sewage, the sewage regulation pool;

Process C2, the lift pump from the conditioning tank to the anaerobic reactor for sewage;

Process C3, from the sludge filtration tank with a reflux pump to the random swing spray fluid stirred anaerobic treatment device conveying sewage slurry, slurry rely on internal pressure fluctuations, the flexible tube is irregular curved combine to push the pipe tremor, swing, the pendulum swing limits, the flexible tube of mud outlet in certain areas of randomly string jump, thereby forming a predetermined area distribution to the reactor sludge slurry, pushing the inner reactor Sludge particles suspended disturbance;

Alternatively, continued stirring for a certain time, stop the return pump; The anaerobic reactor calm after a period of time, then the repeated start reflux pump, followed by cycle;

Process C4, the inner aeration aerobic reactor;

Process C5, the sludge in the filtration tank through the aerobic biochemical reactions of mud were rigid membrane filtration;

Process C6, filter out water for ozone disinfection-line, and then import in the pool;

Process C7, the use of lift pump the water delivered to the cooling cogeneration wastewater treatment system A, access to the process A2;

The rainwater pretreatment system D comprises the following processes:

The process D1, receiving rainwater, sedimentation, overflow into the reservoir tank;

Branching process D1-1, by pumping sludge sedimentation, delivered to the ground backwash filter, filtrate return tanks;

Branching process D1-2, after the filter trapped particles from entering into the filter press filter press dewatering, sludge cake, batch output;

The process D2 to a certain flow from storage tank with a pump to the cooling cogeneration wastewater treatment system A conveyor;

Process D3, shallow bin centrifugal flotation machine oil parts, light organics were separated and floating organic component flows into the sewage treatment system C of the regulation pool; Degreasing underflow import miscellaneous water pool;

Process D4, from the doped buffer pool water pump upgrade process to import the cooling water cogeneration wastewater treatment system A, access to the process A2.

**Assignees:** GUANGXI GUANGYU WATER RESOURCES TECH DEVELOPMENT CO LTD; UNIV CENTRAL SOUTH; CR CEMENT TIANYANG CO LTD; CENTRAL SOUTH UNIV

## 477. Family 52544933 (US2012312194 AA)

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### Title (EP2718241 A1)

[EN] SYNTHETIC FORMULATIONS AND METHODS OF MANUFACTURING AND USING THEREOF

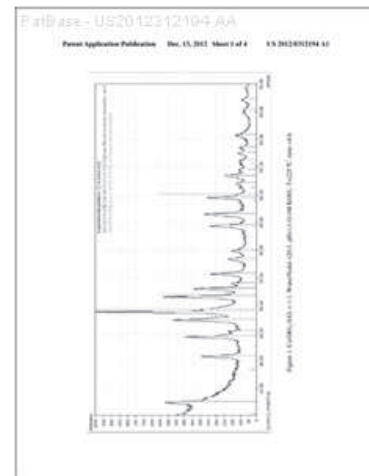
### Abstract (EP2718241 A1)

[EN] A method for producing a reaction product including at least one synthetic formulation that carbonates sufficiently, said method comprising: providing a first raw material, having a first concentration of M; providing a second raw material, having a second concentration of Me; and mixing the first raw material and the second raw material to produce a reaction product that includes at least one synthetic formulation having the general formula  $\text{MaMe}_b\text{Oc}$ ,  $\text{MaMe}_b(\text{OH})_d$ ,  $\text{MaMe}_b\text{Oc}(\text{OH})_d$  or  $\text{MaMe}_b\text{Oc}(\text{OH})_d(\text{H}_2\text{O})_e$ , wherein M comprises at least one metal that can react to form a carbonate and Me is at least one element that can form an oxide during the carbonation reaction, wherein the at least one synthetic formulation is capable of undergoing a carbonation reaction, and wherein the at least one synthetic formulation is capable of undergoing volume change during the carbonation reaction.

### 1st Main Claim (EP2718241 A1)

[EN] 1. A method for producing a reaction product including at least one synthetic formulation that carbonates sufficiently, said method comprising: providing a first raw material, having a first concentration of M; providing a second raw material, having a second concentration of Me; and mixing the first raw material and the second raw material to produce a reaction product that includes at least one synthetic formulation having the general formula  $\text{M}_a\text{Me}_b\text{O}_c$ ,  $\text{M}_a\text{Me}_b(\text{OH})_d$ ,  $\text{M}_a\text{Me}_b\text{O}_c(\text{OH})_d$  or  $\text{M}_a\text{Me}_b\text{O}_c(\text{OH})_d(\text{H}_2\text{O})_e$ , wherein M comprises at least one metal that can react to form a carbonate and Me is at least one element that can form an oxide during the carbonation reaction, wherein the ratio of a:b is between 0.167:1 and 2.5:1, wherein c is 3 or greater, wherein d is 1 or greater, wherein e is 0 or greater, wherein the at least one synthetic formulation is capable of undergoing a carbonation reaction, and wherein the at least one synthetic formulation is capable of undergoing volume change during the carbonation reaction.

**Assignees:** RUTGERS STATE UNIV OF NEW JERSEY; UNIV RUTGERS; LI QINGHUA; RIMAN RICHARD E; LING TANG; NYE THOMAS E; VAKIFAHMETOGLU CEKDAR; ATAKAN VAHIT; TANG LING



## 478. Family 93622618 (CN115141934 A)

[View in PatBase](#)

### Title

[EN] METHOD FOR MIXING, MELTING AND DEPLETING NICKEL-COBALT BLOWING SLAG AND SMELTING SLAG

### Abstract

[EN] The invention discloses a method for mixing, melting and depleting nickel-cobalt blowing slag and smelting slag, and belongs to the field of environment, slag metallurgy and comprehensive utilization of resources. According to the method, physical heat and high chemical activity of nickel and cobalt blowing slag and smelting slag are utilized, the nickel and cobalt blowing slag and the smelting slag are mixed, a dilution agent and a reducing agent are added, nickel and cobalt components are reduced and diluted, copper matte, low nickel matte or high nickel matte is added into the diluted slag for deep dilution, and deep dilution slag is obtained; and the deeply depleted slag is used as a raw material for smelting reduction ironmaking or used as a raw material for cement after water quenching. The novel dilution agent has the advantages of large specific gravity, controllable reaction, small addition amount, no need of heating, no need of adding equipment, cleanness, low cost, good dilution effect and the like, and is a composite dilution agent.

### 1st Main Claim

[MT] 1. A method of mixed melt depletion of nickel-cobalt blown slag with smelt slag, characterized in that it comprises in particular the following steps:

Step (1) Reduction and agent depletion:

Mixing nickel-cobalt blown slag with smelt slag, adding to a high-temperature furnace, adding a lean agent, a reducing agent, a reducing agent, performing high-temperature melt reduction depletion, reducing metal oxides in the nickel-cobalt blown slag and the smelt slag to metal nickel, metal cobalt, metal copper and metal iron, respectively, achieving reduction of the nickel-cobalt component and depletion of the agent, achieving growth and settling of the nickel-cobalt component. Obtaining a nickel-cobalt rich phase and a post-depleted slag; the proportion of smelt slag greater than or equal to 10 wt% based on 100 wt% of a mixture of nickel-cobalt blown smelt slag and smelt slag; the temperature at which the high-temperature melt reduction is depleted is 1150~1450 centigrade; and the depleted agent is a specific gravity greater than 2.6 g/cm<sup>3</sup>;

Step (2) Deep depletion:

Adding one or more combinations of molten ice copper, low ice nickel, or high ice nickel to the post-depleted slag in step (1), performing deep depletion in a high temperature furnace, converting residual copper nickel cobalt oxides in the slag to metals and sulfides, and precipitating to obtain a nickel cobalt rich phase and a deep depleted slag.

**Assignees:** NORTHEASTERN UNIV; UNIV NORTHEASTERN; TOHOKU UNIV

## 479. Family 1774511 (CN1548374 A)

[View in PatBase](#)

### Title

[EN] PROCESS OF UTILIZING FLYASH TO PREPARE ALUMINA AND CO-PRODUCE CEMENT CLINKER

### Abstract

[EN] The present invention features that during alumina producing process, certain amount of bauxite is added, the calcium silicate slag is baked into Portland cement clinker directly without complicated process; and CO<sub>2</sub> gas produced during the production process is conveyed to alumina carbonating step and used as material. The present invention has the advantages of simple production process, complementary production cost, high efficiency, high product quality, no secondary pollution, etc. and is suitable for application in relevant metallurgical and building material enterprises.

### 1st Main Claim

[MT] 1, a use of fly ash and cement clinker alumina prepared by the method of alumina production processes and cement production process and is characterized in that: in the alumina production process, pulverized coal ash and limestone as the main raw material, at the same time with a certain amount of bauxite in the ratio: Fly: bauxite: limestone = 20 percent -40 percent : 5 percent -15 percent : 45 percent -75 percent; calcined form alumina clinker, after chalking from leaching into the lye, filtered off silicon, carbon sub-process production of alumina, its waste - Guangxi calcium slag directly produce Portland cement clinker •, the cement production process generated carbon dioxide gas is supplied to the carbonation step as a raw material of alumina.

**Assignees:** WU SIDONG; MENGXI HI TECH GROUP CORP LTD; INNER MONGOLIA MENGXI HI TECH GROUP CO LTD

## 480. Family 84399210 (US2021107834 AA)

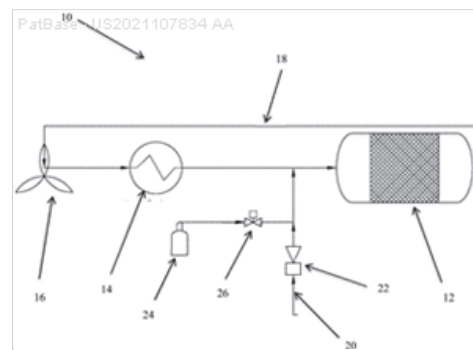
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### Title (EP4041254 A1)

[EN] METHODS OF FORMING CURED COMPOSITE MATERIALS WITH OPTIMIZED PH AND RELATED COMPOSITIONS AND SYSTEMS

### Abstract (EP4041254 A1)

[EN] A method of producing a carbonated composite material is described that includes: providing a carbonatable cementitious material in particulate form; mixing the carbonatable cementitious material with water to produce a mix; forming a predetermined shape with the mix, wherein the predetermined shape has an initial pore structure containing an initial pore solution having a first pH; pre-conditioning the predetermined shape to remove a predetermined amount of the water from the predetermined shape to produce a pre-DELTA conditioned shape; carbonating the pre-conditioned shape in an environment comprising carbon dioxide to produce a modified pore structure containing a modified pore solution having a second pH, wherein the difference between the first pH and the second pH is represented by a DELTA pH, and the DELTA pH is 1.0 or less, 0.75 or less, 0.5 or less, 0.25 or less, or about 0.0. A calcium silicate composition including solid components and liquid components having improved pore solution pH stability is also disclosed.



### 1st Main Claim (EP4041254 A1)

[EN] 1. A method of producing a carbonated composite material, comprising: providing a carbonatable cementitious material in particulate form; mixing the carbonatable cementitious material with water to produce a mix; forming a predetermined shape with the mix, wherein the predetermined shape has an initial pore structure containing an initial pore solution having a first pH; pre-conditioning the predetermined shape to remove a predetermined amount of the water from the predetermined shape to produce a pre-conditioned shape; carbonating the pre-conditioned shape in an environment comprising carbon dioxide to produce a modified pore structure containing a modified pore solution having a second pH, wherein the difference between the first pH and the second pH is represented by a  $\Delta$ pH, and the  $\Delta$ pH is 1.0 or less.

**Assignees:** SOLIDIA TECHNOLOGIES INC; SOLIDIA TECH INC

481. Family 99259354 (CN116832605 A)

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Title

[EN] METHOD FOR FUNCTIONALIZED UTILIZATION OF FLUE GAS TRAPS OF COAL-FIRED POWER PLANT

Abstract

[EN] The invention relates to the technical field of carbon dioxide sequestration and water purification, in particular to a method for functionalized utilization of flue gas traps of a coal-fired power plant, and discloses the method for functionalized utilization of the flue gas traps of the coal-fired power plant, which comprises the following steps: taking steel slag as a raw material, performing primary grinding on blocky steel slag to obtain steel slag coarse powder, performing secondary grinding, and performing secondary grinding to obtain the flue gas traps of the coal-fired power plant. Steel slag micro powder is obtained; 20-50 parts by weight of steel slag micro powder and 1-5 parts by weight of ammonium salt are evenly mixed, a mixture is obtained, and water is added.

According to the method for functionalized utilization of the flue gas traps of the coal-fired power plant, steel slag is used as a main raw material and cooperates with ammonium salt liquid-phase grinding, coal-fired flue gas is introduced, on one hand, steel slag particles are fully crushed through liquid-phase grinding, the contact area of CO<sub>2</sub> in the coal-fired flue gas and the steel slag is increased while calcium ion dissolution is promoted, on the other hand, CO<sub>2</sub> dissolution can be promoted through cooperation with ammonium salt grinding, and the CO<sub>2</sub> content in the coal-fired flue gas is increased. Meanwhile, the steel slag carbon sequestration efficiency is improved.

1st Main Claim

[MT] 1. A method of functional utilization of flue gas traps in a coal-fired power plant, comprising the steps of: Providing a plurality of flue gas traps;

- 1) taking steel slag as a raw material, bulk steel slag after preliminary pulverization to obtain steel slag coarse powder, after re-pulverization to obtain steel slag fine powder;
- 2) 20 to 50 parts by weight of steel slag fine powder and 1 to 5 parts by weight of ammonium salt are homogeneously mixed to obtain a mixture, add water, adjust the solid content between 12.5% to 33.3%, obtain a mixed slurry A;
- 3) Slurry A was placed in a stirred ball mill, and after 10 minutes of milling, dispersant was added, grinding was continued, and coal flue gas was introduced to obtain a solid type functional blend;
- 4) Take 20 to 40 parts by weight of solid carbon type functional blend, 40 to 80 parts by weight cement, 30 to 55 parts by weight fly ash, 7 to 15 parts by weight perlite particles evenly mixed into a round pan granulator;
- 5) start the granulator, then slowly spray water, after about 1 min, see the rolling material in the center part of the initial formation of spherical particles, the spray head slightly adjusted, slightly retract the water flow type, the spray head in the edge of the rolling material slowly spray water, prepare the solid carbon function burn-free ceramic particles.

**Assignees:** HUBEI UNIV OF TECHNOLOGY; UNIV HUBEI TECHNOLOGY

PatBase - CN116832605 A	固碳效率	As 吸附效率	细度模数
实施例 1	31.40%	90%	3.2
实施例 2	33.50%	92%	3.3
实施例 3	42.50%	97%	3.5
实施例 4	36.30%	94%	3.6
实施例 5	37.80%	95%	3.7
实施例 6	36.90%	96%	3.8
对比例 1	20.40%	88%	3.1
对比例 2	11.20%	62%	3.0

482. Family 82711752 (US2022252260 AA)

[View in PatBase](#)

Title (EP3990829 B1)

[EN] APPARATUS AND METHOD FOR PYROLYSING AND COMBUSTING A MATERIAL

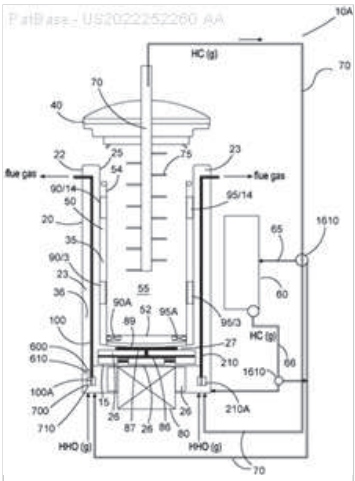
Abstract

[EN] Described herein is an apparatus (10), system (300) and method for pyrolysing and combusting a material. One described embodiment provides an apparatus (10) comprising one or more crucibles (50, 51) for receiving a material to be pyrolysed and combusted therein and one or more heating tubes (100-210) disposed in proximity to the crucible(s) (50, 51). The or each heating tube (100-210) is configured for receiving byproduct(s) produced during pyrolysis and combustion of the material within the crucible(s) (50, 51) and pyrolysing and combusting the byproduct(s) to produce flue gas from the byproduct(s). The flue gas produced within the heating tube(s) (100-210) are mixed with a hydroxy gas.

1st Main Claim (EP3990829 B1)

[EN] 1. An apparatus (10) for pyrolysing and combusting a material, the apparatus (10) comprising:

- one or more crucibles (50, 51) for receiving a material to be pyrolysed and combusted therein; and
- one or more heating tubes (100-210) disposed around the crucible(s) (50, 51),
- wherein the or each heating tube (100-210) is configured for:
- receiving byproduct(s) via a conduit (70) produced during pyrolysis and combustion of the material within the crucible(s);
- mixing, in a mixing chamber (110A-210A) a hydroxy gas comprising a mix of hydrogen and oxygen with the byproduct(s); and
- igniting the hydroxy gas, via an electronic ignition device (600) that is electrically connected to the or each heating tube (100-210) to pyrolyse and combust the mixture of the byproduct(s) and the hydroxy gas to produce processed gas from the byproduct(s).



Assignees: ECO GLOBAL ENERGY PTY LTD; SPIROS SPIRO

483. Family 52448014 (CN102797537 A)

[View in PatBase](#)

Title

[EN] ENGINE TAIL GAS FILTERING PURIFICATION METHOD

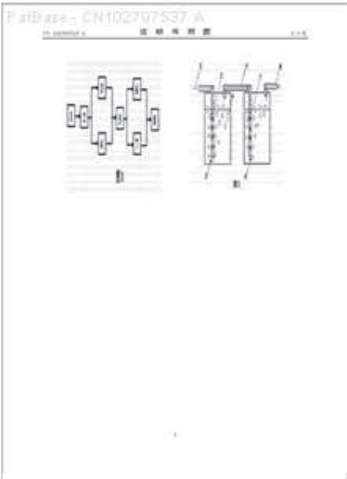
Abstract

[EN] The invention discloses an engine tail gas filtering purification method, which belongs to the technical field of environment friendliness and aims to solve the technical problems of incapability of absorbing carbon dioxide, sulfur dioxide and solid suspension particles (comprising pm2.5), incomplete conversion of nitric oxide, large tail gas noise and influences on engine power existing in the conventional three-way catalytic reactor. By the engine tail gas filtering purification method, the tail gas of an engine is subjected to primary filtering purification and secondary filtering purification to generate a water hardening gelatinization effect and a chemical reaction, so that greenhouse gas, harmful gas and the solid suspension particles (comprising the pm2.5) in the tail gas can be discharged with standard levels. Simultaneously, tail gas discharging noise can be absorbed by reaction liquid, so that the pollution of the tail gas and the tail gas noise to the environment is reduced. The method is suitable for preventing tail gas and tail gas noise pollution of gasoline and diesel engines.

1st Main Claim

[MT] CN 1. An engine exhaust gas filtration and purification method, characterized by: engine exhaust through the initial filtration and purification, to produce hydraulic gelling effect and chemical reactions, the initial secondary filter filtration and purification of exhaust gas purification, the occurrence of two second hydraulic cementitious efficiency and secondary chemical reactions, exhaust emissions standards after the second filtration and purification.

Assignees: YONGXUE REN; ZHIWU ZHANG; YUEAN ZHANG



**484. Family 62926688 (KR20160086312 A)**

[View in PatBase](#)

## Title

[EN] FUNCTIONAL BENTOSPRAY

## Abstract

[EN] The present invention relates to a cutoff member, a waterproof member, a cutoff layer, a waterproof layer, a gas layer, a molding layer, a drainage layer, and a purifying layer, which comprise a functional bentonite spray with an expansion function, a binding gel function, a hydro gel function, and a purifying function. The function bentonite-mixed soil contains one or more materials among an expansion function material, a binding gel function material, a purifying function material, a general water material, a flow water material, a salt water material, a contaminated water material, and other water materials at a ratio among five ratios of 0-20 (10) wt percent, 21-40 (30) wt percent, 41-60 (50) wt percent, 61-80 (70) wt percent, and 81-100 (90) wt percent.

### 1st Main Claim

[MT] 1. A) a certain material is water, the material is such that the water content range of one or more stirring or 30~3000 percent of the water admixture, stirring, or admixture with one or more of the material is stirred and crushed ice or cool the material is and stirred with crushed ice, it was added to its slopes, slopes, walls, ceilings, roofs or spraying in at least one of the thickness, and the 1~100cm formed therefrom, wherein the admixture is fluidizing agent, water reducing agent, expanding agent, a binder, cement, fiber is one of the fiber is fiber, textile fiber, and glass fiber, carbon fiber, steel fiber, one of the plastic fiber, FRP fiber, the injection spray guns, sprayers, pumping pasting machine, shotcrete machine, cement gun, the injector a nozzle group, the nozzle guns, the nozzles injectors, being implemented by one of the other injector, the spray gun is to spray in one shot method or a two shot method, the one-shot method has been put to the agitation in the hopper lower part of the hopper going down the line is to spray through this air pump to the nozzle of the discharge line end via the discharge line was added to the air pressure, the two-shot method has been put to the stirring in one hopper go down to the bottom line of the hopper air which discharged at the same time as applying the air pressure to the pump also sprayed through the nozzle of the discharge line end via the discharge line the adhesive is put on the other one of the hopper through the discharge line going down to the lower line of the hopper was added to the air pressure it to the air pump by spraying through a nozzle tip end of the line in addition to the above was added at the same time as adhesive is injected, B) a) 1 a hydraulic conductivity or permeability  $\times 10^{-5}$  ~  $1 \times 10^{-10}$  cm / sec liner or a range that represents the imperfection of impervious, liner, b) the hydraulic conductivity or permeability coefficient is  $1 \times 10^{-7}$  ~  $1 \times 10^{-15}$  cm / sec or the water shield showing a full range of water impermeable, waterproof, c) the permeability or hydraulic conductivity is  $1 \times 10^{10}$  ~  $1 \times 10^{-4}$  or one of the) scope or pitcher cm / sec gender, or the liner, waterproofing, liner, waterproof of the surface or gas layer that is laid on top or bottom, d) hydraulic conductivity or permeability coefficient is  $1 \times 10^{-3}$  ~  $1 \times 10^{-7}$  the range of cm / sec or incomplete pervious or impervious incomplete, or the liner, waterproofing, liner, boktocheung be laid on one surface or the top of the waterproof layer, e) the permeability or hydraulic conductivity is  $1 \times 10^{10}$  ~  $1 \times 10^{-4}$  cm / sec or range, or permeability, or the liner, waterproofing, liner, drainage layer in which one surface or installed in the top or bottom of the waterproof layer, f) [(initial concentration - later levels) / initial concentration; purification pollution are estimated at \* 100 0.1 to 100 degrees or percent, or permeability or hydraulic conductivity is  $1 \times 10^{10}$  ~  $1 \times 10^{-4}$  or the scope or permeability of cm / sec, or the liner, waterproofing, liner, in the Bento spray is utilized as one of the purifying layers are laid one waterproof layer, gas layer, boktocheung, drainage layer to one surface or the top, wherein the predetermined material has the expansion function material, binding gel functional materials, hydrogel-functional material, purified functional material, General receiving material, the flow receiving material, yeomsuyong material, contamination receiving material, one or more other acceptable material materials are low-rate, low and medium rates of 21-40 percent by weight, 0 to 20 percent by weight of each of 41~ 100 wt percent so that the total ratio of 60 percent by weight, gojung ratio of 61-80 percent by weight, the low ratio of the highest proportion of 81-100 weight percent or 10 wt percent, medium and low rate of 30 percent by weight, the proportion of 50 percent by weight, of 70 percent by weight gojung ratio, the functional spray bentonite to the use, configuration, mixed, form, composition, mixture, mixed, characterized in that one of the mixing ratio with one of the highest proportion of 90 wt percent

**Assignees:** KOREA PARAMOUNT CO LTD; TECOECO CO LTD

## 485. Family 54740937 (US2015020714 AA)

[View in PatBase](#)

### Title (EP2822918 A1)

[EN] HYDRAULIC COMPOSITION WITH LOW CLINKER CONTENT

### Abstract (EP2822918 A1)

[EN] The present invention relates to a hydraulic binder comprising in parts by mass: (a) 40 to 70 parts of a Portland clinker; (b) 30 to 60 parts of fly ash; (c) optionally up to 30 parts of an inorganic material other than clinker or than fly ash; (d) 2.5 to 15 parts of an alkali metal salt expressed in parts of equivalent- $\text{Na}_2\text{O}$  relative to 100 parts of fly ash; and (e) 2 to 14 parts of sulphate expressed in parts of  $\text{SO}_3$  relative to 100 parts of clinker; the fly ash having a  $\text{Dv}_{97}$  less than or equal to 40  $\mu\text{m}$ , and the sum of (a), (b) and (c) being equal to 100.

### 1st Main Claim (EP2822918 A1)

[EN] 1- A hydraulic binder comprising in parts by mass: (a) 40 to 70 parts of a Portland clinker; - (b) 30 to 60 parts of fly ash; (c) optionally up to 30 parts of an inorganic material other than clinker or than fly ash; (d) 2.5 to 15 parts of an alkali metal salt expressed in parts of equivalent- $\text{Na}_2\text{O}$  relative to 100 parts of fly ash; and - (e) 2 to 14 parts of sulphate expressed in parts of  $\text{SO}_3$  relative to 100 parts of clinker; the fly ash having a  $\text{Dv}_{97}$  less than or equal to 40  $\mu\text{m}$ , and the sum of (a), (b) and (c) being equal to 100.

**Assignees:** LAFARGE SA; LAFARZH; LAFARGE GROUP

## 486. Family 75900722 (JP2019151517 A2)

[View in PatBase](#)

### Title

[EN] CONCRETE COMPOSITION AND HARDENED CONCRETE

### Abstract

[EN] To provide a concrete composition containing blast furnace slag, capable of reducing unit consumption of CO<sub>2</sub> obtained hardened concrete and having excellent strength development property, and hardened concrete with reduced unit consumption of CO<sub>2</sub> and high strength. SOLUTION: The concrete composition and the hardened concrete include a binder, water, a fine aggregate, a coarse aggregate and an admixture, in which the binder contains 70 mass percent or more and 100 mass percent or less of blast furnace cement with respect to a total mass of the binder, the blast furnace cement contains 45 mass percent to 75 mass percent of a blast furnace slag fine powder with an average specific surface area of 2500 cm<sup>2</sup>/g to 8000 cm<sup>2</sup>/g, 20 mass percent to 50 mass percent of Portland cement and 1.0 mass percent to 4.5 mass percent, in terms of SO<sub>3</sub>, of sulfate selected from anhydrous gypsum and dihydrate gypsum, and a total content of the blast furnace slag fine powder, the Portland cement and the sulfate is 100 mass percent and a final setting time is 10 to 48 hours. SELECTED DRAWING: None

### 1st Main Claim

[MT] 1 binder, water, fine aggregate, coarse aggregate and admixture, the binder, relative to the total weight of the binder, 70 wt percent more than 100 percent by weight or less of the blast furnace cement, blast furnace cement, the average specific surface area of 45-8000 cm<sup>2</sup>/g 2500 cm<sup>2</sup>/g blast furnace slag fine powder of 75 parts by weight parts by weight percent to 20 weight percent and percent to 50 percent by weight Portland cement, a sulfate, a salt of 3.6 to 4.5 percent by 1.0 percent by weight in terms of SO<sub>3</sub>, Portland cement and blast furnace slag fine powder, sulfate and the total content of 100 parts by weight percent, and, in the end time is 10 hours to 48 hours, concrete composition.

**Assignees:** KAJIMA CORP; TAKEMOTO OIL AND FAT CO LTD; TAKENAKA KOMUTEN CO

## 487. Family 62926684 (KR20160086311 A)

[View in PatBase](#)

### Title

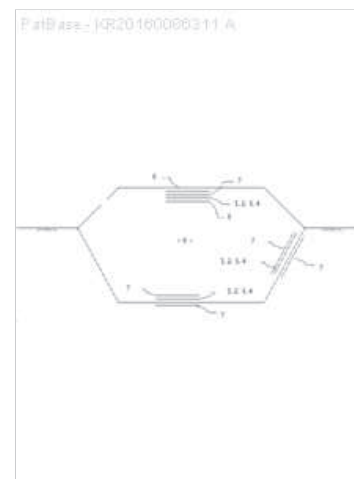
[EN] FUNCTIONAL BENTONITE ADMIXED SOIL

### Abstract

[EN] The present invention relates to a cutoff member, a waterproof member, a cutoff layer, a waterproof layer, a gas layer, a molding layer, a drainage layer, and a purifying layer, which are formed of functional bentonite-mixed soil with an expansion function, a binding gel function, a hydro gel function, and a purifying function. The function bentonite-mixed soil contains one or more materials among an expansion function material, a binding gel function material, a purifying function material, a general water material, a flow water material, a salt water material, a contaminated water material, and other water materials at a ratio among five ratios of 0-20 (10) wt percent, 21-40 (30) wt percent, 41-60 (50) wt percent, 61-80 (70) wt percent, and 81-100 (90) wt percent.

### 1st Main Claim

[MT] 1. A) certain material Moto, quarrying, cement, clay, tailings, pyebun, lung toseok, the motto of the material base and at least one fiber or stirring so that the range of 3-97 percent moisture content, soil, cement, clay, tailings, that the pyebun, lung toseok, fiber, and at least one base is stirred in water, stir to protest being installed in at least one of the flats, floors and surfaces, it is laying its commitment to be the 70-100 percent range of 5 to dajimdo and a 200cm thickness, the stirring was agitated by either a screw agitator, blade agitator, dropping a stirrer, a rotary agitator, a) by the rotation of the rotary screw provided in the trough placed horizontally with the screw agitator predetermined length to be agitated will be stirred by the rotation of the rotary screw provided in the gutter, while the material and the base material is passing through the trough, b) the blade stirrer is charged into the stirring tube as a stirrer rotating blades embedded in the inside of the stirring tube will become the material and base metal stirred by the rotating blades of the inner agitation barrel, c) the fall agitators zigzag manner on the material and the base material is stirring right and left sides of the pail as a stirrer, a swash plate installed in a staggered way to the left and right of the stirring pail would be stirred with passing the installed inclined plate, d) the screening stirred all-in-one as a stirrer to a combination of screening and stirred, which consists of a screen attached to the hopper 2 to the screw agitator, in which the material to the screen attaching hopper one and, the screen mounting the hopper is the base material being added to the other one, it said is the material and the base material passing through the screen flows into the screw agitator, here a screw agitator are rotated in a rotary screw provided in the underlying trough horizontally with a certain length, as addition to the above materials and the base metal to be stirred by the rotation of the stirring rotary screw provided in the gutter, while passing through the trough, the B) a) hydraulic conductivity or permeability by  $1 \times 10^{-5}$  ~  $1 \times 10^{-10}$  cm / sec or indicating a range of primary and reinsurance incomplete impervious, liner, b) the permeability or hydraulic conductivity of  $1 \times 10^{-7}$  ~  $1 \times 10^{-15}$  cm / a water shield or represents the full range of sec impervious, waterproof layer, c) hydraulic conductivity or permeability coefficient is  $1 \times 10^{(10)}$  ~  $1 \times 10^{(-4)}$  range, or water permeability of cm / sec, or the liner, waterproofing, liner, gas layer that is laid on one surface or the top or bottom of the waterproof layer, d) the permeability or hydraulic conductivity  $1 \times 10^{(-3)}$  ~  $1 \times 10^{(-7)}$  cm / sec or water permeability ranges or incomplete, incomplete or impervious, or the liner, waterproofing, liner, boktocheung be laid on one surface or the top of the waterproof layer, e) the permeability or hydraulic conductivity  $1 \times 10^{(10)}$  ~  $1 \times 10^{(-4)}$  cm / sec, or in the range or permeability, or the liner, waterproof materials, liner, drainage layer is laid on one surface or upper or lower portion of the waterproof layer, f) [(initial concentration - later concentration) / decontamination are calculated as the initial concentration] \* 100 degree or 0.1 to 100 percent, or the permeability or hydraulic conductivity  $1 \times 10^{(10)}$  ~  $1 \times 10^{(-4)}$  the range of cm / sec or Permeable, or is in the liner, waterproofing, liner, waterproof, gas layer, boktocheung, bentonite mixed soil is utilized as one of the purification layer is laid on one surface or the top of the drainage layer, the constant material expansion functional materials, binding gel functional materials, hydrogel-functional materials, functional materials purification, general receiving material, a low flow rate of the receiving material, yeomsuyong material, contamination receiving material, other acceptable material is one or more materials, each from 0 to 20 percent by weight so that the total of 100 percent by weight, 21 low and medium ratio of 40 wt percent, the ratio of 41-60 percent by weight, the proportion of gojung 61-80 percent by weight, the low ratio of the highest proportion of 81-100 weight percent or 10 wt percent, medium and low rate of 30 percent by weight, 50 ratio of the wt percent, gojung ratio of 70 percent by weight, used as a proportion of the highest proportion of 90 percent by weight, configuration, functional bentonite mixed soil as mixed, form, composition, mixture, mixed, characterized in that one of the mixed



**Assignees:** KOREA PARAMOUNT CO LTD; TECOECO CO LTD

## 488. Family 71417629 (IN201741011687 A)

[View in PatBase](#)

### Title

[EN] DEVELOPMENT OF GEO POLYMER BASED PAVEMENT INTERLOCKING BLOCK

### Abstract

[EN] A composition for a geopolymer based concrete that uses the waste material as aggregate comprising of; at least one inert aggregate, fly-ash and an alkaline activator, water, microwave radiations, calcium chloride

### 1st Main Claim

[EN] 1. A composition for a geopolymer based coarse aggregate concrete that uses the waste material such as fly ash as filler in aggregate and also to safeguard the environment from carbon dioxide emission from the manufacturing of cement comprising of; i. Coarse Aggregate comprising Hard Broken Granite metal (HBG) of size 20mm to 4.75mm ii. Fine Aggregate comprising of River Sand, passing 4.75mm retaining 150 micron, Fly Ash and GGBS passing 150 microns, Sodium hydroxide, sodium silicate Na2O- 15.9 percent, SiO<sub>2</sub> - 31.4 percent and H<sub>2</sub>O - 52.7 percent iii. Utilise the fly ash by the activation in alkaline medium as paste and optimizing it to arrive mortar using the river sand as fine aggregate and hard broken granite stone as coarse aggregate in produce the geo polymer concrete

489. Family 98580071 (CN116589246 A)

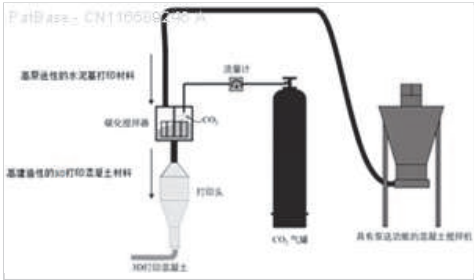
[View in PatBase](#)

Title

[EN] 3D PRINTING CONCRETE MATERIAL AS WELL AS PREPARATION METHOD AND APPLICATION THEREOF

Abstract

[EN] The invention provides a 3D printing concrete material as well as a preparation method and application thereof. The preparation method comprises the following steps: providing cement-based printing slurry; and providing carbonation gas containing carbon dioxide, introducing the carbonation gas, and carrying out carbonization treatment on the cement-based printing slurry, so that minerals in the cement-based printing slurry react with carbon dioxide in the carbonation gas to generate carbonate, and the 3D printing concrete material is obtained. Compared with cement-based printing slurry before carbonization, the carbonized 3D printing concrete material has the advantages that the fluidity is reduced, the setting time is shortened, and the strength after extrusion is improved, so that the constructability of the 3D printing concrete is greatly improved.



1st Main Claim

[MT] 1. A method of preparing a 3D-printed concrete material, comprising the steps of: Providing a concrete material having a first surface and a second surface;

Providing a cement-based printing slurry;

Providing a carbonization gas containing carbon dioxide, passing the carbonization gas, carbonizing the cement-based printing slurry, allowing the minerals in the cement-based printing slurry to react with the carbon dioxide in the carbonation gas to form carbonates, resulting in a 3D-printed concrete material.

**Assignees:** HONG KONG POLYTECHNIC UNIV; UNIV HONG KONG POLYTECHNIC

## 490. Family 102262081 (CN117902868 A)

[View in PatBase](#)

### Title

[EN] METHOD FOR PREPARING SLUDGE CURING AGENT BY USING CARBON SEQUESTRATION DESULFURIZATION ASH

### Abstract

[EN] The invention discloses a sludge curing agent using carbon sequestration desulfurization ash. The sludge curing agent comprises the following components in percentage by mass: 12-15 percent of cement clinker, 50-55 percent of mineral powder, 15-20 percent of steel slag powder, 10-15 percent of carbon sequestration desulfurization ash, 1-2 percent of a solid admixture and 1-2 percent of a liquid admixture. The desulfurization ash is used for fixing CO<sub>2</sub> in industrial tail gas to improve the activity of the desulfurization ash, and then the carbon-fixed desulfurization ash is compounded with the cement clinker, the mineral powder, the steel slag powder, the solid admixture and the liquid admixture to obtain the sludge curing agent. According to the method, the carbon sequestration components in the desulfurized fly ash do not need to be enriched by using chemical means of various flotation agents, the gelatinization activity of the desulfurized fly ash after carbon sequestration is greatly improved, the sulfate excitation effect can be better exerted, the super-superposition coupling effect with the additive is achieved, and the utilization rate of the desulfurized fly ash is improved. The sludge curing agent can be prepared together with a cementing material system such as cement clinker, so that the curing strength of the sludge curing agent on sludge and the curing effect on heavy metals in the sludge are improved while wastes are treated by wastes.

### 1st Main Claim

[MT] 1. A sludge hardener for removing sulfur ash by solid carbon, characterized in that The raw material of the sludge curing agent consists of cement clinker 12% to 15% by mass, mineral powder 50% to 55%, steel slag powder 15% to 20%, carbon-solid sulfur ash 10% to 15%, solid admixture 1% to 2%, liquid admixture 1% to 2%;

The solid admixture consists of NaOH and Na<sub>2</sub>SiO<sub>3</sub>The liquid admixture is formed by mixing triethanolamine and triisopropanolamine in a mass ratio of 1: (1.5-2), and a method for preparing the solid-carbonized sulfur ash comprising the steps of: Mixing the liquid admixture with triisopropanolamine in a mass ratio of 3: 1 to 4: 1;

The method comprises the steps of: (1) spraying the sulfur ash with water and allowing it to wet sufficiently to allow water to overflow from the sulfur ash;

(2) The sulfur ash obtained in step (1) is fed into an autoclave, flue gas is introduced into the autoclave until the partial pressure of carbon dioxide reaches 10 to 20%, flue gas is stopped, and high-pressure steam is continued into the autoclave, the steam pressure reaches 1.5 to 2.0 MPa, and held at this pressure for 2 to 5 hours. The solid carbon sulfur ash is obtained; among these, the flue gas is the industrial exhaust gas after sulfur denitrification.

**Assignees:** BAOWU HUANKE WUHAN METAL RESOURCES CO LTD

491. Family 100277776 (WO23239561 A1)

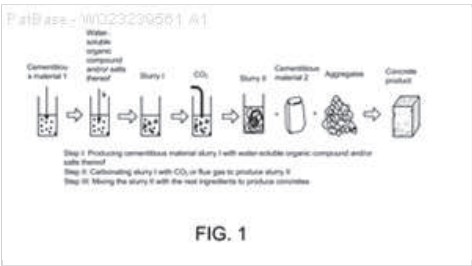
[View in PatBase](#)

**Title**  
[EN] CONCRETE MIXTURES AND METHODS OF MAKING THE SAME

**Abstract**  
[EN] Disclosed herein is a composition comprising a) of about 80 wt percent to about 99 wt percent of a cementitious material; b) of about 0.05 wt percent to about 3 wt percent of a water-soluble organic compound and/or salts thereof, and c) of about 1 wt percent to about 20 wt percent of carbon dioxide. Additionally, articles comprising the disclosed herein composition are also disclosed. Also disclosed are methods of making the compositions and the articles.

**1st Main Claim**  
[EN] 1. A composition comprising: a) about 80 wt percent to about 99 wt percent of a cementitious material; b) about 0.05 wt percent to about 3 wt percent of a water-soluble organic compound and/or salts thereof; and c) about 1 wt percent to about 20 wt percent of carbon dioxide.

**Assignees:** BOARD OF TRUSTEES OF UNIV OF ALABAMA; UNIV ALABAMA



## 492. Family 93374330 (CN115058132 A)

[View in PatBase](#)

### Title

[EN] NEGATIVE CARBON SELF-CLEANING INORGANIC COATING, PREPARATION METHOD THEREOF AND OBTAINED COATING

### Abstract

[EN] The invention discloses a negative carbon self-cleaning inorganic coating, a preparation method thereof and an obtained coating. The negative carbon self-cleaning inorganic coating is prepared from the following raw materials in parts by weight: 40-90 parts of an inorganic cementing material, 1-15 parts of a composite photocatalytic medium, 0-50 parts of an auxiliary carbonizing agent, 0-15 parts of a thickening agent and 30-60 parts of water. By selecting the cementing material with carbonized active components, calcium carbonate and silica gel can be generated in a CO<sub>2</sub> atmosphere, the material has the effects of protecting buildings and binding materials, has good weather resistance, is stable in self-cleaning effect when being washed by rainwater for a long time, and provides a stable chemical environment for a composite photocatalytic medium; meanwhile, the condition that the coating substrate is decomposed by superoxide ions and hydroxyl radicals generated by the composite photocatalytic medium under the excitation of ultraviolet light is avoided; by controlling the mixing amount of the composite photocatalytic medium and the solid content of the coating, the self-cleaning effect of the coating is further improved on the basis of ensuring the mechanical property of the coating.

### 1st Main Claim

[MT] 1. A carbon minus self-cleaning inorganic coating, characterized in that a feedstock comprises, by weight, 40 to 90 parts of an inorganic cementitious material, 1 to 15 parts of a complex photocatalytic medium, 0 to 50 parts of an auxiliary carbonizer, 0 to 15 parts of a thickener and 30 to 60 parts of water; wherein

Said inorganic cementitious material is a carbonized active ingredient or industrial solid waste containing at least 60% of said carbonized active ingredient, and said carbonized active ingredient is at least one of dicalcium silicate, monocalcium silicate, tricalcium disilicate, calcium hydroxide, magnesium hydroxide;

The composite photocatalytic medium is composed of photocatalytic material complexed with a SiO<sub>2</sub>-containing carrier.

**Assignees:** WUHAN UNIV OF TECHNOLOGY; UNIV WUHAN TECH

493. Family 50082519 (KR101085044 B1)

[View in PatBase](#)

Title

[EN] INORGANIC BINDER FOR MANUFACTURING SECONDARY CONCRETE PRODUCT

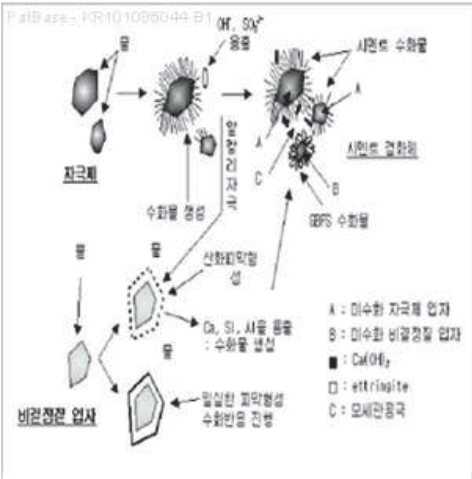
Abstract

[EN] PURPOSE: An inorganic binder for manufacturing a steam-cured secondary concrete product is provided to reduce enormous energy required for a plasticizing process and to reduce the generation of carbon dioxide in a cement manufacturing process by replacing cement using industrial byproducts. CONSTITUTION: An inorganic binder for manufacturing a steam-cured secondary concrete product includes 15-60 parts by weight of a sulfate activator, 1-5 parts by weight of sulfate promoter, 5-30 parts by weight of alkali activator, and 1-5 parts by weight of alkali promoter with respect to 100 parts by weight of slag fine powder of 3000/g or more of specific surface area. The slag fine powder is the mixture of one or more selected from blast furnace slag fine powder, stainless slag fine powder, and copper smelting slag powder. The sulfate activator is the mixture of one or more selected from sodium aluminum sulfate or sodium aluminum fluoride, hydrofluoric acid gypsum, and phosphoric acid gypsum. The hydrofluoric acid gypsum and the phosphoric acid gypsum are industrial byproducts.

1st Main Claim

[MT] 1. The specific surface area is less than 100 parts by weight of blast furnace slag 3,000/g with respect to 15 to 60 parts by weight, and a sulfate stimulant 1-5 parts by weight of sulfate, and stimulating accelerator alkaline stimulant 5 to 30 parts by weight and 1-5 parts by weight of the alkali-stimulation promoter, the slag of blast furnace slag, copper slag, stainless steel slag, selected from any one or a mixture of two or more of the sulphate stimulant is sodium sulfate Saf(sodium polysilicon production process by-product of Sas(sodium (generated as a by-product of the coagulant is PAC (Poly aluminum fluoride industrial processes, industrial process of hydrofluoric acid is generated as a by-product gypsum plaster of any one or a mixture of two or more phosphate characterized in that the steam curing concrete inorganic bonding material for secondary products.

Assignees: CMD GROUP CO LTD



## 494. Family 15380617 (WO0136344 A2)

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### Title

[EN] LOW RETARDING, HIGH FLUIDITY PRODUCING LIGNIN DISPERSANT FOR CONCRETE

### Abstract

[EN] A lignosulfonate-based cement-dispersant that produces high fluidity in cement pastes, mortar, and the like, without causing excessive set-retardation. Cement compositions dosed with this dispersant harden rapidly, and therefore this dispersant is especially beneficial for use in pre-cast concrete where free flowing but fast-setting cement mixes are highly desirable. The lignosulfonates that can be used in making this dispersant are either sugar-lean, i.e. processed to eliminate most if not all of the otherwise existent sugars, or are modified, i.e. have been ammoxidized by a reaction with ammonia or an amine in the presence of an oxidant. The sugar-lean or the modified lignosulfonate, or a combination of such lignosulfonates, is blended with a ligand such as a carbonate, a bicarbonate, a silicate or a metasilicate that can precipitate multivalent cations, namely, calcium (Ca), magnesium (Mg), and aluminum (Al). The weight ratio of lignosulfonate and the precipitant or a combination of precipitants could vary in the range of 1:0.5 to 1:6, while the dosage of the lignin portion of the dispersant must be at least 0.1 percent by weight of the cement.

### 1st Main Claim

[EN] 1. A cement dispersant comprising a blend of a lignosulfonate selected from the group consisting of a de-sugared lignosulfonate, a modified lignosulfonate, and mixtures thereof, and a precipitating agent for multivalent cations.

**Assignees:** LIGNOTECH USA INC

## 495. Family 101522210 (CN117623660 A)

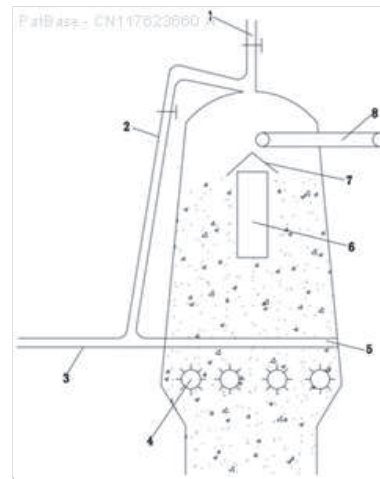
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### Title

[EN] CARBONIZED STEEL SLAG AGGREGATE PREPARATION DEVICE AND PREPARATION METHOD THEREOF

### Abstract

[EN] The invention relates to a carbonized steel slag aggregate preparation device and a preparation method thereof, the carbonized steel slag aggregate preparation device comprises a flue gas discharge pipe, a flue gas inlet pipe, a rotary carrier roller, a flue gas distributor, a gas guide pipe, a distributing device and a feeding conveying belt, the feeding conveying belt is arranged above one side of a carbonization device, and the flue gas inlet pipe is arranged below the other side of the carbonization device; the smoke inlet pipe is communicated with the smoke distributor, a rotating carrier roller is mounted below the smoke distributor, a distributor and a gas guide pipe are mounted in an inner cavity of the carbonization device, the distributor is located at the discharging position of the feeding conveying belt, the gas guide pipe is located below the distributor, and a smoke discharging pipe is mounted at the top of the carbonization device. The method has the beneficial effects that the alkaline calcium ion chelating agent is added to promote the conversion of f-CaO to  $\text{Ca}^{2+}$  and the conversion of  $\text{CO}_2$  in the flue gas to  $\text{CO}_3^{2-}$  to accelerate carbonization. The alkaline calcium ion chelating agent is added, so that conversion from f-CaO to  $\text{Ca}^{2+}$  can be accelerated, the pH value of the environment can be increased, conversion from  $\text{CO}_2$  to  $\text{CO}_3^{2-}$  is promoted, EDTA is recycled, and the effect of a catalyst is achieved.



### 1st Main Claim

[MT] 1. A carbonized steel slag aggregate preparation device, characterized in that it comprises a flue gas outer discharge pipe (1), a flue gas inlet pipe (3), a rotating idler (4), a flue gas distributor (5), a gas guide pipe (6), a distributor (7), a feed conveyor (8). A feed conveyor belt (8) is mounted above one side of the carbonization device, a flue gas inlet pipe (3) is mounted below the other side of the carbonization device, the flue gas inlet pipe (3) is in communication with a flue gas distributor (5), and a rotating idler roller (4) is mounted below the flue gas distributor (5). The inner chamber of the carbonization unit is fitted with a cloth (7) and an air duct (6), the cloth (7) being located at the discharge of the feed conveyor (8), and the air duct (6) being located below the cloth (7), and the top of the carbonization unit is fitted with an outer exhaust fume (1).

**Assignees:** FUJIAN SANSTEEL MIN GUANG CO LTD; FUJIAN SANSTEEL GROUP CO LTD; FUJIAN SANSTEEL MIN GUANG CO

## 496. Family 24912071 (GB257391 A)

[View in PatBase](#)

### Title

[EN] Improvements in or relating to artificial stone for abrasive and other purposes

### Abstract

[EN] 257,391. Wade, H., (Carborundum Co.). July 23, 1925. Concrete, hardening.-An abrasive or other aggregate excluding slate is mixed with Portland cement and calcium hydrate, and the mixture is subjected to the action of carbon dioxide. The amount of lime is generally 10-30 per cent of the Portland cement The materials may be mixed dry, sufficient water being added for moulding, and the article placed in water until the initial set takes place, or a mortar may be poured into a mould and allowed to set. After the initial set, the articles are exposed to carbon dioxide which may be under pressure, for example 30 lb. per sq. in. The alternate water and gas treatment is repeated until the desired hardness is obtained.

### 1st Main Claim

[EN] 1. The method of making a Portland cement composition, which comprises 8 forming a cement mixture containing an aggregate ", and calcium hydrate and (preferably -- after shaping an article therefrom) subjecting the mixtures to the action of carbonic acid gas to thereby convert-the whole or part of the calcium hydrate into calcium carbonate.

**Assignees:** CARBORUNDUM CO

## 497. Family 82639943 (CN112125541 A)

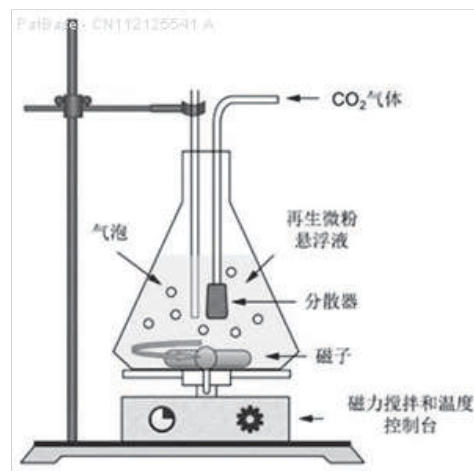
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### Title

[EN] METHOD FOR CARBONIZING AND ACTIVATING WASTE CONCRETE RECYCLED MICRO POWDER BY WET PROCESS AND APPLICATION OF REGENERATED MICRO-POWDER

### Abstract

[EN] The invention provides a method for carbonizing and activating waste concrete recycled micro powder by a wet process, which comprises the following steps of: taking powder generated in the process of producing recycled aggregate by crushing waste concrete as recycled micro powder, dispersing the recycled micro powder into water to form mixed slurry, and continuously introducing industrial waste gas containing carbon dioxide into the mixed slurry, in the process, carbon dioxide contained in the industrial waste gas and the regenerated micro powder are subjected to a carbonization reaction. According to the invention, the regenerated micro-powder is subjected to the carbonization reaction in an aqueous solution, the activity of calcium carbonate and silicon dioxide generated by carbonization is higher, the volcanic ash activity is superior to that of common auxiliary cementing materials such as fly ash and silica fume, and the regenerated micro-powder can be used as an auxiliary cementing material.



### 1st Main Claim

[MT] 1. A wet activated carbonized waste concrete method of renewable powder, characterized in that: The waste generated during the production of recycled aggregate concrete crushing powder as powder regeneration, the regenerated powder is dispersed in water to form a mixed slurry, the mixed slurry to continue through the carbon dioxide-containing industrial waste, in this process, the carbon dioxide content of the industrial waste gas from said regenerated powder carbonization reaction.

**Assignees:** UNIV HENAN POLYTECHNIC; HENAN POLYTECHNIC UNIV

498. Family 103386936 (CN118280493 A)

[View in PatBase](#)

Title

[EN] METHOD FOR ESTABLISHING RELATIONSHIP BETWEEN CARBONIZATION PERFORMANCE AND CARBONIZATION STRUCTURE OF LOW-CARBON CLINKER

Abstract

[EN] The invention discloses a method for establishing a relationship between carbonization performance and a carbonization structure of low-carbon clinker. The method comprises the following steps: 1) determining an optimal water-cement ratio  $w/c$  and a corresponding forming dosage  $c$  of the low-carbon clinker by adopting a compression molding method; (2) carrying out compression molding, drying and carbonization curing according to the determined  $w/c$  and  $c$ , and measuring the compressive strength  $\sigma_c$  and the carbon sequestration rate  $r_c$  of an obtained carbonized product; 3) calculating the volume ratio  $W_{V_{CaCO_3}}$  of  $CaCO_3$  formed after carbonization and the volume ratio  $W_{V_c}$  of the residual low-carbon clinker, and then calculating the total volume ratio  $W_{total}$  of the  $CaCO_3$  and the residual low-carbon clinker; and 4) establishing a stoichiometric relationship between the compressive strength  $\sigma_c$  and the total volume ratio  $W_{total}$ . By constructing the chemometrics relation between the carbonization performance and the carbonization structure of the low-carbon clinker, the carbonization performance of the low-carbon clinker can be intuitively reflected, and the method can be used for guiding efficient application of different types of low-carbon clinker and is suitable for popularization and application.



1st Main Claim

- [MT] 1. A method of establishing a relationship between carbonization performance and carbonization structure of a low carbon clinker, comprising the steps of: Providing a substrate having a first surface and a second surface;
- The method comprises the steps of: 1) determining the optimum water ash ratio  $w/c$  and the corresponding forming amount  $c$  of the low carbon clinker using the press forming method;
- 2) According to the determined optimum water ash ratio  $w/c$  and forming amount  $c$ , the low-carbon clinker is press-formed, and the apparent volume  $V$  of the resulting test piece is recorded<sub>Apparent</sub>. The compressive strength  $\sigma$  of the resulting carbonized product at different moisture levels is measured after drying to different moisture levels, and then carbonization is carried out<sub>C</sub>. And carbon sequestration rate  $r_C$ . And calculate the formation of  $CaCO_3$  after carbonization<sub>3</sub>Volume  $V$  of the<sub>CaCO\_3</sub>The volume  $V$  of the remaining low-carbon clinker after carbonization<sub>C</sub>;
- 3) Calculate the molded low-carbon clinker volume  $V$  according to the parameters determined above<sub>C0</sub> $CaCO_3$  is formed after carbonization<sub>3</sub>Volume of  $W_{V_{CaCO_3}}$ The volume of the remaining low-carbon clinker after carbonization accounts for the ratio  $W_{V_c}$  $CaCO_3$  is formed after carbonization<sub>3</sub>And the total volume of the remaining low-carbon clinker<sub>Total</sub>;
- 4) Establish compressive strength  $\sigma$  after carbonization<sub>C</sub>.  $CaCO_3$  is formed after carbonization<sub>3</sub>And the total volume of the remaining cement clinker in the ratio  $W_{Total}$ . The stoichiometric relationship between the two.

Assignees: HUAXIN CEMENT CO LTD

499. Family 63182850 (KR20160096512 A)

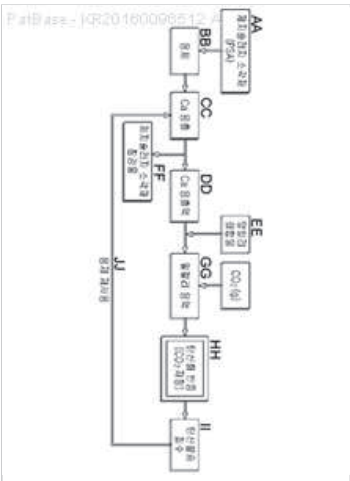
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Title

[EN] A STORAGE METHOD OF CARBON DIOXIDE USING INDIRECT CARBONATION OF PAPER SLUDGE ASH

Abstract

[EN] The present invention relates to a method for storing carbon dioxide through indirect carbonation of paper sludge ash, in which an alkaline solution, generated by adding a base to an effluent produced by mixing paper sludge ash, i.e., a by-product in a paper industry, with an acid or ammonium salt solvent, is converted into calcium carbonate ( $\text{CaCO}_3$ ) in a stable mineral state through reaction with carbon dioxide, thereby improving a storage rate of carbon dioxide. The method comprises: a calcium elution step of preparing a calcium-containing effluent; a sediment separation step of separating sediment; an alkaline solution preparation step of preparing an alkaline solution; and a carbonation step of generating calcium carbonate. Unlike a conventional method in which paper sludge ash is mainly buried or is recycled for production of a raw material or supplementary material of cement, planting soil, a depressant for manufacture of steel, an artificial light-weight aggregate, or the like, the method according to the present invention is configured such that pH of an effluent is increased by adding a sodium hydroxide (NaOH) solution or an ammonia ( $\text{NH}_4\text{OH}$ ) solution to the calcium-containing effluent in which calcium is eluted from the paper sludge ash by using the solvent, and thus a yield of calcium carbonate through reaction with carbon dioxide is increased, thereby providing an effect of improving efficiency of storage of carbon dioxide.



1st Main Claim

[MT] 1. Calcium elution step of adding a solvent to the paper sludge incineration ash, and the calcium-containing eluate produced by stirring and; And sediment separation step of separating paper sludge ash sediments separate from the leaching solution; Producing an alkaline solution by adding a base to the eluate to break up the sediment to an alkalizing step and the leaching solution; Carbonation reaction step of reacting the carbon dioxide generated in the alkali solution of calcium carbonate; The paper sludge incineration ash which comprises a method for indirectly to carbonation treatment store carbon dioxide.

**Assignees:** KOREA MARITIME UNIV IND ACAD; KOREA MARITIME AND OCEAN UNIV IND ACADEMIC COOPERATION CENTER

500. Family 67135868 (US2017283293 AA)

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**Title**  
[EN] METHOD FOR RECYCLING BYPRODUCT SLUDGE IN RECYCLED AGGREGATE PRODUCING PROCESS FROM WASTE CONCRETE

**Abstract**  
[EN] The present disclosure relates to a method for treating and recycling, in an environment-friendly manner, sludge and waste water generated in a process for crushing waste concrete and recycling waste concrete into aggregates. Sand is separated from sludge configured from cement components and sand components and is recycled as fine aggregates, and the cement components can be used as concrete admixtures. Furthermore, the present invention introduces a mineral carbonation technique and thereby allows pH of waste water to satisfy an environmental standard and allows high value calcium carbonate to be produced.

**1st Main Claim**  
[EN] 1. A method for recycling sludge in producing recycled aggregates, the method comprising:  
(a) separating sludge containing waste concrete micro powder and water into overflow products having relatively small particle sizes using a cyclone apparatus and underflow products having relatively great particle sizes;  
(b) dehydrating the overflow products and thereby separating waste water and sludge cakes from each other;  
(c) supplying carbon dioxide in the waste water and carbonating and depositing alkali earth metal in the waste water; and  
(d) separating alkali earth metal carbonate and waste water through solid-liquid separation.

**Assignees:** KOREA INST OF GEOSCIENCE AND MINERAL RESOURCES KIGAM; KOREA INST OF GEOSCIENCE AND MINERAL RESOURCES

