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(73) Octrooihouder(s):
Van Nieuwpoort Beheer B.V. te Gouda.

(72) Uitvinder(s):
Dirk Maria Alfons Jules van Mechelen te Tisselt (BE).
Edwin Menno Michaël Vermeulen te Alphen a.d. Rijn.

(74) Gemachtigde:
Ir. H.V. Mertens c.s. te Rijswijk.

(54) **Method for manufacturing concrete, mortar or grout using lignite fly ash and concrete, mortar or grout obtainable by said method.**

(57) Method for manufacturing concrete, mortar or grout, comprising the step of allowing a mixture of a suitable aggregate material, a binding agent and water to set, wherein the binding agent consists essentially of lignite fly ash having a sulphate content of 6 wt.% or higher, based on the weight of the lignite fly ash

NL C 2008574

Title: Method for manufacturing concrete, mortar or grout using lignite fly ash and concrete, mortar or grout obtainable by said method.

Technical Field

The present invention relates to a method for preparing concrete, mortar or grout using lignite fly ash. The invention further relates to the a concrete, mortar or grout obtainable by said method.

Background Art

The most commonly used type of cement is portland cement, which is typically prepared by calcining limestone, i.e. calcium carbonate, in the presence of small quantities of other materials.

Although concrete made with portland cement is renowned for its advantageous properties such as fast hardening and high ultimate compressive strength, there is a growing concern on the environmental aspects of manufacturing large amounts of portland cement. In addition, efforts have been made to replace portland cement with cheaper alternatives.

It is known to replace part of the portland cement present in a binder composition with fly ash. Fly ashes can be divided into anthracite, bituminous, subbituminous and lignite fly ash, the names referring to the type of coal they originate from. Although the chemical composition of the different types of fly ash varies considerably, all fly ashes have in common that they comprise certain amounts of silicon dioxide, aluminum oxide, iron oxide and calcium oxide. Generally, a lignite fly ash has the highest calcium oxide content and the lowest combined amount of silicon, iron and aluminum oxides. Fly ashes can also be classified as class F fly ash or class C fly ash, the compositional differences between both residing in the calcium oxide content, the sulphate content and the combined amounts of silicon, iron and aluminum oxide. According to ASTM C618, a fly ash is considered a class F fly ash when the sum of silicon, iron and aluminum oxides is 70 wt.% or higher and the sulphate content does not exceed 5 wt.%. In a class C fly ash the sum of silicon, iron and aluminum oxides is 50 wt.% or higher and the sulphate content does not exceed 5 wt.%. Although not a requirement under ASTM C618, class F fly ashes typically have a calcium oxide content lower than 20 wt.%, whereas the calcium oxide content of a class C fly ash typically exceeds 20 wt.%.

US4715896 is related to a binder composition for consolidated fills that are well-adapted for use in non-structural applications such as back fills in mine excavations and sludge stabilization. The binder composition comprises about 55 to 97 wt.% of finely divided water-hardenable vitrified cementitious iron blast furnace slag; about 3 to 45 wt.% of class C fly ash; and about 2 to 15 wt.% of calcium hydroxide. In this document, a distinction is made between class C and class F fly ash. The class C fly ash originates from the Rocky Mountains regions of

North America, whereas the class F fly ash originates from the Appalachian regions. Table 2, comparative example 4, shows the compessive strength after 7, 14 and 28 days of a mixture of class C fly ash and water, without aggregate material. It turns out to be essential that a class C fly ash is used, since a class F fly ash exhibits no significant strength after 28 days, not even when used in combination with calcium hydroxide. This leads the skilled person to the conclusion that, according to US4715896, no fly ashes other than class C fly ash are suitable fur use in cement setting reactions.

Description of the Invention

The present invention is related to a method for manufacturing concrete, mortar or grout, comprising the step of allowing a mixture of a suitable aggregate material, a binding agent and water to set, wherein the binding agent consists essentially of lignite fly ash having a sulphate content of 6 wt.% or higher, based on the weight of the lignite fly ash. This lignite fly ash is neither a class C fly ash, nor a class F fly ash.

Surprisingly, the inventors found that when a concrete, mortar or grout is made, it is sufficient to employ the lignite fly ash according to invention as the sole binding agent. In other words, a significant build-up of compressive strenght is observed when employing the lignite fly ash according to the invention, without the need of employing any other binding agents such as portland cement or ggbs. It is believed that the increased amount of sulphate in the present lignite fly ash causes a setting concrete, mortar or grout mixture to acquire significant compressive strength.

Advantageously, the lignite fly ash is slaked before addition to the binder composition. Slaking is the process of treating the fly ash with water in order to convert the calcium or magnesium oxides present in the lignite fly ash to their corresponding hydroxides.

The lignite fly ash according to the invention can be incorporated in the binder composition as such, or it can be milled or ground before addition. Milling or grinding has the advantage of increasing the specific surface or Blaine of the fly ash and hence enhancing the cementitious reactions, leading to a higher compressive strength. Preferably, the lignite fly has a Blaine of 400 m^2/kg or more. The specific surface or Blaine can be determined using any suitable technique known in the art, e.g. air permeability tests using a Blaine permeameter.

As stated above, all fly ashes, including the lignite fly ash according to the invention, have in common that they comprise certain amounts of silicon dioxide, aluminum oxide, iron oxide and calcium oxide. To determine the chemical composition of the lignite fly ash and the second ingredients any technique commonly used in the art may be employed. Suitable examples of such techniques include x-ray fluorescence (XRF) and x-ray diffraction (XRD).

Preferably, the silicon dioxide content of the lignite fly ash according to the invention does not exceed 35 wt.%. Further, the combined amount of the oxides of silicon, aluminum and

iron preferably does not exceed 50 wt.%. The calcium oxide content of the lignite fly ash is preferably 20 wt.% or higher, more preferably of from 30 to 50 wt.%.

As to the sulphate content of the lignite fly ash, although a sulphate content of 6 wt.% or higher leads to good results, even better results are obtained when the sulphate content lies between 7.5 and 15 wt.%, based on the weight of the lignite fly ash. The sulphate content of lignite fly ash can be measured using any analytical technique or method commonly used in the art, e.g. XRF. It is reported as the sulphur trioxide (SO_3) content, in percentage by weight, based on the total weight of the lignite fly ash composition.

Advantageously, the lignite fly ash comprises a certain amount of free lime, in this context also known as free calcium oxide. In the present context, the expression “free lime” denotes the amount of calcium oxide present in the unslaked lignite fly ash that is available for hydration upon being contacted with water. In this respect it is noted that the remaining fraction of calcium oxide that is not considered “free” is present in the lignite fly ash in the form of calcium aluminates, silicates and aluminosilicates, or it is part of a glassy, amorphous phase, or both. Free lime increases the ultimate compressive strength and boosts the initial setting speed of a setting concrete, mortar or grout mixture. Preferably, the lignite fly ash has a free lime content of at least 2.5 wt.%. More preferably, the free lime content lies between 4 and 10 wt.%.

In the method according to the invention, the lignite fly ash can be combined with one or more additives selected from the group consisting of dyes, plasticizers, stabilizers, waterproofing agents, frost proofing agents, dust proofing agents, air entrainment agents, set accelerating agents and preservatives.

Advantageously, the method according to the invention comprises the steps of:

(a) bringing together, e.g. in a cement mixer, an aggregate material, a lignite fly ash according to the invention and water, thereby forming a wet concrete, mortar or grout mixture;

(b) applying said mixture to a substrate; and

(c) allowing said mixture to cure.

More specifically, said method comprises the steps of:

(a) bringing together, e.g. in a cement mixer, an aggregate material, a lignite fly ash according to the invention and water, thereby forming a wet concrete, mortar or grout mixture;

(b1) pouring said mixture in the case of concrete or grout; or

(b2) applying said mixture on a block or brick in the case of mortar; and

(c) allowing said mixture to cure.

The nature of the aggregate material used in the above method is not particularly limited. In fact, every aggregate material commonly used in the art is suitable. Examples of suitable aggregate materials include sand, natural gravel, shingle, grit and crushed rock. Also recycled materials (derived from construction, demolition and excavation waste) can be used as an at least partial replacement for conventional aggregate materials. It is noted that in the present

context the term “aggragate material” also includes mixtures of aggregate materials, such as a combination of sand and gravel.

The weight proportions of aggregate material, lignite fly ash and water are application and location dependent. The person skilled in the art, however, is capable of determining which amounts of said aggregate material, lignite fly ash and water should be combined in order to obtain a suitable concrete, mortar or grout.

Yet another aspect of the invention is related to a concrete-aggregate composition comprising a suitable aggregate material and lignite fly ash, both as specified above. This composition is suitably mixed with water to form a concrete, mortar or grout. Preferably, the aggregate material and lignite fly ash are present in the concrete-aggregate composition in a weight ratio of between 2:1 and 10:1. Advantageously, the concrete-aggregate composition is used to in the manuafacture of a concrete floor.

Stil another aspect of the invention is related to concrete, mortar or grout obtainable by the above specified method or by allowing a mixture of the above concrete-aggregate composition and water to set.

In a preferred embodiment, a concrete floor or a road base comprising one or more concrete layers obtainable by the method of the present invention is provided. Alternatively, such a concrete floor or road base is provided by allowing a mixture of the above concrete-aggregate composition and water to set. In this context, a road base is a concrete layer that is used as a structural base of a road. To manufacture a concrete floor or a road base a suitable aggregate material, lignite fly ash according to the invention and water are preferably mixed in a weight ratio of from about 4:2:1 to 15:5:1 so as to obtain a wet concrete mixture or slurry. Alternatively, a concrete-aggregate composition according to the invention and water are mixed in a weight ratio of 6:1 to 20:1. The thus formed wet mixture is then poured over the floor or road surface and allowed to set. When used as a floor, the concrete layer can be the surface layer or it can be covered with one or more top layers comprising e.g. a wear resistant resin. When used as a road base, the concrete layer may be covered with one or more asphalt concrete layers.

Examples

The invention is now illustrated by means of the following examples. A lignite fly ash A according to the invention was used as a binding agent in the preparation of concrete. The chemical composition of fly ash A is listed in table 1. The chemical composition was determined using XRF. In addition, the free lime content was detemined using XRD.

table 1	
ingredients (wt.%)	lignite fly ash A
SiO_2	24
Fe_2O_3	10
CaO[1]	41
MgO	4
Al_2O_3	11
$SiO_2 + Fe_2O_3 + Al_2O_3$	45
Na_2O	0
K_2O	0
SO_3	10
Free lime[1]	8
[1]The CaO content includes the free lime content	

Example 1

In correspondence with NEN standard EN 197-1, 1350 grams of sand (grain size up to 4 mm), 450 grams of a binder composition comprising lignite fly ash A and 225 grams of water were mixed in a 40x40x160 mm mould and allowed to set. After 6 days the sample was released from the mould and wrapped in foil. The lignite fly ash was not ground or slaked prior to addition to the binder composition. In table 2 the compressive strength after 56 days is listed.

Example 2

The procedure set out in example 1 was repeated with the difference that lignite fly ash A was slaked prior to its addition to the binder composition. In table 2 the compressive strength after 28 and 56 days is listed.

Example 3

In correspondence with NEN standard EN 197-1, 1350 grams of sand (grain size up to 4 mm), 500 grams of a binder composition comprising lignite fly ash A and 205 grams of water were mixed in a 40x40x160 mm mould and allowed to set. After 7 days the sample was released from the mould and placed under water. The lignite fly ash A was ground to a Blaine of 550 m^2/kg and slaked prior to addition to the binder composition. In addition 1.6 wt.%, based on the weight of the lignite fly ash, of a modified polycarboxylate plasticizer (Chrysofluid® Optima 200) was added to the mixture. In table 2 the compressive strength after 28 and 91 days is listed.

table 2			
example	1	2	3
lignite fly ash	A	A	A
slaked	no	yes	yes
ground	no	no	yes
Blaine (m^2/kg)			550
compressive strength (MPa); after:			
28 days	-	6.0	22.1
56 days	13.9	12.5	-
91 days	-	-	33.2

The results in table 2 show that the use of lignite fly ash A as a binding agent leads to a concrete mortar or grout having a significant compressive strength. Particularly good results are obtained when the lignite fly ash is ground and slaked before use.

Clauses

1. Method for manufacturing concrete, mortar or grout, comprising the step of allowing a mixture of a suitable aggregate material, a binding agent and water to set, wherein the binding agent consists essentially of lignite fly ash having a sulphate content of 6 wt.% or higher, based on the weight of the lignite fly ash.

2. Method according to clause 1, wherein the lignite fly ash is slaked prior to its addition to the mixture.

3. Method according to clause 1 or 2, wherein the lignite fly ash is ground prior to its addition to the mixture.

4. Method according to clause 3, wherein the lignite fly ash has a Blaine of 400 m^2/kg or more.

5. Method according to one of the preceding clauses, wherein the lignite fly ash has a sulphate content of from 7.5 to 15 wt.%, based on the weight of the lignite fly ash.

6. Method according to one of the preceding clauses, wherein the lignite fly ash comprises silicon oxides in an amount of at most 35 wt.%, based on the weight of the lignite fly ash.

7. Method according to one of the preceding clauses, wherein the combined amount of the oxides of silicon, aluminum and iron present in the lignite fly ash does not exceed 50 wt.%, based on the weight of the lignite fly ash.

8. Method according to one of the preceding clauses, wherein the lignite fly ash comprises calcium oxide in an amount of at least 20 wt.%, preferably 30 to 50 wt.%, based on the weight of the lignite fly ash.

9. Method according to one of the preceding clauses, wherein the lignite fly ash comprises free lime, preferably in an amount of at least 2.5 wt.%, more preferably 4 to 10 wt.%, based on the weight of the lignite fly ash.

10. Method according to one of the preceding clauses, wherein one or more additives selected from the group consisting of dyes, plasticizers, stabilizers, waterproofing agents, frost proofing agents, dust proofing agents, air entrainment agents, set accelerating agents and preservatives are added to the mixture.

11. Concrete-aggregate composition comprising an aggregate material and a binding agent which consists essentially of lignite fly ash having a sulphate content of 6 wt.% or higher, based on the weight of the lignite fly ash.

12. Concrete, mortar or grout obtainable by the method of one of the preceding clauses 1 to 10 or by allowing a mixture of the concrete-aggregate composition of clause 11 and water to set.

13. Concrete floor obtainable by the method of one of the preceding clauses 1 to 10 or by allowing a mixture of the concrete-aggregate composition of clause 11 and water to set .

14. Use of lignite fly ash having a sulphate content of 6 wt.% or higher, based on the weight of the lignite fly ash, as the sole binding agent in the manufacturing of concrete, mortar or grout.

Conclusies

1. Werkwijze voor het vervaardigen van beton, mortel of grout, omvattende de stap van het laten uitharden van een mengsel van een geschikt aggregaatmateriaal, een bindmiddel en water, waarin het bindmiddel hoofdzakelijk uit bruinkoolvliegas met een sulfaatgehalte van 6 gew.% of meer bestaat, betrokken op het gewicht van de bruinkoolvliegas.

2. Werkwijze volgens conclusie 1, waarin de bruinkoolvliegas voorafgaand aan het toevoegen aan het mengsel wordt geblust.

3. Werkwijze volgens conclusie 1 of 2, waarin de bruinkoolvliegas voorafgaand aan het toevoegen aan het mengsel wordt gemalen.

4. Werkwijze volgens conclusie 3, waarin de bruinkoolvliegas een Blaine van 400 m^2/kg of meer heeft.

5. Werkwijze volgens een van de voorgaande conclusies, waarin de bruinkoolvliegas een sulfaatgehalte van 7,5 - 15 gew.% heeft, betrokken op het gewicht van de bruinkoolvliegas.

6. Werkwijze volgens een van de voorgaande conclusies, waarin de bruinkoolvliegas siliciumoxiden omvat in een hoeveelheid van maximaal 35 gew.%, betrokken op het gewicht van de bruinkoolvliegas.

7. Werkwijze volgens een van de voorgaande conclusies, waarin de gecombineerde hoeveelheid van de in de bruinkoolvliegas aanwezige silicium-, aluminium- en ijzeroxiden niet meer is dan 50 gew.%, betrokken op het gewicht van de bruinkoolvliegas.

8. Werkwijze volgens een van de voorgaande conclusies, waarin de bruinkoolvliegas calciumoxide omvat in een hoeveelheid van ten minste 20 gew.%, bij voorkeur 30-50 gew.%, betrokken op het gewicht van de bruinkoolvliegas.

9. Werkwijze volgens een van de voorgaande conclusies, waarin de bruinkoolvliegas vrije kalk omvat, bij voorkeur in een hoeveelheid van ten minste 2,5 gew.%, met meer voorkeur 4-10 gew.%, betrokken op het gewicht van de bruinkoolvliegas.

10. Werkwijze volgens een van de voorgaande conclusies, waarin een of meer hulpstoffen gekozen uit de groep bestaande uit kleurstoffen, weekmakers, stabilisatoren, waterdichtmakende middelen, vorstbestendigmakende middelen, stofdichtmakende middelen,

luchtbelvormende middelen, bindingsversnellers en conserveermiddelen aan het mengsel worden toegevoegd.

11. Beton-aggregaatsamenstelling omvattende een aggregaatmateriaal en een bindmiddel dat hoofdzakelijk uit bruinkoolvliegas met een sulfaatgehalte van 6 gew.% of meer bestaat, betrokken op het gewicht van de bruinkoolvliegas.

12. Beton, mortel of grout verkrijgbaar middels de werkwijze volgens een van de voorgaande conclusies 1-10 of door een mengsel van de beton-aggregaatsamenstelling volgens conclusie 11 en water uit te laten harden.

13. Betonnen vloer verkrijgbaar middels de werkwijze volgens een van de voorgaande conclusies 1-10 of door een mengsel van de beton-aggregaatsamenstelling volgens conclusie 11 en water uit te laten harden.

14. Gebruik van bruinkoolvliegas met een sulfaatgehalte van 6 gew.% of meer, betrokken op het gewicht van de bruinkoolvliegas, als het enige bindmiddel in de vervaardiging van beton, mortel of grout.

SAMENWERKINGSVERDRAG (PCT)

RAPPORT BETREFFENDE NIEUWHEIDSONDERZOEK VAN INTERNATIONAAL TYPE

IDENTIFICATIE VAN DE NATIONALE AANVRAGE	KENMERK VAN DE AANVRAGER OF VAN DE GEMACHTIGDE
	P30995NL00/JHO
Nederlands aanvraag nr. **2008574**	Indieningsdatum **30-03-2012**
	Ingeroepen voorrangsdatum
Aanvrager (Naam) **Van Nieuwpoort Beheer B.V.**	
Datum van het verzoek voor een onderzoek van internationaal type **26-05-2012**	Door de Instantie voor Internationaal Onderzoek aan het verzoek voor een onderzoek van internationaal type toegekend nr. **SN 58169**

I. CLASSIFICATIE VAN HET ONDERWERP (bij toepassing van verschillende classificaties, alle classificatiesymbolen opgeven)

Volgens de internationale classificatie (IPC)

C04B28/02

II. ONDERZOCHTE GEBIEDEN VAN DE TECHNIEK

Onderzochte minimumdocumentatie

Classificatiesysteem	Classificatiesymbolen
IPC8	**C04B**

Onderzochte andere documentatie dan de minimum documentatie, voor zover dergelijke documenten in de onderzochte gebieden zijn opgenomen

III.	☐	**GEEN ONDERZOEK MOGELIJK VOOR BEPAALDE CONCLUSIES**	(opmerkingen op aanvullingsblad)
IV.	☐	**GEBREK AAN EENHEID**	(opmerkingen op aanvullingsblad)

ONDERZOEKSRAPPORT BETREFFENDE HET RESULTAAT VAN HET ONDERZOEK NAAR DE STAND VAN DE TECHNIEK VAN HET INTERNATIONALE TYPE

Nummer van het verzoek om een onderzoek naar de stand van de techniek
NL 2008574

A. CLASSIFICATIE VAN HET ONDERWERP
INV. C04B28/02
ADD.

Volgens de Internationale Classificatie van octrooien (IPC) of zowel volgens de nationale classificatie als volgens de IPC.

B. ONDERZOCHTE GEBIEDEN VAN DE TECHNIEK

Onderzochte miminum documentatie (classificatie gevolgd door classificatiesymbolen)
C04B

Onderzochte andere documentatie dan de mimimum documentatie, voor dergelijke documenten, voor zover dergelijke documenten in de onderzochte gebieden zijn opgenomen

Tijdens het onderzoek geraadpleegde elektronische gegevensbestanden (naam van de gegevensbestanden en, waar uitvoerbaar, gebruikte trefwoorden)
EPO-Internal, INSPEC, WPI Data

C. VAN BELANG GEACHTE DOCUMENTEN

Categorie °	Geciteerde documenten, eventueel met aanduiding van speciaal van belang zijnde passages	Van belang voor conclusie nr.
X	FR 2 543 942 A1 (SETEC GEOTECHNIQUE [FR]) 12 oktober 1984 (1984-10-12) * bladzijde 2, regel 29 - bladzijde 4, regel 9 * * voorbeelden 1,2 * * conclusies 1-4 *	1-14
A,D	US 4 715 896 A (BERRY WILLIAM A [CA]) 29 december 1987 (1987-12-29) in de aanvraag genoemd * conclusies 1-8; voorbeelden 1-25 *	1-14
A	DE 195 03 142 A1 (BANNWARTH HORST PROF DR [DE]) 8 augustus 1996 (1996-08-08) * conclusies 1,2; voorbeelden 1-3 *	1-14
A	DE 40 39 014 A1 (SUDER MICHAEL DR [DE]) 11 juni 1992 (1992-06-11) * conclusies 1-7; voorbeeld 1 *	1-14

☐ Verdere documenten worden vermeld in het vervolg van vak C.

☒ Leden van dezelfde octrooifamilie zijn vermeld in een bijlage

° Speciale categorieën van aangehaalde documenten

"A" niet tot de categorie X of Y behorende literatuur die de stand van de techniek beschrijft

"D" in de octrooiaanvrage vermeld

"E" eerdere octrooi(aanvrage), gepubliceerd op of na de indieningsdatum, waarin dezelfde uitvinding wordt beschreven

"L" om andere redenen vermelde literatuur

"O" niet-schriftelijke stand van de techniek

"P" tussen de voorrangsdatum en de indieningsdatum gepubliceerde literatuur

"T" na de indieningsdatum of de voorrangsdatum gepubliceerde literatuur die niet bezwarend is voor de octrooiaanvrage, maar wordt vermeld ter verheldering van de theorie of het principe dat ten grondslag ligt aan de uitvinding

"X" de conclusie wordt als niet nieuw of niet inventief beschouwd ten opzichte van deze literatuur

"Y" de conclusie wordt als niet inventief beschouwd ten opzichte van de combinatie van deze literatuur met andere geciteerde literatuur van dezelfde categorie, waarbij de combinatie voor de vakman voor de hand liggend wordt geacht

"&" lid van dezelfde octrooifamilie of overeenkomstige octrooipublicatie

Datum waarop het onderzoek naar de stand van de techniek van internationaal type werd voltooid	Verzenddatum van het rapport van het onderzoek naar de stand van de techniek van internationaal type
27 november 2012	

Naam en adres van de instantie	De bevoegde ambtenaar
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Burtan, M

1

ONDERZOEKSRAPPORT BETREFFENDE HET RESULTAAT VAN HET ONDERZOEK NAAR DE STAND VAN DE TECHNIEK VAN HET INTERNATIONALE TYPE

Informatie over leden van dezelfde octrooifamilie

Nummer van het verzoek om een onderzoek naar de stand van de techniek: NL 2008574

In het rapport genoemd octrooigeschrift	Datum van publicatie	Overeenkomend(e) geschrift(en)	Datum van publicatie
FR 2543942	A1 12-10-1984	GEEN	
US 4715896	A 29-12-1987	GEEN	
DE 19503142	A1 08-08-1996	GEEN	
DE 4039014	A1 11-06-1992	GEEN	

Agentschap NL
Ministerie van Economische Zaken,
Landbouw en Innovatie

WRITTEN OPINION

File No.	Filing date *(day/month/year)*	Priority date *(day/month/year)*	Application No.
SN58169	30.03.2012		NL2008574

International Patent Classification (IPC)
INV. C04B28/02

Applicant
Van Nieuwpoort Beheer B.V.

This opinion contains indications relating to the following items:

- ☒ Box No. I Basis of the opinion
- ☐ Box No. II Priority
- ☐ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- ☐ Box No. IV Lack of unity of invention
- ☒ Box No. V Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- ☐ Box No. VI Certain documents cited
- ☐ Box No. VII Certain defects in the application
- ☐ Box No. VIII Certain observations on the application

	Examiner
	Burtan, M

Application number

WRITTEN OPINION

NL2008574

Box No. I Basis of this opinion

1. This opinion has been established on the basis of the latest set of claims filed before the start of the search.

2. With regard to any **nucleotide and/or amino acid sequence** disclosed in the application and necessary to the claimed invention, this opinion has been established on the basis of:

   a. type of material:

   ☐ a sequence listing

   ☐ table(s) related to the sequence listing

   b. format of material:

   ☐ on paper

   ☐ in electronic form

   c. time of filing/furnishing:

   ☐ contained in the application as filed.

   ☐ filed together with the application in electronic form.

   ☐ furnished subsequently for the purposes of search.

3. ☐ In addition, in the case that more than one version or copy of a sequence listing and/or table relating thereto has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that in the application as filed or does not go beyond the application as filed, as appropriate, were furnished.

4. Additional comments:

Box No. V Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty	Yes:	Claims	
	No:	Claims	1-14
Inventive step	Yes:	Claims	
	No:	Claims	1-14
Industrial applicability	Yes:	Claims	1-14
	No:	Claims	

2. Citations and explanations

see separate sheet

Re Item V

Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1 Reference is made to the following document:

D1 FR 2 543 942 A1 (SETEC GEOTECHNIQUE [FR]) 12 oktober 1984 (1984-10-12)

2 The present application does not meet the criteria of patentability, because the subject-matter of independent claims 1, 11 and 14 is not new. D1 discloses, *inter alia*:

- a method for manufacturing concrete, mortar or grout, comprising the step of allowing a mixture of a suitable aggregate material, a binding agent and water so set, wherein the binding agent consists essentially of lignite fly ash having a sulphate content of 6 wt% or higher, based on the weight of the lignite fly ash.

- a concrete-aggregate composition comprising an aggregate material and a binding agent which consists essentially of lignite fly ash having a sulphate content of 6 wt% or higher, based on the weight of the lignite fly ash.

- the use of lignite fly ash having a sulphate content of 6 wt% or higher, based on the weight of the lignite fly ash, as the sole binding agent in the manufacture of concrete, mortar or grout.

(see the Search Report and the relevant passages of D1 cited therein)

3 Dependent claims 2 - 10, 12 and 13 do not appear to contain any features which, in combination with the features of any claim to which they refer, meet the requirements of novelty and inventive step, see D1.