

Bogotá, D.C., 19 de agosto de 2020

Doctor
EDNA MARCELA RAMÍREZ OROZCO
Director Nuevas Creaciones
SUPERINTENDENCIA DE INDUSTRIA Y COMERCIO -SIC-
E. S. D.

RE.:	SOLICITANTE:	ETEX SERVICES NV
		COMPTOIR DU BATIMENT NV
	TITULO:	"RODUCTOS DE FIBROCEMENTO DE COLOR
		PÁLIDO Y MÉTODOS PARA SU
		PRODUCCIÓN"
	EXP.:	NC2019/0009675

SOLICITUD PROCEDIMIENTO ACCELERADO DE PATENTES (PPH)

HELENA CAMARGO WILLIAMSON, mayor de edad y vecina de Bogotá D.C., identificada como aparece al pie de mi firma, en mi condición de apoderada de las empresas **ETEX SERVICES NV** y **COMPTOIR DU BATIMENT NV**, me dirijo a usted respetuosamente con el fin de solicitar que la presente solicitud sea examinada bajo el Procedimiento Acelerado de Patentes como a continuación explico:

1. La solicitud de patente de la referencia, corresponde a la solicitud internacional "PCT/EP2018/057774" presentada el 27 de marzo de 2018 y la fase nacional presentada ante la Oficina Europea de Patentes "EP3601193" también presentada el 27 de marzo de 2018.
2. La solicitud internacional relacionada en el punto anterior y la fase nacional Europea, corresponden a la fase nacional presentada en Colombia ante la Superintendencia de Industria y Comercio con número de expediente "NC2019/0009675".
3. En dicha fase internacional, el Solicitante recibió la notificación del reporte internacional de búsqueda y la opinión escrita de la autoridad internacional, que para el caso particular es la "Oficina de Patentes Europea" donde manifiesta que la invención cumple con los requisitos de novedad, nivel inventivo y aplicación industrial en el punto No. V de dicho reporte. La

comunicación mencionada y el texto publicado se adjuntan al presente memorial como base para el presente estudio.

4. Adicionalmente, el Solicitante recibió la notificación el 7 de agosto de 2020 por parte de la Oficina de Patentes donde manifiesta su intención de otorgar la patente “EP3601193”, por lo que es claro que la solicitud cumple con los requisitos de patentabilidad. Esta notificación se adjuntan al presente memorial como base para el presente estudio junto con el texto objeto de patente.
5. La solicitud de patente colombiana y en especial sus reivindicaciones reflejan la misma materia protegida por el alcance de las reivindicaciones analizadas por la autoridad de búsqueda internacional y la fase nacional Europe, tal y como se evidencia a continuación:

PCT/EP2018/057774 / EP3601193	NC2019/0009675
1. Un producto de fibrocemento de color pálido que comprende por lo menos cemento blanco y fibras sintéticas, donde las fibras sintéticas están pigmentadas con por lo menos un pigmento oscuro seleccionado del grupo que consiste en un pigmento negro, un pigmento marrón, un pigmento azul, un rojo pigmento, un pigmento verde y un pigmento gris.	1. Un producto de fibrocemento de color pálido que comprende por lo menos cemento blanco y fibras sintéticas, donde las fibras sintéticas están pigmentadas con por lo menos un pigmento oscuro seleccionado del grupo que consiste en un pigmento negro, un pigmento marrón, un pigmento azul, un rojo pigmento, un pigmento verde y un pigmento gris.
2. El producto de fibrocemento de color pálido de acuerdo con la reivindicación 1, donde dichas fibras sintéticas son fibras de polipropileno.	2. El producto de fibrocemento de color pálido de acuerdo con la reivindicación 1, donde dichas fibras sintéticas son fibras de polipropileno.
3. El producto de fibrocemento de color pálido de acuerdo con las reivindicaciones 1 o 2, donde dichas fibras sintéticas son fibras de polipropileno que tienen un grosor de alrededor de 70 dtex.	3. El producto de fibrocemento de color pálido de acuerdo con las reivindicaciones 1 o 2, donde dichas fibras sintéticas son fibras de polipropileno que tienen un grosor de alrededor de 70 dtex.
4. El producto de fibrocemento de color pálido de acuerdo con cualquiera de las reivindicaciones 1 a 3, donde dichas fibras sintéticas son fibras de polipropileno molidas que tienen una longitud promedio de alrededor de 1 mm a alrededor de 2 mm.	4. El producto de fibrocemento de color pálido de acuerdo con cualquiera de las reivindicaciones 1 a 3, donde dichas fibras sintéticas son fibras de polipropileno molidas que tienen una longitud promedio de alrededor de 1 mm a alrededor de 2 mm.
5. El producto de fibrocemento de color pálido de acuerdo con cualquiera de las reivindicaciones 1 a 4, donde dichas fibras sintéticas están pigmentadas con por lo menos un pigmento oscuro, que es un óxido de hierro gris, un óxido de hierro negro, un óxido de hierro marrón o negro de carbón.	5. El producto de fibrocemento de color pálido de acuerdo con cualquiera de las reivindicaciones 1 a 4, donde dichas fibras sintéticas están pigmentadas con por lo menos un pigmento oscuro, que es un óxido de hierro gris, un óxido de hierro negro, un óxido de hierro marrón o negro de carbón.

6. El producto de fibrocemento de color pálido de acuerdo con cualquiera de las reivindicaciones 1 a 5, que comprende además un pigmento blanco.	6. El producto de fibrocemento de color pálido de acuerdo con cualquiera de las reivindicaciones 1 a 5, que comprende además un pigmento blanco.
7. El producto de fibrocemento de color pálido de acuerdo con la reivindicación 6, donde dicho pigmento blanco es óxido de titanio (TiO ₂).	7. El producto de fibrocemento de color pálido de acuerdo con la reivindicación 6, donde dicho pigmento blanco es óxido de titanio (TiO ₂).
8. El producto de fibrocemento de color pálido de acuerdo con la reivindicación 6 o 7, donde dicho pigmento blanco está presente en una cantidad entre alrededor de 3% en peso y alrededor de 6% en peso (en comparación con el peso seco total de la composición de fibrocemento) de dicho producto de fibrocemento.	8. El producto de fibrocemento de color pálido de acuerdo con la reivindicación 6 o 7, donde dicho pigmento blanco está presente en una cantidad entre alrededor de 3% en peso y alrededor de 6% en peso (en comparación con el peso seco total de la composición de fibrocemento) de dicho producto de fibrocemento.
9. El producto de fibrocemento de color pálido de acuerdo con cualquiera de las reivindicaciones 1 a 8, que comprende además piedra caliza (CaCO ₃) en una cantidad de entre alrededor de 5% en peso y alrededor de 15% en peso (en comparación con el peso seco total de la composición de fibrocemento de dicho producto de fibrocemento).	9. El producto de fibrocemento de color pálido de acuerdo con cualquiera de las reivindicaciones 1 a 8, que comprende además piedra caliza (CaCO ₃) en una cantidad de entre alrededor de 5% en peso y alrededor de 15% en peso (en comparación con el peso seco total de la composición de fibrocemento de dicho producto de fibrocemento).
10. El producto de fibrocemento de color pálido de acuerdo con cualquiera de las reivindicaciones 1 a 9, que está revestido con un revestimiento transparente.	10. El producto de fibrocemento de color pálido de acuerdo con cualquiera de las reivindicaciones 1 a 9, que está revestido con un revestimiento transparente.
11. El producto de fibrocemento de color pálido de acuerdo con la reivindicación 10, donde dicho revestimiento transparente comprende entre alrededor de 0,5% en peso y alrededor de 4% en peso (en comparación con el peso seco total de la composición de fibrocemento de dicho producto de fibrocemento) de un pigmento blanco.	11. El producto de fibrocemento de color pálido de acuerdo con la reivindicación 10, donde dicho revestimiento transparente comprende entre alrededor de 0,5% en peso y alrededor de 4% en peso (en comparación con el peso seco total de la composición de fibrocemento de dicho producto de fibrocemento) de un pigmento blanco.
12. El producto de fibrocemento de color pálido de acuerdo con la reivindicación 11, donde dicho pigmento blanco es óxido de titanio (TiO ₂).	12. El producto de fibrocemento de color pálido de acuerdo con la reivindicación 11, donde dicho pigmento blanco es óxido de titanio (TiO ₂).
13. Un método para la fabricación de un producto de fibrocemento de color pálido de acuerdo con cualquiera de las reivindicaciones 1 a 12, que comprende por	13. Un método para la fabricación de un producto de fibrocemento de color pálido de acuerdo con cualquiera de las reivindicaciones 1 a 12, que comprende por

lo menos las etapas de: d) proporcionar una suspensión de fibrocemento que comprende por lo menos cemento blanco y fibras sintéticas, donde dichas fibras sintéticas están pigmentadas con por lo menos un pigmento oscuro seleccionado del grupo que consiste en un pigmento negro, un pigmento marrón y un pigmento gris; e) fabricar un producto de fibrocemento mediante un proceso de producción de fibrocemento; f) curar el producto de fibrocemento, para obtener dicho producto de fibrocemento de color pálido.	lo menos las etapas de: d) proporcionar una suspensión de fibrocemento que comprende por lo menos cemento blanco y fibras sintéticas, donde dichas fibras sintéticas están pigmentadas con por lo menos un pigmento oscuro seleccionado del grupo que consiste en un pigmento negro, un pigmento marrón y un pigmento gris; e) fabricar un producto de fibrocemento mediante un proceso de producción de fibrocemento; f) curar el producto de fibrocemento, para obtener dicho producto de fibrocemento de color pálido.
14. El método de acuerdo con la reivindicación 13, donde dicha etapa c) de curar el producto de fibrocemento comprende curar al aire el producto de fibrocemento.	14. El método de acuerdo con la reivindicación 13, donde dicha etapa c) de curar el producto de fibrocemento comprende curar al aire el producto de fibrocemento.
15. Uso de un producto de fibrocemento de color pálido de acuerdo con cualquiera de las reivindicaciones 1 a 12, como un material de construcción.	15. Uso de un producto de fibrocemento de color pálido de acuerdo con cualquiera de las reivindicaciones 1 a 12, como un material de construcción.

6. En correspondencia con la información previamente presentada, se evidencia que la Solicitud de Patente Colombiana y la Solicitud Internacional cumplen con los siguientes requisitos establecidos para la solicitud del examen acelerado a través del Procedimiento Acelerado De Patentes:
 - 6.1. La “Opinión Escrita de la Autoridad de Búsqueda Internacional (WO/ISA)” indica que la materia reivindicada cumple con los requisitos de novedad, nivel inventivo y aplicación industrial.
 - 6.2. La relación entre la solicitud ante la SIC y la solicitud internacional correspondiente satisface el siguiente requisito: La solicitud es una solicitud en fase nacional de la solicitud internacional correspondiente.
 - 6.3. Todas las reivindicaciones en el expediente colombiano, como originalmente fueron presentadas para su examen en virtud del PCT-PPH, corresponden suficientemente a todas las reivindicaciones indicadas como patentables/otorgables en el producto del trabajo internacional más reciente de la solicitud internacional correspondiente teniendo como autoridad de búsqueda y examen la EPO, así como también al texto de la fase nacional europea.
 - 6.4. La solicitud SIC ha sido publicada.
 - 6.5. La SIC no ha notificado el examen de fondo de la solicitud de patente al día de hoy, 14 de agosto, momento en el que se presenta esta solicitud

7. Adjunto los siguientes documentos como sustento para la solicitud de Procedimiento Acelerado de Patentes:
 - 7.1. Opinión escrita de la Autoridad de Búsqueda Internacional de la solicitud internacional de la patente de la referencia.
 - 7.2. Copia del documento de patente publicado en la Solicitud Internacional, junto con las reivindicaciones estudiadas en la Opinión Escrita.
 - 7.3. Copia de los documentos citados en el informe de la Opinión escrita.
8. En vista de lo anterior, solicito de manera respetuosa que las traducciones de los documentos junto con la solicitud de PPH, sean tomadas en cuenta para el estudio de la presente solicitud, toda vez que corresponde al mismo anexado, pero en idioma español, para mayor claridad a la hora de ser estudiados.

De la Señora Directora,

POSSE HERRERA RUIZ



HELENA CAMARGO WILLIAMSON
C.C 35.455.268 de Bogotá
T.P. 76985

- Anexos:
- Opinión escrita de la Autoridad de Búsqueda Internacional de la solicitud internacional de la patente de la referencia en inglés y español.
 - Copia del documento de patente estudiado, junto con el pliego de reivindicaciones estudiado.
 - Copia de los documentos citados en el informe de la Opinión escrita.
 - Copia de la notificación de intención de otorgar emitido por la Oficina Europea de Patentes
 - Copia del documento de patente objeto de patente en la Oficina Europea de Patentes.

PATENT COOPERATION TREATY

From the INTERNATIONAL SEARCHING AUTHORITY

PCT

To:
Vaeck, Elke
ETEX SERVICES NV
Kuiermansstraat 1
1880 Kapelle-op-den-Bos
BELGIQUE



NOTIFICATION OF TRANSMITTAL OF
THE INTERNATIONAL SEARCH REPORT AND
THE WRITTEN OPINION OF THE INTERNATIONAL
SEARCHING AUTHORITY, OR THE DECLARATION

(PCT Rule 44.1)

Date of mailing (day/month/year) 27 June 2018 (27-06-2018)	
Applicant's or agent's file reference FC1710WO	FOR FURTHER ACTION See paragraphs 1 and 4 below
International application No. PCT/EP2018/057774	International filing date (day/month/year) 27 March 2018 (27-03-2018)
Applicant ETEX SERVICES NV	

1. ☒ The applicant is hereby notified that the international search report and the written opinion of the International Searching Authority have been established and are transmitted herewith.

Filing of amendments and statement under Article 19:

The applicant is entitled, if he so wishes, to amend the claims of the International Application (see Rule 46):

When? The time limit for filing such amendments is normally two months from the date of transmittal of the International Search Report.

How? Directly to the International Bureau of WIPO, 34 chemin des Colombettes
1211 Geneva 20, Switzerland, Facsimile No.: (41-22) 338.82.70

For more detailed instructions, see PCT Applicant's Guide, International Phase, paragraphs 9.004 - 9.011.

2. ☐ The applicant is hereby notified that no international search report will be established and that the declaration under Article 17(2)(a) to that effect and the written opinion of the International Searching Authority are transmitted herewith.
3. ☐ **With regard to any protest** against payment of (an) additional fee(s) under Rule 40.2, the applicant is notified that:
- ☐ the protest together with the decision thereon has been transmitted to the International Bureau together with any applicant's request to forward the texts of both the protest and the decision thereon to the designated Offices.
- ☐ no decision has been made yet on the protest; the applicant will be notified as soon as a decision is made.

4. Reminders

The applicant may **submit comments on an informal basis on the written opinion of the International Searching Authority** to the International Bureau. These comments will be made available to the public after international publication. The International Bureau will send a copy of such comments to all designated Offices unless an international preliminary examination report has been or is to be established.

Shortly after the expiration of **18 months from the priority date, the international application will be published** by the International Bureau. If the applicant wishes to avoid or postpone publication, a notice of withdrawal of the international application, or of the priority claim, must reach the International Bureau before the completion of the technical preparations for international publication (Rules 90*bis*.1 and 90*bis*.3).

Within **19 months** from the priority date, but only in respect of some designated Offices, a demand for international preliminary examination must be filed if the applicant wishes to postpone the entry into the national phase **until 30 months** from the priority date (in some Offices even later); otherwise, the applicant must, **within 20 months** from the priority date, perform the prescribed acts for **entry into the national phase** before those designated Offices. In respect of other designated Offices, the time limit of **30 months** (or later) will apply even if no demand is filed within 19 months. For details about the applicable time limits, Office by Office, see www.wipo.int/pct/en/texts/time_limits.html and the *PCT Applicant's Guide*, National Chapters.

Within **22 months from the priority date, the applicant may request that a supplementary international search be carried out** by a different International Searching Authority that offers this service (Rule 45*bis*.1). The procedure for requesting supplementary international search is described in the *PCT Applicant's Guide*, International Phase, paragraphs 8.006-8.032.

Name and mailing address of the International Searching Authority



European Patent Office, P.B. 5818 Patentlaan 2
NL-2280 HV Rijswijk
Tel. (+31-70) 340-2040
Fax: (+31-70) 340-3016

Authorized officer

MAZZARIOL, Francesca
Tel: +49 (0)89 2399-7911

PATENT COOPERATION TREATY

PCT

INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference FC1710WO	FOR FURTHER ACTION see Form PCT/ISA/220 as well as, where applicable, item 5 below.	
International application No. PCT/EP2018/057774	International filing date (day/month/year) 27 March 2018 (27-03-2018)	(Earliest) Priority Date (day/month/year) 28 March 2017 (28-03-2017)
Applicant ETEX SERVICES NV		

This international search report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This international search report consists of a total of 3 sheets.

☒ It is also accompanied by a copy of each prior art document cited in this report.

1. Basis of the report

a. With regard to the **language**, the international search was carried out on the basis of:

- ☒ the international application in the language in which it was filed
☐ a translation of the international application into _____, which is the language of a translation furnished for the purposes of international search (Rules 12.3(a) and 23.1(b))

b. ☐ This international search report has been established taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91 (Rule 43.6*b/s(a)*).

c. ☐ With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, see Box No. I.

2. ☐ **Certain claims were found unsearchable** (See Box No. II)

3. ☐ **Unity of invention is lacking** (see Box No III)

4. With regard to the **title**,

- ☒ the text is approved as submitted by the applicant
☐ the text has been established by this Authority to read as follows:

5. With regard to the **abstract**,

- ☒ the text is approved as submitted by the applicant
☐ the text has been established, according to Rule 38.2, by this Authority as it appears in Box No. IV. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority

6. With regard to the **drawings**,

- a. the figure of the **drawings** to be published with the abstract is Figure No. _____
☐ as suggested by the applicant
☐ as selected by this Authority, because the applicant failed to suggest a figure
☐ as selected by this Authority, because this figure better characterizes the invention
 b. ☒ none of the figures is to be published with the abstract

INTERNATIONAL SEARCH REPORT

International application No

PCT/EP2018/057774

A. CLASSIFICATION OF SUBJECT MATTER

INV. C04B28/04 C04B16/06

ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

C04B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP 2 172 434 A1 (REDCO SA [BE]) 7 April 2010 (2010-04-07) paragraphs [0004], [0006], [0010], [0017], [0019] - paragraphs [0021], [0026]; tables 1-3 -----	1-15
A	WO 2016/202680 A1 (ETERNIT AG [DE]) 22 December 2016 (2016-12-22) pages 1, 8, lines 11-14, 22-28; claim 1; example 1 -----	1-15
A	CN 101 955 343 A (WENGUANG CHEN) 26 January 2011 (2011-01-26) WPI abstract and machine translated document -----	1-15



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

13 June 2018

Date of mailing of the international search report

27/06/2018

Name and mailing address of the ISA/

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040,
Fax: (+31-70) 340-3016

Authorized officer

Philippart, Anahí

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/EP2018/057774

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 2172434	A1	07-04-2010	BR PI0920780 A2 22-12-2015
			CO 6351769 A2 20-12-2011
			DK 2172434 T3 01-06-2015
			EP 2172434 A1 07-04-2010
			ES 2537053 T3 02-06-2015
			JP 5770091 B2 26-08-2015
			JP 2012504540 A 23-02-2012
			PE 00722012 A1 23-02-2012
			PT 2172434 E 17-07-2015
			WO 2010037628 A1 08-04-2010
WO 2016202680	A1	22-12-2016	EP 3106448 A1 21-12-2016
			EP 3307696 A1 18-04-2018
			WO 2016202680 A1 22-12-2016
CN 101955343	A	26-01-2011	NONE

TITLE: PALE-COLORED FIBER CEMENT PRODUCTS AND METHODS FOR THE PRODUCTION THEREOF

APPLICANT: ETEX SERVICES NV

IPC CLASSIFICATION: C04B28/04, C04B16/06

EXAMINER: Philippart, Anahí

CONSULTED DATABASES: WPI, EPODOC

CLASSIFICATION SYMBOLS DEFINING EXTENT OF THE SEARCH:

IPC:

CPC: 1-

C04B28/04, C04B14/28, C04B14/305, C04B16/0633, C04B16/0641, C04B18/24, C04B40/0064, C04B41/483, 2- C04B16/0633, C04B20/1059, C04B28/04, C04B16/0633, C04B2111/802

FI/F-TERMS:

KEYWORDS OR OTHER ELEMENTS FEATURING THE INVENTION:

- fiber cement
- pigmented fiber
- white cement

© EPODOC / EPO

PN - CN101955343 A 20110126

TI - Energy-saving leveling putty powder

AB - The invention relates to energy-saving leveling putty powder, which is characterized by being prepared from the following raw materials in percentage by weight: 20 to 30 percent of white cement, 5 to 10 percent of gray calcium powder, 40 to 60 percent of heavy calcium carbonate powder, 5 to 15 percent of 50 to 100-mesh light sand, 0.1 to 1 percent of reinforcing fiber, 0.1 to 1.5 percent of polyvinyl alcohol, 0.1 to 1.8 percent of cellulose and 1 to 3 percent of polymer powder, wherein the light sand is polyphenyl particles, vitrified micro bubbles or expanded perlite; the reinforcing fiber is 2-mm polypropylene fiber; and the cellulose is carboxymethyl cellulose. The energy-saving leveling putty powder has the characteristics of high strength, high water resistance, no toxicity or odor, yellowing resistance and the like; moreover, by adding the light sand with heat preservation and thermal insulation function, the putty powder has the obvious characteristics of light weight, heat preservation, high thermal insulation, abrasion resistance, corrosion resistance, high electric insulating performance, radiation protection and the like, while the basic performance is ensured.

CCI - C04B28/02

CLC - C04B28/02, C04B14/02, C04B14/24, C04B14/28, C04B16/08, C04B20/0048, C04B20/0076, C04B20/008, C04B24/24, C04B24/2623, C04B24/383 , INV
- C04B28/02, C04B14/02, C04B14/185, C04B14/28, C04B16/0633, C04B16/08, C04B20/0076, C04B24/24, C04B24/2623, C04B24/383 , INV

CCA - C04B2103/61 ; C04B2111/00025 ; C04B2111/00258 ; C04B2111/00663 ; C04B2111/2038 ; C04B2111/27 ; C04B2111/28 ; C04B2111/40 ; C04B2111/802

PA - WENGUANG CHEN

IN - WENGUANG CHEN

CT - || STSE (A)
CN1537898 A 20041020 [] (WANG GANGWEI [CN], et al);
CN1908081 A 20070207 [] (DONG LIHUA WU [CN]);
CN1657574 A 20050824 [] (ZHANG RENTAO [CN]);
CN1557884 A 20041229 [] (ZHOU SHIBIN [CN]);
CN101709170 A 20100519 [] (MINGQING CHEN, et al)

AP - CN20101268975 20100831

PR - CN20101268975 20100831

DT - I

© WPI / 2017 Clarivate Analytics.

AN - 2011-D00943

TI - Leveling putty powder comprises specified amount of white cement, grey calcium powder, heavy calcium carbonate powder, light sand, reinforced fiber, polyvinyl alcohol, cellulose and polymer powder

AB - NOVELTY :
A putty powder comprises (in weight%) white cement (20-30), grey calcium powder (5-10), heavy calcium carbonate powder (40-60), light sand (5-15), reinforced fiber (0.1-1), polyvinyl alcohol (0.1-1.5), cellulose (0.1-1.8) and polymer powder (1-3). The light sand is polyphenyl particles, vitrified micro-beads and/or expanded pearlite. The reinforcing fiber is polypropylene fiber. The cellulose is carboxymethyl cellulose. The polypropylene fiber has length of 2 mm. The grain size of light sand is 50-100 meshes.
- USE :
Leveling putty powder.

- ADVANTAGE :

The leveling putty powder has excellent electric insulation property, high strength, water resistance, yellowing resistance, heat stability, heat insulation property, abrasion resistance, corrosion resistance, radiation resistance and non toxic without smell, and is lightweight and contributes to energy-saving.

- CERAMICS AND GLASS :

Preferred Composition: The putty powder comprises #425-type white cement (28 or 29), grey calcium powder (7 or 8), heavy calcium carbonate powder (44, 51 or 55), light sand (5 or 9 or 15), reinforced fiber (0.1-1), polyvinyl alcohol (0.9), cellulose (1.1 or 0.8 or 1.3) and polymer powder (1.9 or 2.3 or 2.5). The leveling putty powder further contains carboxymethyl cellulose (0.5 or 0.6 or 0.7). Preferred Property: The light sand has grain size of 80 meshes.

IW	- PUTTY POWDER COMPRISE SPECIFIED AMOUNT WHITE CEMENT GREY CALCIUM HEAVY CARBONATE LIGHT SAND REINFORCED POLYVINYL ALCOHOL CELLULOSE POLYMER
PN	- CN101955343 A 20110126 DW201130
ICAI	- C04B28/04
MC	- A03-A04A A04-G03E A10-E09B A12-R01A L02-C02 L02-C08 L02-D14S
DC	- A97 L02
PA	- (CHEN-I) CHEN W
IN	- CHEN W
AP	- CN20101268975 20100831
PR	- CN20101268975 20100831

© TXPCNEA / EPO

CN101955343 A 20110126

The present invention relates to a kind of energy-conservation leveling putty powder, it is characterized in that by following raw materials according formulated by weight percentage, wherein: white cement **20%-30%**, grey matter calcium powder **5%-10%**, heavy calcium carbonate **40%-60%**, **50-100** purpose lightweight sand **5%-15%**, fortifying fibre **0.1%-1%**, polyvinyl alcohol **0.1-1.5%**, Microcrystalline cellulose **0.1%-1.8%**, polymer powder **1%-3%**;Wherein lightweight sand is granular polystyrene, glass bead, perhaps pearlstone select a material, fortifying fibre is the **2mm** polypropylene fibre, Microcrystalline cellulose is a carboxymethyl cellulose.The present invention is except that having characteristics such as high strength, water-tolerant, nonpoisonous and tasteless, anti-xanthochromia, owing to added lightweight sand with incubation and thermal insulation function, make putty powder of the present invention when guaranteeing fundamental property, also have light weight, insulation, heat insulation good, wear-resisting, corrosion-resistant, distinguishing features such as electrical insulation capability is good, radioprotective.

A kind of energy-conservation leveling putty powder

Technical field:

The invention belongs to building materials field, a kind of energy-conservation leveling putty powder of exterior wall bottoming in particularly a kind of being used for.

Background technology:

Building trade is various in order to the material of interior exterior wall bottoming at present, tradition has the gypsum of employing, talcum powder, lime putty, white cement to infiltrate **107** glue, stirring into paste constructs and scrapes at the end, along with the attention of people to environmental protection, especially interior wall bottoming aspect, **107** glue have been abandoned, most of employing putty powder water transfer bottoming.Putty powder is mainly formed by materials processings such as water-ground limestone, white cements, and hardness was moderate after bottoming was solidified, and was convenient to sand flat.The leading indicator of existing putty powder is freedom from cracking, non-scale, does not come off, and has certain rigidity and water tolerance.Along with social progress, people also improve gradually to the functional requirement of putty powder, except general requirement,also need consider the demand of energy-conserving and environment-protective.

Putty powder is many at present is base-material with the inorganic coagulation material, the filler that is aided with vast scale, as silica powder, talcum powder, calcite in powder etc., with the solids content that increases putty with improve workability, but these fillers have increased the proportion of putty powder itself greatly, for the packed and transported and the construction process of putty increased great inconvenience, and production cost and construction cost have been increased.

How developing a kind of is environmental protection, energy-conservation, construction facility, and the putty powder that can satisfy the specific function demand has again become the trend of putty development from now on, and at present, the energy-conservation leveling putty powder that possesses the light heat insulating characteristic at home simultaneously yet there are no relevant report.

Summary of the invention:

The purpose of this invention is to provide the modulation of a kind of water, contain fiber, have the energy-conservation leveling putty powder of lightweight characteristic and incubation and thermal insulation function.

Technical solution of the present invention is achieved in that a kind of energy-conservation leveling putty powder, it is characterized in that by following raw materials according formulated by weight percentage, wherein: white cement **20%-30%**, grey matter calcium powder **5%-10%**, heavy calcium carbonate **40%-60%**, **50-100** purpose lightweight sand **5%-15%**, fortifying fibre **0.1%-1%**, polyvinyl alcohol **0.1-1.5%**, Microcrystalline cellulose **0.1%-1.8%**, polymer powder **1%-3%**; Wherein lightweight sand is granular polystyrene, glass bead, perhaps pearlstone select a material, fortifying fibre is the 2mm polypropylene fibre, Microcrystalline cellulose is a carboxymethyl cellulose.

Compared with prior art, invention is filled a prescription in the selected starting material, the lightweight sand with heat-insulation and heat-preservation effect and the fortifying fibre of anti-be full of cracks effect have been added, compare with traditional wall putty powder, the putty powder that uses this prescription to produce has functional performances such as insulation, heat insulation, sound-absorbing, also has advantages such as environmental protection, strong adhesion, easily polishing, freedom from cracking, water-fast, thick matter simultaneously. And because lightweight sand proportion only is the **1/5-1/8** of common fillers, adopt this light filler to alleviate the weight of putty powder greatly, for its packed and transported and construction process have increased great facility, and greatly reduce production cost and construction cost, meet the development trend of nowadays energy-saving and emission-reduction.

Embodiment:

Embodiment one:

Producing **100** parts of energy-conservation leveling putty powder is example, the raw material that preferably processes proportionately divides shared part by weight to be respectively: **425#** white cement **28%**, grey matter calcium powder **7%**, heavy calcium carbonate **51%**, **80** order granular polystyrenes **9%**, 2mm polypropylene fibre **0.5%**, polyvinyl alcohol **0.9%**, carboxymethyl cellulose **1.1%**, polymer powder **2.5%**.

In container, put into white cement, grey matter calcium powder, heavy calcium carbonate and the granular polystyrene of only about half of amount earlier, stir after **10** minutes; Then add polypropylene fibre, polyvinyl alcohol, carboxymethyl cellulose and polymer powder, stir after **10** minutes; Add remaining white cement, grey matter calcium powder, heavy calcium carbonate and granular polystyrene again, continue to stir discharging in **30** minutes, pack after the exhaust, and seal after can weighing by packed standard. According to the putty powder of said ratio hybrid modulation, add water furnishing paste, can be used for the metope bottoming.

Prepare a kind of energy-conservation leveling putty powder of the present invention according to described preparation method, its every performance index are as follows:

[image]

[image]

Embodiment two:

By the identical technology of last example; and by the proportional range of following preferred feedstock; raw material is mixed stirring, wherein **425#** white cement **28%**, grey matter calcium powder **8%**, heavy calcium carbonate **55%**, **70** order glass beads **5%**, 2mm polypropylene fibre **0.6%**, polyvinyl alcohol **0.7%**, carboxymethyl cellulose **0.8%**, polymer powder **1.9%**.

Prepare a kind of energy-conservation leveling putty powder of the present invention according to described preparation method, its every performance index are as follows:

[image]

[image]

Embodiment three:

By the identical technology of last example, be ready to raw material, and by the proportional range of following preferred feedstock, raw material is mixed stirring, wherein **425#** white cement **29%**, grey matter calcium powder **7%**, heavy calcium carbonate **44%**, **100** order pearlstones **15%**, 2mm polypropylene fibre **0.7%**, polyvinyl alcohol **0.7%**, carboxymethyl cellulose **1.3%**, polymer powder **2.3%**.

Prepare a kind of energy-conservation leveling putty powder of the present invention according to described preparation method, its every performance index are as follows:

[image]

Test putty sample of the present invention, find that putty powder of the present invention has very outstanding heat-insulation and heat-preservation function, thermal conductivity is low, and the polishing performance is good, and the sticking power excellence is water-fast impervious. And dry density is lower, greatly alleviates the load of transportation and construction, sheerly energy-conserving product.

[Claims]

1. energy-conservation leveling putty powder, it is characterized in that by following raw materials according formulated by weight percentage, wherein: white cement **20%-30%**, grey matter calcium powder **5%-10%**, heavy calcium carbonate **40%-60%**, **50-100** purpose lightweight sand **5%-15%**, fortifying fibre **0.1%-1%**, polyvinyl alcohol **0.1-1.5%**, Microcrystalline cellulose **0.1%-1.8%**, polymer powder **1%-3%**; Wherein lightweight sand is granular polystyrene, glass bead, perhaps pearlstone select a material, fortifying fibre is the 2mm polypropylene fibre, Microcrystalline cellulose is a carboxymethyl cellulose.

2. a kind of energy-conservation leveling putty powder according to claim 1 is characterized in that the preferred feedstock weight percent is: **425#** white cement **28%**, grey matter calcium powder **7%**, heavy calcium carbonate **51%**, **80** order granular polystyrenes **9%**, 2mm polypropylene fibre **0.5%**, polyvinyl alcohol **0.9%**, carboxymethyl cellulose **1.1%**, polymer powder **2.5%**.

3. a kind of energy-conservation leveling putty powder according to claim 1 is characterized in that the preferred feedstock weight percent is: **425#** white cement **28%**, grey matter calcium powder **8%**, heavy calcium carbonate **55%**, **70** order glass beads **5%**, 2mm polypropylene fibre **0.6%**, polyvinyl alcohol **0.7%**, carboxymethyl cellulose **0.8%**, polymer powder **1.9%**.

4. a kind of energy-conservation leveling putty powder according to claim 1 is characterized in that the preferred feedstock weight percent is: **425#** white cement **29%**, grey matter calcium powder **7%**, heavy calcium carbonate **44%**, **100** order pearlstones **15%**, 2mm polypropylene fibre **0.7%**, polyvinyl alcohol **0.7%**, carboxymethyl cellulose **1.3%**, polymer powder **2.3%**.

PATENT COOPERATION TREATY

From the
INTERNATIONAL SEARCHING AUTHORITY

To:

see form PCT/ISA/220

PCT

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY (PCT Rule 43bis.1)

Date of mailing
(day/month/year) see form PCT/ISA/210 (second sheet)

Applicant's or agent's file reference
see form PCT/ISA/220

FOR FURTHER ACTION
See paragraph 2 below

International application No.
PCT/EP2018/057774

International filing date (day/month/year)
27.03.2018

Priority date (day/month/year)
28.03.2017

International Patent Classification (IPC) or both national classification and IPC
INV. C04B28/04 C04B16/06

Applicant
ETEX SERVICES NV

1. 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 under Rule 43bis.1(a)(i) with regard to novelty, inventive step and industrial applicability; citations and explanations supporting such statement
- ☐ Box No. VI Certain documents cited
- ☒ Box No. VII Certain defects in the international application
- ☒ Box No. VIII Certain observations on the international application

2. FURTHER ACTION

If a demand for international preliminary examination is made, this opinion will usually be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA") except that this does not apply where the applicant chooses an Authority other than this one to be the IPEA and the chosen IPEA has notified the International Bureau under Rule 66.1bis(b) that written opinions of this International Searching Authority will not be so considered.

If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to the IPEA a written reply together, where appropriate, with amendments, before the expiration of 3 months from the date of mailing of Form PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later.

For further options, see Form PCT/ISA/220.

Name and mailing address of the ISA:



European Patent Office
D-80298 Munich
Tel. +49 89 2399 - 0
Fax: +49 89 2399 - 4465

Date of completion of
this opinion

see form
PCT/ISA/210

Authorized Officer

Philippart, Anahi

Telephone No. +49 89 2399-0



Box No. I Basis of the opinion

1. With regard to the **language**, this opinion has been established on the basis of:
 - ☒ the international application in the language in which it was filed.
 - ☐ a translation of the international application into , which is the language of a translation furnished for the purposes of international search (Rules 12.3(a) and 23.1 (b)).
2. ☐ This opinion has been established taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91 (Rule 43*bis*.1(a))
3. ☐ With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, this opinion has been established on the basis of a sequence listing:
 - a. ☐ forming part of the international application as filed:
 - ☐ in the form of an Annex C/ST.25 text file.
 - ☐ on paper or in the form of an image file.
 - b. ☐ furnished together with the international application under PCT Rule 13*ter*.1(a) for the purposes of international search only in the form of an Annex C/ST.25 text file.
 - c. ☐ furnished subsequent to the international filing date for the purposes of international search only:
 - ☐ in the form of an Annex C/ST.25 text file (Rule 13*ter*.1(a)).
 - ☐ on paper or in the form of an image file (Rule 13*ter*.1(b) and Administrative Instructions, Section 713).
4. ☐ In addition, in the case that more than one version or copy of a sequence listing has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that forming part of the application as filed or does not go beyond the application as filed, as appropriate, were furnished.
5. Additional comments:

Box No. V Reasoned statement under Rule 43*bis*.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes: Claims	<u>1-15</u>
	No: Claims	
Inventive step (IS)	Yes: Claims	<u>1-15</u>
	No: Claims	
Industrial applicability (IA)	Yes: Claims	<u>1-15</u>
	No: Claims	

2. Citations and explanations

see separate sheet

Box No. VII Certain defects in the international application

The following defects in the form or contents of the international application have been noted:

see separate sheet

Box No. VIII Certain observations on the international application

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:

see separate sheet

Re Item V

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

1 Novelty and Inventive Step (Art. 33(2) and 33(3) PCT)

1.1 The subject-matter of claims 1-15 seem to be novel and inventive (Art. 33 (1) PCT), over the documents D1-D3

1.2 Document D1 could be considered the closest prior art to the subject-matter of independent claims 1, 13 and 15 because of the most common features in the field of fibre-cement products. D1 discloses a fibre-cement product composition and shaped products, wherein the composition comprises PP, PVA and cellulose fibres (being alkali-resistant and used as reinforcing agents), CaCO_3 and Portland cement (see D1 passages cited in Search Report).

The subject-matter of **claim 1, 13 and 15** therefore differs from the disclosure of document D1 in that the binder is not white cement, and that the synthetic fibres are not pigmented.

The technical problem solved by said differentiating feature, and corresponding to the alleged technical problem of the present application (see page 1 I.29-33) is to prevent degradation of inks or dyes used in the prior art, which degrade due to the alkaline environment during the processes of manufacturing fibre-cement products.

Document D2 addresses this particular problem. However, the problem is solved by providing an improved coloured coating to a fibre cement product. D2 discloses a process to produce coated fibre cement products, the first step providing a cured fibre cement product wherein the fibre cement product is prepared by a fibre cement slurry comprising at least cement, water and fibers such as cellulose fibres, waste-paper fibres or polypropylene fibres (see D2 p.8). Further step of the process providing a second layer of a second radiation curable composition to the partially cured first layer, the second radiation curable composition comprising pigments (see D2 p.8 and claim 1).

Document D3 discloses compositions (no fibre-cement) comprising white cement, CaCO_3 and "fortifying fibres" (synthetic fibers) (see machine translated document D3 and WPI abstract).

Even though, the several aspects of the invention are disclosed in the different documents D1 (fibre-cement product), D2 (ink/dye degradation problem), D3 (white cement with synthetic fibres), the person skilled in the art has no suggestion from any of D1-D3 that would allow an obvious combination of this prior art in order to produce a pale-coloured fibre cement product comprising white cement and pigmented synthetic fibres as in the present application.

Therefore product claim 1, method claim 13 and use claim 15 are considered new and inventive.

- 1.3 Dependent **claims 2-12 and 14** are also considered new and inventive.

Re Item VII

Certain defects in the international application

- 2 The applicant is requested to delete the sentence of the description on **page 15** referring to the wording "spirit of the invention", since said wording is vague and unclear.

Re Item VIII

Certain observations on the international application

- 1 The term "about" used in **claims 3,4,8,9,11** is vague and unclear and leaves the reader in doubt as to the meaning of the technical features to which it refers, thereby rendering the definition of the subject-matter of said claims unclear.

TRATADO DE COOPERACIÓN DE PATENTES

De la AUTORIDAD DE BÚSQUEDA INTERNACIONAL

Para: Vaeck, Elke ETEX SERVICES NV Kuiermansstraat 1 1880 Kapelle-op-den.Bos BÉLGICA Sello: RECIBIDO 27 – 06 – 2018	PCT NOTIFICACIÓN DE TRANSMISIÓN DEL INFORME DE BÚSQUEDA INTERNACIONAL Y LA OPINIÓN ESCRITA DE LA AUTORIDAD DE BÚSQUEDA INTERNACIONAL, O LA DECLARACIÓN (Regla PCT 44.1)
	Fecha de Envío (día / mes / año) 27 de junio de 2018 (27 – 06 – 2018)
Referencia de archivo del solicitante o agente: FC170WO	PARA ACCIÓN ADICIONAL: Ver párrafos 1 y 4 más abajo
Solicitud Internacional No. PCT / EP2018 / 057774	Fecha de Radicación Internacional (día / mes / año) 27 de marzo de 2018 (27 – 03 – 2018)
Solicitante ETEX SERVICES N. V.	
1. ☒ El solicitante queda notificado de que el informe de búsqueda internacional y la opinión escrita de la Autoridad de Búsqueda Internacional han sido establecidos y se transmiten con el presente. Radicación de Modificaciones y declaración bajo el Artículo 19: El solicitante tiene derecho, si así lo desea, de modificar las reivindicaciones de la Solicitud Internacional (ver Regla 46) ¿Cuándo? El límite de tiempo para radicar tal modificación normalmente es de dos meses desde la fecha de transmisión del informe de búsqueda internacional. ¿Cómo? Directamente a la Oficina Internacional de la OMPI en el 34 Chemin des Colombettes 1211 Ginebra 20, Suiza Fax No.: (41 – 22) 338. 82. 70 Para instrucciones más detalladas , véase la <i>Guía del Solicitante de PCT</i>, Fase Internacional, párrafo 9.004 – 9.011 2. ☐ Por el presente se le notifica al solicitante que el informe de búsqueda internacional será establecido y que la declaración bajo el establecido y que la declaración bajo el Artículo 17 (2) (a) par ese efecto y la opinión escrita de la Autoridad de Búsqueda Internacional se transmiten con el presente. 3. ☐ Respecto de cualquier protesta contra el pago de un (os) honorario (s) internacional (es) bajo la Regla 40.2, se le notifica al solicitante. ☐ El protesto junto con la decisión sobre el mismo han sido transmitidos a la Oficina Internacional, junto con cualquier solicitud del solicitante para mandar los textos tanto del protesto como la decisión del mismo a las Oficinas designadas. ☐ No se ha tomado ninguna decisión sobre el protesto; el solicitante será notificado tan pronto como se tome una decisión. 4. ☐ Recordatorios El solicitante podrá presentar comentarios sobre una base internacional sobre la opinión escrita de la Autoridad de Búsqueda Internacional a la Oficina Internacional. Estos comentarios se pondrán a disposición del público después de la publicación internacional. La oficina internacional enviará una copia de esos comentarios a todas las Oficinas designadas a no ser que un informe preliminar de examen haya sido o vaya a ser establecido. Poco después del vencimiento de los 18 meses desde la fecha de prioridad, la solicitud internacional será publicada por la Oficina Internacional. Si el solicitante desea evitar o posponer la publicación, un aviso de retiro de la solicitud internacional o de la reivindicación de prioridad debe llegar a la Oficina Internacional antes de la culminación de las preparaciones mecánicas para publicación internacional (Reglas 90 bis 1 y 90 bis 3). Dentro de los 19 meses siguientes a la fecha de la prioridad, pero sólo respecto de algunas oficinas designadas, se puede radicar una solicitud de examinación preliminar si el solicitante desea pospones la entrada a la fase nacional hasta por 30 meses desde la fecha de prioridad (en algunas Oficinas aún más tarde); de lo contrario, el solicitante debe, en un plazo de 20 meses desde la fecha de prioridad, realizar los actos prescritos para entrar a la fase nacional ante esas oficinas designadas. Respecto de otras oficinas designadas, el tiempo límite de 19 meses (o más) será aplicable aún si no se radica tal	

exigencia dentro de los 19 meses. Para detalles acerca de los límites de tiempo aplicables, Oficina por Oficina, ver www.wipo.int/pct/en/texts/time_limits.html y <i>Guía del Solicitante de PCT</i>, capítulos nacionales. Dentro de los 22 meses siguientes a la fecha de la prioridad, el solicitante podrá pedir que se realice una búsqueda internacional complementaria por una Autoridad de Búsqueda Internacional distinta que ofrezca ese servicio /(Regla 45 bis 1). El procedimiento para solicitar búsqueda complementaria internacional se describe en la <i>Guía del Solicitante de PCT</i>, Fase Internacional, parágrafos 8.006.-8.032.	
Nombre y dirección de la Autoridad de Búsqueda Internacional Oficina Europea de Patentes, P. B. 5818 Patentiaan 2 NL 2280 HV Rijswijk Tel: (+ 31 – 70) 340 – 2040 Fax: (+ 31 – 70) 340 – 3016	Funcionario Autorizado MAZZARIOL, Francesca Tel. + 49 (0) 89 2399 - 7911

TRATADO DE COOPERACIÓN DE PATENTES

PCT

INFORME DE BÚSQUEDA INTERNACIONAL

(PCT Artículo 18 y Reglas 43 y 44)

Referencia de Archivo de Solicitante o Agente: FC170WO	PARA ACCIÓN ADICIONAL:	Ver forma PCT / ISA / 220 así como, donde sea aplicable , el punto 5 más abajo
Solicitud Internacional No. PCT / EP2018 / 057774	Fecha de Radicación Internacional (día / mes / año) 27 de marzo de 2018 (27 – 03 – 2018)	Fecha de Prioridad (más temprana) (día / mes / año) 28 de marzo de 2017 (28 – 03 – 2017)
Solicitante ETEX SERVICES N. V.		
Este informe de búsqueda internacional ha sido preparado por esta Autoridad de Búsqueda Internacional y se transmite al solicitante de acuerdo con el Artículo 18. Una copia está siendo transmitida a la Oficina Internacional. Este informe de búsqueda internacional consta de un total de <u>3</u> hojas. ☒ También va acompañado de una copia de cada documento de arte previo citado en este informe.		
1. Base del Informe a. Respecto del idioma, la búsqueda internacional fue realizada sobre la base de: ☒ La solicitud internacional en el idioma en el cual fue radicado ☐ Una traducción de la solicitud internacional al _____, que es el idioma de la traducción entregada para los fines de búsqueda internacional (Reglas 12.3 (a) y 23.1 (b)). b. ☐ El informe de búsqueda internacional ha sido establecido tomando en cuenta la rectificación de un error obvio autorizado o notificado a esta Autoridad bajo la Regla 91 (Regla 43.6 bis (a)). c. ☐ Respecto de cualquier secuencia nucleótida y / o amino ácida revelada en la solicitud internacional, ver casilla No. I. 2. ☐ Se encontró que ciertas reivindicaciones eran imbuscables (Ver Casilla No. II). 3. ☐ La unidad de una invención no está presente (Ver Casilla No. III). 4. Respecto del Título, ☒ El texto se aprueba tal como fue enviado por el solicitante ☐ Esta Autoridad ha establecido que el texto debe decir lo siguiente: 5. Respecto del Extracto, ☒ El texto se aprueba tal como fue enviado por el solicitante ☐ Esta autoridad ha establecido el texto como aparece en la Casilla No. IV, de acuerdo con la regla 38.2. El solicitante puede, dentro del mes siguiente a la fecha de envío por correo de este informe de búsqueda internacional, hacer comentarios a esta Autoridad 6. Respecto de los Planos a. La figura de los planos a ser publicada con el extracto es la Figura No. _____. ☐ Como lo ha sugerido el solicitante ☐ Como lo ha seleccionado esta Autoridad, puesto que el solicitante no sugirió una figura ☐ Como lo ha seleccionado esta Autoridad, puesto que esta figura caracteriza mejor la invención. b. ☒ Ninguna de las figuras será publicada con el extracto.		

INFORME DE BÚSQUEDA INTERNACIONAL

Solicitud Internacional No.
PCT / EP2018 / 057774

A. CLASIFICACIÓN DE LA MATERIA

INV C04B28 / 04 C04B16 / 06
ADD.

De acuerdo con la Clasificación Internacional de Patentes (IPC) o tanto a la clasificación nacional como a la IPC

B. CAMPOS BUSCADOS

Documentación mínima buscada distinta de la documentación mínima en la medida en que tales documentos estén incluidos en el campo buscado.

Base de datos electrónica consultada durante la búsqueda internacional (nombre de la base de datos y, donde sea posible, términos de búsqueda usados)

EPO - Internal, WPI Data

C. DOCUMENTOS QUE SE CONSIDERAN RELEVANTES

Categoría *	Cita del documento con indicación, donde sea apropiado, del pasaje relevante	Relevante para la Reivindicación No.
A	EP 2 172 434V A1 (REDCO SA [BE]) 7 abril 2010 (010 – 04 – 07) parágrafos [0004], [0006], [0010] [0017], [0019], - parágrafos [0021], [0026]; Tablas 1 – 3.	1 – 15
A	WO 2016 / 202680 A1 (ETERNIT AG [DE]) 22 diciembre 2016 (2016 – 12 – 22) páginas 1, 8, renglones 11 – 14, 22 – 29, reivindicación 1 ejemplo 1	1 – 15
A	CN 101 955 343 A (WENGUANG CHEN) 26 enero 2011 (2011 – 01 – 26) Extracto WPI y Documento traducido máquina	1 – 15

☐ Documentos adicionales se relacionan en la continuación de la Casilla C

☒ Ver familia de patente anexa

* Categorías especiales de los documentos citados:

“A” Documento que define el estado general del arte que no se considera ser de particular relevancia;

“E” Solicitud previa de patente pero publicada en o después de la fecha de radicación internacional;

“L” Documento que puede generar dudas sobre la (s) reivindicación (es) de prioridad o que es citad para establecer la fecha de publicación de otra cita u otra razón especial (según se especifique);

“O” Documento que se refiere a revelación oral, exhibición u otros medios;

“P” documento publicado antes de la fecha de radicación internacional pero posterior a la fecha de prioridad reivindicada

“I” Documento posterior publicado después de la fecha de radicación internacional o fecha de prioridad y que no está en conflicto con la solicitud pero que se cita para entender el principio o teoría subyacente a la invención;

“X” documento de relevancia especial; la invención reivindicada no podría considerarse novedosa o no podría considerarse que involucra un paso inventivo cuando el documento se toma por sí solo;

“Y” documento de relevancia especial; la invención reivindicada no podría considerarse que involucra un paso inventivo cuando el documento se combina con uno o más otros documentos, tal combinación siendo obvia para una persona experta en el arte;

“&” documento miembro de la misma familia de patentes.

Fecha de la terminación de la búsqueda internacional 13 Junio 2008	Fecha de envío por correo del informe de búsqueda internacional 27 / 06 / 2018
Nombre y dirección de correspondencia de la Isa / Oficina Europea de Patentes, P. B. 5818 Patentiaan 2 NL 2280 HV Rijswik Tel: (+ 31 – 70) 340 – 2040 Fax: (+ 31 – 70) 340 – 3016	Funcionario Autorizado Philippart, Anahí

INFORME DE BÚSQUEDA INTERNACIONAL
 Información sobre miembros de la familia de patente

Solicitud Internacional No.
 PCT / EP2018 / 057774

Documento de patente citado en el informe de búsqueda		Fecha de Publicación	Miembro (s) de la familia de patente			Fecha de Publicación
EP 2172434	A1	07 - 04 - 2010	BR	PI090780	A2	22 - 12 - 2015
			CO	63551769	A2	20 - 12 - 2011
			DK	2172434	T3	01 - 06 - 2015
			EP	2172434	A1	07 - 04 - 2010
			ES	2537053	T3	02 - 06 - 2015
			JP	5770091	B2	26 - 08 - 2015
			JP	2012504540	A	23 - 02 - 2012
			PE	00722012	A1	17 - 07 - 2015
			PT	2172434	E	08 - 04 - 2010
			WO	2010037628	A1	21 - 12 - 2016
WO 2016202680	A1	22 - 12 - 2016	EP	3106448	A1	18 - 04 - 2018
			EP	3307696	A1	22 - 12 - 2016
			WO	2016202680	A1	
CN 101955343	A	26 - 01 - 2011	NINGUNO			

INFORMACIÓN SOBRE ESTRATEGIA DE BÚSQUEDA: Fase Piloto (ver OJ 2015, A 86) .
El tipo de información contenida en esta hoja puede cambiar durante el piloto para mejorar la utilidad de este nuevo servicio

Solicitud Internacional No.
PCT / EP2018 / 057774

TÍTULO: PRODUCTOS DE FIBRA CEMENTO DE COLOR PÁLIDO Y MÉTODOS PARA LA PRODUCCIÓN DE LOS MISMOS

SOLICITANTE: ETEX SERVICES NV

CLASIFICACIÓN IPC: C04B28 / 04, C04B16 / 06

EXAMINADORA: Philippart, Anahí

BASES DE DATOS CONSULTADAS: WPI, EPODOC

SÍMBOLOS DE CLASIFICACIÓN QUE DEFINEN LA EXTENSIÓN DE LA BÚSQUEDA:

IPC :

CPC: 1 –

C04B28 / 04, C04B14 / 28, C04B14 / 305, C04B16 / 0633, C04B16 / 0641, C04B18 / 24 ,C04B18 / 24, C04B40 / 0064, C04B41 / 483, 2 – C04B16 / 0633, C04B20 / 1059, C04B28 / , 04, C04B16 / 0633, C04B2111 / 802

TÉRMINOS FI / F:

PALABRAS CLAVE U OTROS ELEMENTOS QUE PRESENTAN LA INVENCION:

- Fibra cemento
- Fibra pigmentada
- Cemento blanco

- PN - CN101955343 A 20110126
- TI - Masilla niveladora ahorradora de energía en polvo
- AB - La invención se refiere a Masilla niveladora ahorradora de energía en polvo, que se caracteriza por ser preparada de las siguientes materias primas en porcentaje por peso: 20 a 30 por ciento de cemento blanco; 5 a 10 por ciento de polvo gris de calcio; 40 a 60 por ciento de carbonato pesado de calcio en polvo; 5 a 15 por ciento de arena fina de medida de 50 a 100 malla; 0,1 a 1 por ciento de fibra de refuerzo; 0,1 a 1,5 por ciento de alcohol polivinilo; 0,1 a 1,8 por ciento de celulosa y 1 a 3 por ciento de polímero en polvo, donde la arena fina es partículas de polifenilo, micro burbujas vitrificadas o perlita expandida; la fibra de refuerzo es fibra de polipropileno de 2 mm, y la celulosa es celulosa carboximetilo. La Masilla niveladora ahorradora de energía en polvo tiene las características de alta resistencia, alta resistencia al agua, no toxicidad ni olor, resistencia al amarillamiento y similares; aún más, al añadir la arena fina con preservación de calor y función de aislamiento térmico, la masilla en polvo tiene las características obvias de peso liviano, preservación del calor, alto aislamiento térmico, resistencia a la abrasión, resistencia a la corrosión, alto desempeño de aislamiento eléctrico, protección contra radiación y similares, al tiempo que se garantiza el desempeño básico.
- CCI - C04B28 / 02
- CLC - C04B28 / 02, C05B14 / 02, C04B14 / 24, C04B14 / 28, C04B16 / 08, C04B20 / 0048, C04B20 / 0076, C04B20 / 008, C04B24 / 24, C04B24 / 2623, C04B24 / 383, INV
- C04B28 / 02, C04B14 / 02, C04B14 / 185, C04B14 / 28, C04B16 / 0633, C04B16 / 08, C04B20 / 0076, C04B24 / 24, C04B24,23, C04B24 / 383, INV
- CCA - C04B2103 / 61; C04B2111 / 00025; C04B2111 / 00258; C04B2111 / 00063; C04B2111 / 2038; C04B2111 / 27; C04B2111 / 28; C04B2111 / 40; C04B2111 / 802
- PA - WENGUANG CHEN
- IN - WENGUANG CHEN
- CT - I I STSE (A)
- CN1537898 A 20041020 [] (WANF GUANGWEI [CN], ET AL);
- CN1908081 A 20079297 [] (DONG LIHUA WU [CN]);
- CN1657574 A 20050824 [] (ZHANG RENATO [CN]);
- CN1557884 A 20041229 [] (ZHOU SHIBIN [CN]);
- CN101709170 A 20100519 [] (MINQING CHEN, ET AL)
-
- AP - CN20101268975 20100831
- PR - CN20101268975 20100831
- DT - I

- AN - 2011- D00943
- TI - La masilla niveladora en polvo comprende una cantidad especificada de cemento blanco, polvo gris de calcio, carbonato pesado de calcio en polvo, arena fina, fibra de refuerzo, alcohol polivinilo, celulosa y polímero en polvo.

- AB - NOVEDAD :
Una masilla niveladora en polvo comprende (en % de peso) cemento blanco (20 – 30), polvo gris de calcio (5 – 10), carbonato pesado de calcio en polvo (40 – 60), arena fina (5 – 15), fibra de refuerzo (0,1 – 1), alcohol polivinilo (0,1 – 1,5), celulosa (0,1 – 1,8) y polímero en polvo (1 – 3). La arena fina es partículas de polifenilo, micro burbujas vitrificadas o perlita expandida. La fibra de refuerzo es fibra de polipropileno. La celulosa es celulosa carboximetilo. La fibra de polipropileno tiene una longitud de 2 mm. El tamaño de gran de la arena liviana es de 50 – 100 malla.
- USO :
masilla niveladora en polvo
- VENTAJA :
La masilla niveladora en polvo tiene una excelente propiedad de aislamiento eléctrico, alta resistencia, alta resistencia al agua, resistencia al amarillamiento, estabilidad de calor, propiedad de aislamiento de calor, resistencia a la abrasión, resistencia a la corrosión y es no tóxica y no tiene olor, y su peso liviano contribuye al ahorro de energía
- CERÁMICA Y VIDRIO :
Composición preferida: la masilla niveladora en polvo consta de cemento blanco tipo #425 (28 o 29), polvo gris de calcio (7 u 8), carbonato pesado de calcio en polvo (44, 51 o 55), arena fina 5 o 9 o 10), fibra de refuerzo (0,1 – 1), alcohol polivinilo (0,9), celulosa (1,1 o 0,8 o 1,3) y polímero en polvo (1,9 o 2.3 o 2.5). La masilla niveladora en polvo además contiene celulosa carboximetilo (0,5 o 0,6 o 0,7). Propiedad preferida: la arena fina tiene un tamaño de grano de 80 malla.
- IW - LA MASILLA EN POLVO COMPRENDE CANTIDAD ESPECÍFICA CEMENTO BLANCO POLVO GRIS DE CALCIO CARBONATO PESADO DE CALCIO EN POLVO ARENA FINA FIBRA DE REFUERZO ALCOHOL POLIVINILO CELULOSA POLÍMERO
- PN - CN101955343 A 20110126 DW 201130
- ICAI - C04B28 / 04
- MC - A03 – A04A A04 – G03E A10 – E09B A12 R01A L02 – C02 L02 – C08 L02 – D14S
- DC - A97 L02
- PA - (CHEN – I) CHEN W
- IN - CHEN W
- AP - CN20101268975 20100831
- PR - CN20101268975 20100831

(Nota del traductor: este texto es prácticamente incomprensible en el original en inglés. El traductor al español ha hecho su mejor esfuerzo pero salva su responsabilidad por la razón mencionada).

CN101955343 A 20110126

La presente invención se refiere a una especie de masilla en polvo niveladora de conservación de energía, se caracteriza porque al seguir las materias primas según formulado por porcentaje en peso, donde: cemento blanco 20% -30%, polvo de calcio de materia gris 5% -10%, carbonato de calcio pesado 40% -60%, 50-100 arena ligera 5% -15%, fibra fortificante 0,1% -1%, alcohol polivinílico 0,1-1,5%, celulosa microcristalina 0,1% -1,8%, polvo de polímero 1% -3 %; Donde la arena liviana es poliestireno granular, perlas de vidrio, tal vez piedra perla, seleccione un material, la fibra fortalecedora es la fibra de polipropileno de 2 mm, la celulosa microcristalina es una carboximetilcelulosa. La presente invención es excepto que al tener características tales como alta resistencia, tolerante al agua, no venenoso e insípido, anti-xantocromía, debido a la adición de arena ligera con función de incubación y aislamiento térmico, hacen la masilla en polvo de la presente invención al garantizar propiedad fundamental, también tener peso ligero, aislamiento, buen aislamiento térmico, resistente al desgaste, resistente a la corrosión, características distintivas como la capacidad de aislamiento eléctrico es buena, radioprotectora.

Una especie de masilla en polvo niveladora que conserva la energía

Campo técnico:

La invención pertenece al campo de los materiales de construcción, una especie de masilla niveladora en polvo de conservación de energía de fondo de pared exterior en particular un tipo de uso.

Tecnología en la que se basa:

El negocio de la construcción es diferente para el material de la base de la pared exterior interior en la actualidad, la tradición tiene el uso de yeso, talco, masilla de cal, cemento blanco para infiltrar el pegamento 107, mezclar en construcciones de pasta y raspaduras al final, junto con el atención de las personas a la protección del medio ambiente, especialmente el aspecto del fondo de la pared interior, se han abandonado 107 pegamentos, la mayoría de los que emplean masilla en polvo transferencia de agua en el fondo. El polvo de masilla está formado principalmente por procesos de materiales como piedra caliza molida al agua, cementos blancos y la dureza fue moderada después de que el fondo se solidificó y fue conveniente lijar en forma plana. El indicador principal del polvo de masilla existente es que no se agrieta, no se incrusta, no se desprende y tiene cierta rigidez y tolerancia al agua. Junto con el progreso social. Las personas también mejoran gradualmente al requisito funcional de masilla en polvo, excepto el requisito general, también deben considerar la demanda de conservación de energía y protección del medio ambiente.

La masilla en polvo a la fecha se basa mucho en material de coagulación inorgánica; el relleno se ayuda con escala grande, tal como polvo de sílice, polvo de talco, calcita en polvo, etc., con el contenido de sólidos que aumenta la trabajabilidad de la masilla, pero estos filtros han aumentado en gran medida la proporción de la masilla en polvo para el empaque y el transporte y el proceso de construcción de masilla aumentado gran inconveniente (sic), y el costo de producción y el costo de construcción han aumentado.

Como el desarrollar una clase de protección ambiental, conservación de energía, facilidad de construcción y la masilla en polvo que puede satisfacer la función específica la demanda otra

vez se ha vuelto la tendencia del desarrollo de masilla de ahora en adelante, y en el presente, la Masilla niveladora ahorradora de energía en polvo que posee la característica de aislamiento de calor leve en el hogar simultáneamente pero no hay reportes relevantes.

Resumen de la invención:

El objeto de esta invención es el dar la modelación de una masilla de nivelación en polvo de un tipo de agua, contiene fibra, tiene conservación de energía de características de peso liviano e incubación y función de aislamiento térmico.

La solución térmica de la presente invención se logra en cuanto que una clase de Masilla niveladora ahorradora de energía en polvo, se caracteriza por ser formulada con las siguientes materias primas en porcentaje de peso: 20 a 30 por ciento de cemento blanco; 5 a 10 por ciento de polvo gris de calcio; 40 a 60 por ciento de carbonato pesado de calcio; 5 a 15 por ciento de arena fina de medida de 50 a 100 malla; 0,1 a 1 por ciento de fibra de refuerzo; 0,1 a 1,5 por ciento de alcohol polivinilo; 0,1 a 1,8 por ciento de celulosa y 1 a 3 por ciento de polímero en polvo, donde la arena fina es partículas de polifenilo, micro burbujas vitrificadas o perlita expandida; la fibra de refuerzo es fibra de polipropileno de 2 mm, la celulosa Microcristalina es celulosa carboximetilo.

Comparado con el arte anterior, la invención se llena una fórmula en el material de arranque seleccionado, la arena liviana con efecto de aislamiento de calor y de preservación de calor y la fibra fortificante de anti – ser lleno de grietas han sido añadidas, comparado con la masilla en polvo tradicional para muros, la masilla en polvo que usa esta fórmula para producir tiene desempeños funcionales tales como aislamiento, aislamiento de calor, absorción de sonido, y también tiene ventajas tales como protección ambiental, fuerte adhesión, fácil de pulir, libre de grietas, ayuno agua, material espeso simultáneamente. Y como la proporción de arena liviana es sólo el 1/5 - 1/8 de masillas comunes, adopta esta masilla liviana para aliviar el peso de la masilla en polvo de forma importante, pues su empaque y transporte y proceso de producción han aumentado grandemente la facilidad y reducen de forma importante los costos de producción, cumplen con la tendencia de desarrollo de hoy día de ahorro de energía y reducción de emisiones

Realizaciones:

Realización Uno:

El producir 100 partes de Masilla niveladora ahorradora de energía en polvo por ejemplo, la materia prima que preferiblemente procesa divide parte compartida por peso para ser respectivamente Cemento blanco # 425 28%, polvo gris de calcio 7%, carbonato pesado de calcio 51%, 80 poli estirenos de orden granular 9%, fibra de polipropileno de 2 mm 0,5%, alcohol polivinilo 0,9%, celulosa carboximetilo 1,1%, polvo polímero 2,5%.

En un recipiente, ponga Cemento blanco, polvo gris de calcio, carbonato pesado de calcio, y el poliestireno granular de sólo la mitad de la cantidad previa, revuelva por 10 minutos; luego añada la fibra de polipropileno, el alcohol polivinilo, celulosa carboximetilo y polvo polímero revuelva por 10 minutos; añada el resto de Cemento blanco, polvo gris de calcio, carbonato pesado de calcio, y el poliestireno granular nuevamente, siga revolviendo por 30 minutos, empaque y selle después de pesar la lata por estándar de empaque. De acuerdo con la modulación híbrida de tal índice de masilla en polvo, añada agua para obtener pasta, que puede usarse para sellado de metopa.

Preparar una Masilla niveladora ahorradora de energía en polvo de la presente invención de acuerdo con el método de preparación descrito, su índice de desempeño es como sigue:

[imagen]

[imagen]

Realización dos:

Con la idéntica tecnología del último ejemplo, y por el rango proporcional de las siguientes materias primas preferidas se mezcla revolviendo donde Cemento blanco # 425 28%, polvo gris de calcio 8%, carbonato pesado de calcio 55%, 70 bolas de vidrio orden 5%%, fibra de polipropileno de 2 mm 0,6%, alcohol polivinilo 0,7%, celulosa carboximetilo 0,8%, polvo polímero 1,9%.

Preparar una Masilla niveladora ahorradora de energía en polvo de la presente invención de acuerdo con el método de preparación descrito, su índice de desempeño es como sigue:

[imagen]

[imagen]

Realización tres:

Con la idéntica tecnología del último ejemplo, y por el rango proporcional de las siguientes materias primas preferidas se mezcla revolviendo donde Cemento blanco # 425 29%, polvo gris de calcio 7%, carbonato pesado de calcio 44%, 100 perlas de piedra orden 15%%, fibra de polipropileno de 2 mm 0,7%, alcohol polivinilo 0,7%, celulosa carboximetilo 1,3%, polvo polímero 2,3%.

Preparar una Masilla niveladora ahorradora de energía en polvo de la presente invención de acuerdo con el método de preparación descrito, su índice de desempeño es como sigue:

[imagen]

Probar la muestra de masilla de la presente invención encontrar que la masilla en polvo de la presente invención tiene una función muy sobresaliente de aislamiento de calor y preservación de calor, la conductividad térmica es baja y el desempeño de pulido es bueno, y la excelencia del poder de adherencia es impermeable. Y la densidad seca es menor, alivia en gran medida la carga de transporte y construcción, siendo así un producto ahorrador de energía.

[Reivindicaciones]

1. Masilla niveladora ahorradora de energía en polvo, se caracteriza por ser formulada con las siguientes materias primas en porcentaje de peso: 20 a 30 por ciento de cemento blanco; 5 a 10 por ciento de polvo gris de calcio; 40 a 60 por ciento de carbonato pesado de calcio; 5 a 15 por ciento de arena fina de medida de 50 a 100 malla; 0,1 a 1 por ciento de fibra de refuerzo; 0,1 a 1,5 por ciento de alcohol polivinilo; 0,1 a 1,8 por ciento de celulosa y 1 a 3 por ciento de polímero en polvo, donde la arena fina es partículas de polifenilo, micro burbujas vitrificadas o perlita expandida; la fibra de refuerzo es fibra de polipropileno de 2 mm, la celulosa Mierocristalina es celulosa carboximetilo.

2. Masilla niveladora ahorradora de energía en polvo de acuerdo con la reivindicación 1, que se caracteriza por ser formulada con las siguientes materias primas en porcentaje de peso: Cemento blanco # 425 28%, polvo gris de calcio 7%, carbonato pesado de calcio 51%, 80 poli estirenos de orden granular 9%, fibra de polipropileno de 2 mm 0,5%, alcohol polivinilo 0,9%, celulosa carboximetilo 1,1%, polvo polímero 2,5%.

3. Masilla niveladora ahorradora de energía en polvo de acuerdo con la reivindicación 1, que se caracteriza por ser formulada con las siguientes materias primas en porcentaje de

peso: Cemento blanco # 425 28%, polvo gris de calcio 8%, carbonato pesado de calcio 55%, 70 bolas de vidrio orden 5%%, fibra de polipropileno de 2 mm 0,6%, alcohol polivinilo 0,7%, celulosa carboximetilo 0,8%, polvo polímero 1,9%.

4. Masilla niveladora ahorradora de energía en polvo de acuerdo con la reivindicación 1, que se caracteriza por ser formulada con las siguientes materias primas en porcentaje de peso: Cemento blanco # 425 29%, polvo gris de calcio 7%, carbonato pesado de calcio 44%, 100 perlas de piedra orden 15%%, fibra de polipropileno de 2 mm 0,7%, alcohol polivinilo 0,7%, celulosa carboximetilo 1,3%, polvo polímero 2,3%.

13 : 06 : 2018 14 : 10 : 03

TRATADO DE COOPERACIÓN DE PATENTES

De la AUTORIDAD DE BÚSQUEDA INTERNACIONAL

Para: Ver Formulario PCT / ISA / 220		PCT OPINIÓN ESCRITA DE LA AUTORIDAD DE BÚSQUEDA INTERNACIONAL (Regla PCT 44 bis. 1)																	
Referencia de archivo del solicitante o agente: Ver Formulario PCT / ISA / 220		Fecha de Envío (día / mes / año) Ver Formulario PCT / ISA / 220 (hoja dos)																	
Solicitud Internacional No. PCT / EP2018 / 057774		Fecha de Radicación Internacional (día / mes / año) 27 – 03 – 2018	Fecha de Prioridad) (día / mes / año) 28 – 03 – 2017																
Clasificación Internacional de Patentes (IPC) tanto de la clasificación nacional como de IPC INV. C04B28 / 04 C04B16 / 06																			
Solicitante ETEX SERVICES N. V.																			
1. Esta opinión contiene indicaciones relativas a los siguientes ítems: <table style="width: 100%; border: none;"> <tr> <td style="width: 10%;">☒ Casilla No. I</td> <td>Base de la Opinión</td> </tr> <tr> <td>☐ Casilla No. II</td> <td>Prioridad</td> </tr> <tr> <td>☐ Casilla No. III</td> <td>No establecimiento de opinión respecto de novedad, paso inventivo y aplicabilidad industrial</td> </tr> <tr> <td>☐ Casilla No. IV</td> <td>Falta de unidad de invención</td> </tr> <tr> <td>☒ Casilla No. V</td> <td>Declaración razonada bajo la Regla 43 bis. 1 (a) (i) respecto de novedad, paso inventivo y aplicabilidad industrial; citas y explicaciones que soportan tal declaración</td> </tr> <tr> <td>☐ Casilla No. VI</td> <td>Ciertos documentos citados</td> </tr> <tr> <td>☒ Casilla No. VII</td> <td>Ciertos defectos en la solicitud internacional</td> </tr> <tr> <td>☒ Casilla No. VIII</td> <td>Ciertas observaciones en la solicitud internacional</td> </tr> </table> 2. ACCIONES ADICIONALES Si se hace una solicitud de examen preliminar internacional, esta opinión por lo general será considerada como una opinión escrita de la Autoridad Internacional de Exámenes Preliminares ("IPEA") excepto que no aplica cuando el solicitante escoja una Autoridad distinta a esta para que sea la IPEA y la IPEA escogida ha notificado a la Oficina Internacional bajo la Regla 66.1 bis (b) que la opinión escrita de esta Autoridad de Búsqueda Internacional no será considerada como tal. Si esta opinión, como se establece más arriba, es considerada como una opinión escrita de la IPEA, se invita al solicitante a entregar a la IPEA una respuesta escrita junto, cuando sea apropiado, con modificaciones antes de la expiración de 22 meses desde la fecha de prioridad, la que expire después. Para más opciones, ver el Formulario PCT / ISA / 220.				☒ Casilla No. I	Base de la Opinión	☐ Casilla No. II	Prioridad	☐ Casilla No. III	No establecimiento de opinión respecto de novedad, paso inventivo y aplicabilidad industrial	☐ Casilla No. IV	Falta de unidad de invención	☒ Casilla No. V	Declaración razonada bajo la Regla 43 bis. 1 (a) (i) respecto de novedad, paso inventivo y aplicabilidad industrial; citas y explicaciones que soportan tal declaración	☐ Casilla No. VI	Ciertos documentos citados	☒ Casilla No. VII	Ciertos defectos en la solicitud internacional	☒ Casilla No. VIII	Ciertas observaciones en la solicitud internacional
☒ Casilla No. I	Base de la Opinión																		
☐ Casilla No. II	Prioridad																		
☐ Casilla No. III	No establecimiento de opinión respecto de novedad, paso inventivo y aplicabilidad industrial																		
☐ Casilla No. IV	Falta de unidad de invención																		
☒ Casilla No. V	Declaración razonada bajo la Regla 43 bis. 1 (a) (i) respecto de novedad, paso inventivo y aplicabilidad industrial; citas y explicaciones que soportan tal declaración																		
☐ Casilla No. VI	Ciertos documentos citados																		
☒ Casilla No. VII	Ciertos defectos en la solicitud internacional																		
☒ Casilla No. VIII	Ciertas observaciones en la solicitud internacional																		
Nombre y Dirección de Correspondencia de la ISA Oficina Europea de Patentes D – 80298 Munich Tel. + 49 89 2399 – 0 Fax: . + 49 89 2399 – 4465		Fecha de diligenciamiento de esta opinión Ver el Formulario PCT / ISA / 220																	
		Funcionario Autorizado: Philippart, Anahi Tel. + 49 89 2399 – 0																	

Casilla No. I – Base de la Opinión

1. Respecto del idioma, la presente opinión fue realizada sobre la base de:

☒ La solicitud internacional en el idioma en el cual fue radicado

☐ Una traducción de la solicitud internacional al _____, que es el idioma de la traducción entregada para los fines de búsqueda internacional (Reglas 12.3 (a) y 23.1 (b))

2. ☐ La presente opinión ha sido establecida tomando en cuenta la rectificación de un error obvio autorizado o notificado a esta Autoridad bajo la Regla 91 (Regla 43.6 bis (a)).

3. ☐ Respecto de cualquier secuencia nucleótida y / o amino ácida revelada en la solicitud internacional, esta opinión ha sido establecida sobre la base de una secuencia que relaciona:

a. ☐ que forma parte de la solicitud internacional como fue radicada:

☐ en la forma de un Anexo C / ST.25 archivo de texto

☐ en papel en la forma de un archivo de imagen

b. ☐ Entregada junto con la solicitud internacional bajo la regla PCT 13 ter . 1 (a) para los fines de búsqueda internacional exclusivamente e la forma de un Anexo C / ST.25 archivo de texto.

c. ☐ Entregada después de la fecha de radicación internacional para los fines de búsqueda internacional exclusivamente

☐ en la forma de un Anexo C / ST.25 archivo de texto(regla PCT 13 ter . 1 (a))

☐ en papel en la forma de un archivo de imagen (regla PCT 13 ter . 1 (b) e instrucciones administrativas, Sección 713)

4. ☐ Así mismo, en caso de que se haya radicado o entregado más de una versión o copia de una lista de secuencia, las declaraciones requeridas de que la información en las copias subsiguientes o adicionales es idéntica a aquella que forma parte de la solicitud radicada o no va más allá de la solicitud como fue radicada, según sea apropiado, fueron entregadas.

5. Comentarios Adicionales

Casilla No. V – Declaración razonada bajo la Regla 43 bis. 1 (a) (i) respecto de novedad, paso inventivo y aplicabilidad industrial; citas y explicaciones que soportan tal declaración

1. Declaración:

Novedad (N)	Sí	Reivindicaciones	<u>1 – 15</u>
	No	Reivindicaciones	
Paso Inventivo (IS)	Sí	Reivindicaciones	<u>1 – 15</u>
	No	Reivindicaciones	
Aplicabilidad Industrial:	Sí	Reivindicaciones	<u>1 – 15</u>
	No	Reivindicaciones	

2. Citas y explicaciones

Ver hoja separada

Casilla No. VII – Ciertos defectos en la solicitud internacional

Se han notado los siguientes defectos en la forma o en el contenido de la solicitud internacional:

Ver hoja separada

Casilla No. VIII – Ciertas observaciones en la solicitud internacional

Se hacen las siguientes observaciones sobre la claridad de las reivindicaciones, descripción y planos o sobre la cuestión de que las reivindicaciones están plenamente soportadas por la descripción.

Ver hoja separada

Re. Punto V

Declaración razonada bajo la Regla 43 bis. 1 (a) (i) respecto de novedad, paso inventivo y aplicabilidad industrial; citas y explicaciones que soportan tal declaración

1. Novedad y Paso Inventivo (Art. 33 (2) y 33 (3) PCT)

1.1. La materia de las reivindicaciones 1 – 15 parece ser novedoso e inventivo (Art. 33 (1) PCT) sobre los documentos D1 – D3.

1.2. El Documento D1 puede ser considerado como el arte previo más cercano al tema de reivindicaciones independientes 1, 13 y 15 en razón de las características más comunes en el campo de los productos de fibra – cemento. D1 revela la composición de un producto de fibra – cemento y productos formados, donde la composición comprende PP, PVA y fibras celulósicas (que son álcali – resistentes y usadas como agentes de refuerzo), CaCO_3 y cemento Portland (Ver pasajes citados de D1 en el Informe de Búsqueda).

El tema de las reivindicaciones 1, 13 y 15 por lo tanto difiere de la revelación del documento D1 en que el aglutinante no es cemento blanco, y que las fibras sintéticas no están pigmentadas.

El problema técnico resuelto por esa característica diferencial, y que corresponde al supuesto problema técnico de la presente solicitud (ver pág. 1 l.29 – 33) es el prevenir la degradación de tintas o colorantes usados en el arte previo, que se degradan debido al ambiente alcalino durante los procesos de fabricación de productos de fibra – cemento.

El documento D2 aborda este problema en particular. Sin embargo, el problema se resuelve dando un recubrimiento mejorado de color a un producto de fibra cemento. D2 revela un proceso para producir productos de fibra cemento recubiertos, el primer paso da un producto de fibra cemento donde el producto de cemento es preparado por una lechada de fibra cemento que consta de por lo menos cemento, agua y fibras tales como fibras de celulosa, fibras de papel de desperdicio o fibras de polipropileno (ver D2 p. 8) Un paso posterior del proceso que da una segunda capa de una segunda composición de radiación curable a la primera capa parcialmente curada, la segunda composición de radiación curable comprende pigmentos (ver D2 p. 8 y reivindicación 1).

El Documento D3 revela composiciones (no fibra cemento) que comprende cemento blanco y “fibras fortificantes” (fibras sintéticas) (véase el documento traducido por máquina D3 y el extracto WPI).

De todas formas, los distintos aspectos de la invención se revelan en los diferentes documentos D1 (productos de fibra cemento), D2 (problema de degradación de tintas / colorantes), D3 (cemento blanco con fibras sintéticas), la persona experta en el arte no tiene sugerencia de ninguno de D1 – D3 que permitiría una combinación obvia de este arte previo para producir un producto de cemento de color pálido que comprenda cemento blanco y fibras sintéticas pigmentadas como en la presente solicitud.

Así la reivindicación de producto 1, reivindicación de método 13 y la reivindicación de uso 15 se consideran como nuevas e inventivas.

1.3. Las reivindicaciones dependientes 2 – 12 y 14 así mismo se consideran como nuevas e inventivas.

Re. Punto VII

Ciertos defectos en la solicitud internacional

2. Se le pide al solicitante que elimine la frase de la descripción de la página 15 que se refiere a la redacción el “espíritu de la invención” pues es vago y poco claro.

Re. Punto VIII

Ciertas observaciones en la solicitud internacional

1. El término “alrededor de” (“*about*”) usado en las reivindicaciones 3, 4, 8 9, 11 es vago y poco claro y deja al lector con dudas respecto del significado de las características técnicas a las cuales se refiere, haciendo de esta manera que la definición del tema de tales reivindicaciones no sea clara



(51) International Patent Classification:

C04B 28/04 (2006.01) **C04B 16/06** (2006.01)

Published:

— with international search report (Art. 21(3))

(21) International Application Number:

PCT/EP2018/057774

(22) International Filing Date:

27 March 2018 (27.03.2018)

(25) Filing Language:

English

(26) Publication Language:

English

(30) Priority Data:

17163339.9 28 March 2017 (28.03.2017) EP

(71) Applicants: **ETEX SERVICES NV** [BE/BE]; Kuiermansstraat 1, 1880 Kapelle-op-den-Bos (BE). **COMPTOIR DU BATIMENT NV** [BE/BE]; Kuiermansstraat 1, 1880 Kapelle-op-den-Bos (BE).

(72) Inventors: **BORDIN, Ruben**; Mechelveldstraat 10, 2800 Mechelen (BE). **VERLEENE, Dave**; Eksterlaar 92, 2100 Deurne (BE). **KERSTENS, Jan**; Genielaan 2, 2950 Kapellen (BE).

(74) Agent: **VAECK, Elke** et al.; Kuiermansstraat 1, 1880 Kapelle-op-den-Bos (BE).

(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DJ, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JO, JP, KE, KG, KH, KN, KP, KR, KW, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Declarations under Rule 4.17:

— of inventorship (Rule 4.17(iv))

(54) Title: PALE-COLORED FIBER CEMENT PRODUCTS AND METHODS FOR THE PRODUCTION THEREOF

(57) Abstract: The present invention relates to pale-colored fiber cement products at least comprising white cement and synthetic fibers, wherein the synthetic fibers are pigmented with at least one dark pigment chosen from the group consisting of a black pigment, a brown pigment, a blue pigment, a red pigment, a green pigment and a gray pigment. The present invention further relates to methods for the production of these pale-colored fiber cement products as well as to uses thereof in the building industry.



PALE-COLORED FIBER CEMENT PRODUCTS AND METHODS FOR THE PRODUCTION THEREOF

Field of the invention

- 5 The present invention relates to pale-colored fiber cement products. The present invention further relates to methods for the production of these pale-colored fiber cement products as well as to uses thereof in the building industry.

Background of the invention

- 10 Pale-colored or white-colored fiber cement products are known in the art. Obtaining the white color is achieved either by using white cement as a basic component or by coating ordinary gray fiber cement-based products with a white-colored paint. The latter way is most commonly applied because it is simple to do, less expensive compared to the use of white cement, and because it allows to obtain any desired white color shade.

15

Summary of the invention

The present inventors have now developed new and inventive pale-colored fiber cement products at least comprising white cement and synthetic fibers. The pale-colored fiber cement products of the present invention are esthetically appealing and have very good mechanical and physical properties.

- 20 More specifically, the fiber cement products of the present invention at least comprise white cement and synthetic fibers, wherein the synthetic fibers are pigmented with at least one dark pigment chosen from the group consisting of a black pigment, a brown pigment, a blue pigment, a red pigment, a green pigment and a gray pigment.

- While developing the new fiber cement products, the inventors have found that it is essential to color the synthetic fibers with a pigment, rather than applying a dye or an ink. In fact, dark-colored fibers stained with a dye or an ink, proved to be unsuitable for the production of the pale-colored fiber cement products of the present invention. It was observed by the present inventors that after incorporating dye-stained or ink-stained fibers in the fiber cementitious products, the dye or ink caused bleeding effects and stains throughout the white cementitious matrix or, in other cases, the fibers simply completely lost their color and as a result also their visibility. Without being bound to any hypothesis or theory, the inventors believe that the aqueous alkaline environment of the cementitious matrix causes an alteration in the chemical structure of the specific dye (or ink), thereby breaking the chemical bond between the dye (or ink) and the fiber or thereby causing a decolorization.
- 25
- 30

Accordingly, the inventors looked for a solution to solve the above problems and have surprisingly found that when using a pigment to color the synthetic fibers, the bleeding or decoloring issues did not occur.

The resulting pale-colored fiber cement products of the present invention are esthetically appealing, especially because the surface of these products displays the texture and color of the core materials, which provides the products with a natural yet modern look. In particular, the pale-colored fiber cement products of the present invention expose the natural texture of both the cement (which is white-colored or pale-colored) and the synthetic fibers (which are dark-colored), creating an appealing contrast between both components. Furthermore, the pale-colored products of the present invention are mechanically strong and highly resistant to cracks and wearing, even under harsh and adverse weather conditions. An additional advantage of the products according to the present invention is that, since the inner core and the surface consist of the same material, any faults or damage that may occur during the life-time of the products will be less visible compared to coated products, which typically have a surface color which is different from the inner mass color.

Presently, there is an increasing demand from architects and designers to develop new fiber cement products, visualizing the natural fiber cement core material. Of course, such natural looking building products have to fulfill the same standard national requirements with regard to mechanical and physical properties (i.e. mechanical strength, hygric movement etc.) as their corresponding predecessors. The present inventors have met this increasing market demand with the products of the present invention.

Accordingly, in a first aspect, the present invention provides pale-colored fiber cement products at least comprising white cement and synthetic fibers, wherein the synthetic fibers are pigmented with at least one dark pigment chosen from the group consisting of a black pigment, a brown pigment, a blue pigment, a red pigment, a green pigment and a gray pigment.

In particular embodiments, the synthetic fibers comprised in the pale-colored fiber cement products of the present invention are polypropylene fibers. In further particular embodiments, the synthetic fibers are polypropylene fibers having a thickness of about 70 dtex. In further particular embodiments, the synthetic fibers are milled polypropylene fibers. In yet further particular embodiments, the synthetic fibers are milled polypropylene fibers having an average length of about 1 mm to about 2 mm.

In particular embodiments, the synthetic fibers comprised in the pale-colored fiber cement products of the present invention are pigmented with at least one dark pigment, such as an iron oxide, carbon black, a manganese oxide, cobalt blue, a cobalt oxide, a chromium oxide, copper phthalocyanine, or

ultramarine blue. In particular embodiments, the synthetic fibers comprised in the pale-colored fiber cement products of the present invention are pigmented with at least one dark pigment, which is an inorganic pigment.

5

In particular embodiments, the pale-colored fiber cement products of the present invention further comprise a white pigment. In further particular embodiments, the white pigment is present in an amount of between about 3 weight % and about 6 weight % (compared to the total dry weight of the fiber cement composition) of the fiber cement product. In yet further particular embodiments, the
10 white pigment is chosen from the group consisting of a titanium oxide, a barium oxide, a barium sulfate and a barium containing mixture. In yet further particular embodiments, the white pigment is titanium oxide (TiO₂).

In particular embodiments, the pale-colored fiber cement products of the present invention further
15 comprise limestone (CaCO₃) in an amount of between about 5 weight % and about 15 weight % (compared to the total dry weight of the fiber cement composition of said fiber cement product). In particular, the present inventors have found that CaCO₃ improves the water channeling properties of the fiber cement products of the present invention. Without being bound to any hypothesis or theory, the inventors believe that this is because white cement has a relatively low specific surface area
20 compared to ordinary gray cement and therefore tends to enclose water in a higher degree. However, entrapped amounts of water are undesirable because these could be the cause of cracks and swelling of the fiber cement material upon exposure to rain and freeze-thaw conditions. The present inventors have managed to solve this issue by adding limestone. This ingredient ensures that a network of channels is created in between the cement particles of the fiber cement product, so as to ensure an
25 optimal internal flow and channeling of water.

In particular embodiments, the pale-colored fiber cement products of the present invention are coated with a clear coating. In particular embodiments, the pale-colored fiber cement products of the present invention are coated with a clear coating, which clear coating comprises about 0.5% to about 4%
30 (compared to the total dry weight of the fiber cement composition of said fiber cement product) of a white pigment. In further particular embodiments, the clear coating comprises about 1% to about 2% (compared to the total dry weight of the fiber cement composition of said fiber cement product) of a white pigment. In yet further particular embodiments, the clear coating comprises about 1% to about 2% (compared to the total dry weight of the fiber cement composition of said fiber cement product)
35 of titanium oxide (TiO₂).

In particular embodiments, the pale-colored fiber cement products of the present invention are coated with a clear coating, which is a clear synthetic coating, such as a clear acrylic coating. In alternative particular embodiments, the clear coating is a UV-curable clear coating.

5

In a second aspect, the present invention provides methods for the manufacture of pale-colored fiber cement products according to the invention, which methods at least comprise the steps of:

- a) Providing a fiber cement slurry at least comprising white cement and synthetic fibers, which synthetic fibers are pigmented with at least one dark pigment chosen from the group
10 consisting of a black pigment, a brown pigment and a gray pigment;
- b) Manufacturing a fiber cement product by means of a fiber cement production process;
- c) Curing the fiber cement product, so as to obtain the pale-colored fiber cement product.

In particular embodiments, step c) of the methods according to the present invention comprises air-
15 curing the fiber cement product.

In particular embodiments, the present invention provides methods for the manufacture of pale-colored fiber cement products, wherein step b) of manufacturing a fiber cement product is performed by means of a fiber cement production process chosen from the group consisting of a Hatschek
20 process, a Magnani process, an extrusion process and a flow-on method. In further particular embodiments, the present invention provides methods for the manufacture of pale-colored fiber cement products, wherein step b) of manufacturing a fiber cement product is performed by means of a Hatschek production process.

25 In particular embodiments, the present invention provides methods for the manufacture of pale-colored fiber cement products, wherein at least one white pigment is added in the fiber cement slurry during step (i) of providing a fiber cement slurry. In further particular embodiments, the white pigment is added in an amount of between about 3 weight % and about 6 weight % (compared to the total dry weight of the fiber cement composition) of the fiber cement product. In further particular
30 embodiments, the at least one white pigment is TiO_2 .

In a third aspect, the present invention provides pale-colored fiber cement products obtainable by any of the methods according to the present invention.

In a fourth aspect, the present invention provides uses of the pale-colored fiber cement products according to the present invention as building materials.

In particular embodiments, the present invention provides uses of the pale-colored fiber cement products according to the present invention as an outer surface to walls, applied internally or externally, e.g. as façade plate, siding, etc. In other particular embodiments, the pale-colored fiber cement products according to the present invention can be used for decking applications, fencing applications and/or covering applications.

The independent and dependent claims set out particular and preferred features of the invention.

Features from the dependent claims may be combined with features of the independent or other dependent claims, and/or with features set out in the description above and/or hereinafter as appropriate.

The above and other characteristics, features and advantages of the present invention will become apparent from the following detailed description, taken in conjunction with the accompanying drawings, which illustrate, by way of example, the principles of the invention. This description is given for the sake of example only, without limiting the scope of the invention. The reference figures quoted below refer to the attached drawings.

Brief description of the drawings

Figure 1 is a full picture of the top surface of a pale-colored fiber cement product according to the present invention.

Figure 2 is a detail picture of the top surface of a pale-colored fiber cement product according to the present invention.

Figures 3 to 6 are full pictures of sections of pale-colored fiber cement products according to the present invention.

The same reference signs refer to the same, similar or analogous elements in the different figures.

Detailed description of the invention

It is to be noted that the term “comprising”, used in the claims, should not be interpreted as being restricted to the means listed thereafter; it does not exclude other elements or steps. It is thus to be interpreted as specifying the presence of the stated features, steps or components as referred to, but does not preclude the presence or addition of one or more other features, steps or components, or

groups thereof. Thus, the scope of the expression “a device comprising means A and B” should not be limited to devices consisting only of components A and B. It means that with respect to the present invention, the only relevant components of the device are A and B.

5 Throughout this specification, reference to “one embodiment” or “an embodiment” are made. Such references indicate that a particular feature, described in relation to the embodiment is included in at least one embodiment of the present invention. Thus, appearances of the phrases “in one embodiment” or “in an embodiment” in various places throughout this specification are not necessarily all referring to the same embodiment, though they could. Furthermore, the particular
10 features or characteristics may be combined in any suitable manner in one or more embodiments, as would be apparent to one of ordinary skill in the art.

The following terms are provided solely to aid in the understanding of the invention.

15 As used herein, the singular forms “a”, “an”, and “the” include both singular and plural referents unless the context clearly dictates otherwise.

The terms “comprising”, “comprises” and “comprised of” as used herein are synonymous with “including”, “includes” or “containing”, “contains”, and are inclusive or open-ended and do not exclude additional, non-recited members, elements or method steps.

20

The recitation of numerical ranges by endpoints includes all numbers and fractions subsumed within the respective ranges, as well as the recited endpoints.

The term “about” as used herein when referring to a measurable value such as a parameter, an
25 amount, a temporal duration, and the like, is meant to encompass variations of +/-10% or less, preferably +/-5% or less, more preferably +/-1% or less, and still more preferably +/-0.1% or less of and from the specified value, insofar such variations are appropriate to perform in the disclosed invention. It is to be understood that the value to which the modifier “about” refers is itself also specifically, and preferably, disclosed.

30

The terms “(fiber) cementitious slurry” or “(fiber) cement slurry” as referred to herein generally refer to slurries at least comprising water, fibers and cement. The fiber cement slurry as used in the context of the present invention may also further comprise other components, such as but not limited to, limestone, chalk, quick lime, slaked or hydrated lime, ground sand, silica sand flour, quartz flour,

amorphous silica, condensed silica fume, microsilica, metakaolin, wollastonite, mica, perlite, vermiculite, aluminum hydroxide, pigments, anti-foaming agents, flocculants, and other additives.

“Fiber(s)” present in the fiber cement slurry as described herein may be for example process fibers and/or reinforcing fibers which both may be organic fibers (typically cellulose fibers) or synthetic fibers (polyvinyl alcohol, polyacrylonitrile, polypropylene, polyamide, polyester, polycarbonate, etc.).

“Cement” present in the fiber cement slurry as described herein may be for example but is not limited to Portland cement, cement with high alumina content, Portland cement of iron, trass-cement, slag cement, plaster, calcium silicates formed by autoclave treatment and combinations of particular binders.

“White cement” present in the fiber cement slurry for the manufacture of the fiber cement products of the present invention may be for example but is not limited to white Portland cement.

The terms “predetermined” and “predefined” as used herein when referring to one or more parameters or properties generally mean that the desired value(s) of these parameters or properties have been determined or defined beforehand, i.e. prior to the start of the process for producing the products that are characterized by one or more of these parameters or properties.

The term “cementitious” as in “cementitious product” or “cementitious material” as used herein refers to any product or material comprising cement, such as but not limited to Portland cement, cement with high alumina content, Portland cement of iron, trass-cement, slag cement, plaster, calcium silicates formed by autoclave treatment and combinations of particular binders. In more particular embodiments, cement in the products of the invention is Portland cement.

The term “fiber cement product” as used herein refer to products at least comprising fibers and cement. The fiber cement products as used in the context of the present invention may also further comprise other components, such as but not limited to, limestone, chalk, quick lime, slaked or hydrated lime, ground sand, silica sand flour, quartz flour, amorphous silica, condensed silica fume, microsilica, metakaolin, wollastonite, mica, perlite, vermiculite, aluminum hydroxide, pigments, anti-foaming agents, flocculants, and other additives.

A “(fiber cement) sheet” as used herein, also referred to as a panel or a plate, is to be understood as a flat, usually rectangular element, a fiber cement panel or fiber cement sheet being provided out of fiber cement material. The panel or sheet has two main faces or surfaces, being the surfaces with the largest surface area. The sheet can be used to provide an outer surface to walls, both internal as well as external a building or construction, e.g. as façade plate, siding, etc.

The term “fiber cement layer” as used herein generally, and particularly in the context of the present invention, refers to any flat, optionally substantially rectangular, layer or cake essentially consisting of a fiber cement composition and having a thickness of at least about 1 mm, in particular between about 1 mm and 200 mm, more particularly between about 2 mm and about 150 mm, most particularly between about 4 mm and about 100 mm, such as between about 8 mm and about 10 mm.

A “Hatschek fiber cement layer” or a “Hatschek layer” as interchangeably used herein refers to a fiber cement layer (as defined herein), which is produced according to a Hatschek process, which at least comprises the steps of:

- (i) building a fiber cement film on a sieve, which sieve rotates so as to be in contact with a fiber cement slurry in a vat;
- (ii) transferring the fiber cement film from the sieve to the felt transport belt, and
- (iii) accumulating the fiber cement film on an accumulator roll via the felt transport belt.

In the context of the present invention, the use of the term “fiber cement film” refers to such a thin layer of fiber cement being applied onto the felt transport belt by one or more sieves rotating in a fiber cement slurry that is present in one or more vats of the Hatschek process. As may be understood from the aforementioned, series of thin fiber cement layers are produced on the one or more sieves from the Hatschek machine and subsequently superimposed and transferred from the one or more sieves to the transport belt, resulting in one or more uncured Hatschek fiber cement layers after accumulation on an accumulation roll. Thus, it will be clear that, when referring to “a fiber cement film” in the context of the present invention, it is to be understood that this term encompasses, where applicable, both the meaning of one single fiber cement film having a thickness of between about 0.01 mm and about 0.9 mm, such as in particular between about 0.05 mm and about 0.5 mm, such as between about 0.1 mm and about 0.4 mm, such as about 0.3 mm. (i.e. one thin layer of fiber cement also called a mono-layer, a single layer or a primary layer, that is applied onto the felt transport belt by a sieve from a vat of the Hatschek process) as well as the meaning of a layer comprising two or more superimposed fiber cement layers, each having a thickness of between about 0.01 mm and about 0.9 mm, such as in particular between about 0.05 mm and about 0.5 mm, such as between about 0.1 mm and about 0.4 mm, such as about 0.3 mm (i.e. two or more superimposed thin layers of fiber cement

applied onto the felt transport belt by two or more sieves from a vat of the Hatschek process). The skilled person will understand, depending on the particular configuration of the Hatschek section, that when referring to processes of the invention in general both meanings of the term “fiber cement film” as described above will be applicable, while in more particular embodiments only one of both meanings are applicable. For instance, in a particular case where only one sieve is used in the Hatschek section for performing the processes of the invention, “a fiber cement film” as used herein means only one single layer having a thickness of between about 0.01 mm and about 0.9 mm that is applied onto the felt transport belt by the sieve from a vat of the Hatschek process. On the other hand, where two or more sieves are used in the Hatschek section for performing the processes of the invention, “a fiber cement film” as used herein means a superposition of two or more single layers, each having a thickness of between about 0.01 mm and about 0.9 mm, which are applied onto the felt transport belt by the sieve from a vat of the Hatschek process.

The term “water-permeable” as used herein when referring to a water-permeable (region of a) transport belt generally, and particularly in the context of the present invention, means that the material of which the water-permeable (region of the) belt is made allows water to flow through its structure to a certain extent.

The “water-permeability” as used herein when referring to the water-permeability of a (region of a) transport belt generally, and particularly in the context of the present invention, refers to the extent or degree to which the material of which the water-permeable (region of the) belt is made, allows water to flow through its structure. Suitable materials for water-permeable transport belts are known to the person skilled in the art, such as but not limited to felts.

A “non-hydrophobized (fiber cement) product” or a “non-hydrophobized fiber cement (film) layer” as used in the present context refers to a product, such as a fiber cement product or a fiber cement (film) layer, which has not been treated before, during or after its production, with a hydrophobizing agent. In particular, a “non-hydrophobized fiber cement product” or a “non-hydrophobized fiber cement sheet” as used herein will only comprise “fiber cement film layers”, which are non-hydrophobized.

The terms “pale-colored” and “white-colored” when referring to a fiber cement product are used interchangeably herein and have the meaning that at least part of the, and preferably the entire, internal structure of that fiber cement product comprises white cement as the main ingredient.

The terms “internal (fiber cement) structure”, “inner (fiber cement) structure”, “internal (fiber cement) mass” or “inner (fiber cement) mass” as referred to interchangeably herein are used to indicate the fiber cement material present in a fiber cement product, which material is not visible with the eye when looking at the product from the outside.

5

The terms “external (fiber cement) structure” or “external (fiber cement) surface” as referred to interchangeably herein are used to indicate the fiber cement material which is exposed and visible on the outside of a fiber cement product.

10 A “transparent pigment” as used herein is meant to indicate a pigment of which the pigment particles have the property of transmitting visible light. Thus, a “transparent pigment” as used herein is a pigment, of which the majority of pigment particles are smaller than the wave length of visible light.

15 An “opaque pigment” as used herein is meant to indicate a pigment of which the pigment particles do not have the property of transmitting visible light. Thus, an “opaque pigment” as used herein is a pigment of which the majority of pigment particles are greater than the wave length of visible light.

A “semi-opaque pigment” (also referred to in the art as a semi-transparent pigment) as used herein is meant to indicate a pigment of which only a certain but significant percentage of pigment particles have the property of transmitting visible light. Thus, a “semi-opaque pigment” as used herein is a pigment of which a certain but significant percentage of pigment particles are greater than the wave
20 length of visible light and of which the remaining percentage of pigment particles are smaller than the wave length of visible light.

The term “pigment” as used herein refers to a dry insoluble substance, usually pulverized, which when suspended in a liquid vehicle becomes a paint, ink, etc. Pigments typically consist of tiny solid particles
25 that are used to enhance the appearance by providing color and/or to improve the physical (functional) properties of the paint or ink. Pigments used to provide color generally range from 0.2 to 0.4 microns in diameter. Functional pigments are typically 2-4 microns in diameter, but they may be as large as 50 microns.

30 The term “prime pigment” as used herein refers to any pigment (as defined herein), which is capable of providing whiteness and/or color to a substance while also contributing significantly to the hiding power of said substance. Prime pigments can be subdivided in white pigments and color pigments.

35 The term “white pigment” as referred to herein means a prime pigment, capable of scattering light and providing whiteness and hiding in flat or glossy paint or ink. White inorganic pigments include but

are not limited to antimony pigments including Antimony White: Sb_2O_3 ; lead pigments (toxic) including White Lead $(\text{PbCO}_3)_2 \cdot \text{Pb}(\text{OH})_2$; titanium pigments including Titanium White: titanium (IV) oxide TiO_2 and ; zinc pigments including Zinc White: Zinc Oxide (ZnO).

5 The term “color pigment” as referred to herein means a prime pigment, capable of selectively absorbing light and providing color to a paint or ink. There are two main types of color pigments: organic pigments, which include the brighter colors but are not highly durable in exterior use and inorganic pigments, which are not as bright as organic colors but are the most durable exterior pigments.

10

The term “inorganic pigment” as used herein refers to naturally occurring mineral coloring compounds typically consisting of metallic salts. Inorganic pigments are usually oxides or sulphides of one or more metals.

15 Inorganic pigments include for instance but are not limited to:

- Blue inorganic pigments:

- aluminum pigments, including ultramarine: a complex naturally occurring pigment of sulfur-containing sodio-silicate ($\text{Na}_{8-10}\text{Al}_6\text{Si}_6\text{O}_{24}\text{S}_{2-4}$);
- cobalt pigments, including Cobalt Blue and Cerulean Blue: cobalt(II) stannate;
- 20 ○ copper pigments, including Egyptian Blue: a synthetic pigment of calcium copper silicate ($\text{CaCuSi}_4\text{O}_{10}$) and Han Blue $\text{BaCuSi}_4\text{O}_{10}$; and
- iron pigments, including Prussian Blue: a synthetic pigment of ferric hexacyanoferrate ($\text{Fe}_7(\text{CN})_{18}$);

- Green inorganic pigments

- 25 ○ cadmium pigments, including Viridian: a dark green pigment of hydrated chromium(III) oxide (Cr_2O_3) and Cadmium Green: a light green pigment consisting of a mixture of Chromium Yellow (CrS) and Viridian (Cr_2O_3);
- chromium pigments, including Chrome Green;
- copper pigments, including Paris Green: copper(II) acetoarsenite ($\text{Cu}(\text{C}_2\text{H}_3\text{O}_2)_2 \cdot 3\text{Cu}(\text{AsO}_2)_2$) and
- 30 Scheele's Green (also called Schloss Green): copper arsenite CuHAsO_3 ;

- Yellow inorganic pigments

- arsenic pigments including Orpiment natural monoclinic arsenic sulfide (As_2S_3);
- cadmium pigments including Cadmium Yellow: cadmium sulfide (CdS);
- chromium pigments including Chrome Yellow: natural pigment of lead(II) chromate (PbCrO_4);

- cobalt pigments including Aureolin (also called Cobalt Yellow): Potassium cobaltinitrite ($\text{Na}_3\text{Co}(\text{NO}_2)_6$);
- iron pigments including Yellow Ochre: a naturally occurring clay of hydrated iron oxide ($\text{Fe}_2\text{O}_3 \cdot \text{H}_2\text{O}$);
- 5 ○ lead pigments including Naples Yellow;
- titanium pigments including Titanium Yellow;
- tin pigments including Mosaic gold: stannic sulfide (SnS_2);
- Orange inorganic pigments
- cadmium pigments including Cadmium Orange: an intermediate between cadmium red and
- 10 cadmium yellow: cadmium sulfoselenide;
- chromium pigments including Chrome Orange: a naturally occurring pigment mixture composed of lead(II) chromate and lead(II) oxide. ($\text{PbCrO}_4 + \text{PbO}$)
- Red inorganic pigments
- cadmium pigments including Cadmium Red: cadmium selenide (CdSe);
- 15 ○ iron oxide pigments including Sanguine, Caput Mortuum, Oxide Red, Red Ochre: anhydrous Fe_2O_3 , Burnt Sienna: a pigment produced by heating Raw Sienna, Venetian Red;
- lead pigments (toxic) including Red Lead: lead tetroxide, Pb_3O_4 ;
- mercury pigments (toxic) including Vermilion: Synthetic and natural pigment: Occurs naturally in mineral cinnabar; Mercuric sulfide (HgS);
- 20 - Brown inorganic pigments
- clay earth pigments (naturally formed iron oxides) including Raw Umber: A natural clay pigment consisting of iron oxide, manganese oxide and aluminum oxide: $\text{Fe}_2\text{O}_3 + \text{MnO}_2 + \text{nH}_2\text{O} + \text{Si} + \text{AlO}_3$; Raw Sienna: a naturally occurring yellow-brown pigment from limonite clay;
- Black inorganic pigments
- 25 ○ Carbon pigments including Carbon Black, Ivory Black, Vine Black, Lamp Black;
- Iron Pigments including Fe_3O_4 ;
- Titanium pigments: Titanium Black;
- Gray inorganic pigments
- Payne's gray: a mixture of Ultramarine and black or of Ultramarine and Sienna;

30

The term "organic pigment" as used herein refers to synthetic organic coloring compounds, which are carbon based molecules manufactured from petroleum compounds, acids, and other chemicals, usually under intense heat or pressure.

Organic pigments include for instance but are not limited to:

- 35 - Yellow organic pigments:

Yellow Lakes, which are transparent pigments used as a yellow to cover other inks but not hide them, Tartrazine Yellow Lake (also called FD&C Yellow No. 5 and used as a dyestuff in foods), Hansa Yellows, and Diarylide Yellows, which are the most common yellow pigments used in printing inks. Fluorescent Yellow is also used in some specialty applications. Organic Yellows are commonly used to replace

Chrome Yellows;

- Orange organic pigments:

The most common orange pigment is Diarylide Orange, a transparent yet not very fast-to-light pigment. Other assorted orange materials tend to be used where orange pigments are necessary, and include DNA Orange, Pyrazolone Orange, Fast Orange F2G, Benzimidazolone Orange HL, and Ethyl Lake

Red C;

- Red organic pigments:

Reds include Para Reds, Toluidine Red, ["Permanent Red "R"], Carmine F.B., Naphthol Reds and Rubines, Permanent Red FRC, Bordeaux FRR, Rubine Reds, Lithol Reds, BON Red, Lithol Rubine 4B, BON Maroon, Rhodamine 6G, Lake Red C, BON Arylamide Red, Quinacrinone Magentas, Copper

- Blue organic pigments:

'Blues'. Blues include Phthalocyanine Blues (the most commonly used group of organic blue pigments), PMTA Victoria Blue, Victoria Blue CFA, Ultramarine Blue, Indanthrene Blue, Alkali Blues, and Peacock

- Violet organic pigments:

Violets overlap slightly with some of the bluer reds (such as *Benzimidazolone Bordeaux HF 3R* (see Benzimidazolone Carmines and Reds), and also include such pigments as PMTA Rhodamine, PMTA Violet (also known as Methyl Violet), Dioxazine Violet (RL) Carbazole Violet, Crystal Violet, Dioxazine

- Green organic pigments:

A common series of greens are the Phthalocyanine Greens as well as the PMTA Greens;

- Brown organic pigments:

Brown pigments include Diazo Brown and Benzimidazolone Brown HFR;

The terms "extender pigment" or "filler pigment" as used herein refers to any pigment (as defined herein) having a low refractive index or opacity and therefore not providing color or hiding power to a substance. Extender or filler pigments appear transparent in a paint or ink. Extender pigments have significant positive effects on various properties of the paint for example, as described further below, mica can improve the water resistance of a film due to its "platy" particle shape and tendency to orient

itself in overlapping layers horizontal to the surface. Extender pigments or filler pigments for instance include but are not limited to Barium Sulphate, Calcium Carbonate, Magnesium Silicate, Mica, Kaolin (China Clay), Asbestine, Talc, Silica / Quartz, Alumina Hydrate, Kalunite, Pumice, Bentonite, Vermiculite, and Glass Beads.

5

The term “UV-curable” refers to a composition that can polymerize upon application of UV irradiation. Typically, this at least implies the presence of photo-polymerizable monomers or oligomers, together with photoinitiators and/or photosensitizers.

10 A “clear coat” or a “clear coating composition” as referred to herein is used to indicate a coating formulation or composition having the property of transmitting rays of light through its substance so that surfaces or objects, which are situated beyond or behind the coating, such as surfaces or objects coated by such transparent coating, are distinctly visible.

15 The term “transparent” or “transparency” when referring to a coating composition or a coating layer refers to the physical characteristic of allowing light to pass through the coating without being scattered. Transparency can be measured with any method known in the art. For instance, a haze meter measures the transparency, haze, see-through quality, and total transmittance of a coating, based on how much visible light is diffused or scattered when passing through the coating. Haze is
20 measured with a wide angle scattering test in which light is diffused in all directions which results in a loss of contrast. That percentage of light that when passing through deviates from the incident beam greater than 2.5 degrees on average is defined as haze. See through quality is measured with a narrow angle scattering test in which light is diffused in a small range with high concentration. This test measures the clarity with which finer details can be seen through the coating being tested. The haze
25 meter also measures total transmittance. Total transmittance is the measure of the total incident light compared to the light that is actually transmitted (e.g. total transmittance). So the incident light may be 100%, but because of absorption and reflection the total transmittance may only be 94%. The data gained from the haze meter can be transferred to a PC for further data processing to ensure a consistent product.

30

The term “(staple) length of fiber(s)” as used herein refers to the average length of a group of (staple) fibers of any composition. For cut synthetic fibers, such as polypropylene fibers, the (staple) length refers to the discrete length to which these fibers have been cut, and is thus the same for every fiber present in the group. For broken or torn synthetic fibers, such as polypropylene fibers, the (staple)
35 length refers to the average length to which these fibers have been broken or torn.

In the context of the present invention, the term “polypropylene” is intended to include any polymeric composition comprising propylene monomers, either as a homopolymer or copolymer with other polyolefins, dienes, or other monomers (such as ethylene, butylene, and the like). The term is also intended to encompass any different configuration and arrangement of the constituent monomers (such as syndiotactic, isotactic, and the like). Thus, the term as applied to filaments, monofilaments, multifilaments or fibers herein, is intended to encompass endless stretches, actual long strands, threads, and the like, of polypropylene homopolymer or copolymer.

The invention will now be further explained in detail with reference to various embodiments. It will be understood that each embodiment is provided by way of example and is in no way limiting to the scope of the invention. In this respect, it will be clear to those skilled in the art that various modifications and variations can be made to the present invention without departing from the scope or spirit of the invention. For instance, features illustrated or described as part of one embodiment, can be used in another embodiment to yield a still further embodiment. Thus, it is intended that the present invention covers such modifications and variations as encompassed within the scope of the appended claims and equivalents thereof.

The present invention provides novel pale-colored fiber cement products, which are mechanically strong and highly resistant to cracks and wearing, even under harsh and adverse weather conditions. In addition, the fiber cement products as provided by the present invention have an attractive appearance because of their specific esthetic features, whereby the natural texture of both the cement (which is white-colored or pale-colored) and the synthetic fibers (which are dark-colored) is exposed, creating an appealing contrast between both components. This provides the products with a natural yet modern look and additionally provides for the advantage that any defects or damages occurring during the life-time of the products will be less visible compared to coated products, which typically have a surface color which is different from the inner mass color.

Accordingly, in view of the above, it is clear that the present invention provides fiber cement products, which are both technically (good mechanical strength and impact resistance and highly wearproof) and esthetically (intense though natural appearing colour and no colour change upon damage) improved.

In a first aspect, the present invention provides pale-colored fiber cement products at least comprising white cement and synthetic fibers, wherein the synthetic fibers are pigmented with at least one dark

pigment chosen from the group consisting of a black pigment, a brown pigment, a red pigment, a blue pigment, a green pigment and a gray pigment.

In the context of the present invention, fiber cement products are to be understood as cementitious products comprising cement and synthetic (and optionally natural) fibers. The fiber cement products are made out of fiber cement slurry, which is formed in a so-called "green" fiber cement product, and then cured.

Dependent to some extent on the curing process used, the fiber cement slurry typically comprises water, process or reinforcing fibers which are synthetic organic fibers (and optionally also natural organic fibers, such as cellulose), cement (e.g. Portland cement), limestone, chalk, quick lime, slaked or hydrated lime, ground sand, silica sand flour, quartz flour, amorphous silica, condensed silica fume, microsilica, kaolin, metakaolin, wollastonite, mica, perlite, vermiculite, aluminum hydroxide (ATH), pigments, anti-foaming agents, flocculants, and/or other additives.

The fiber cement products according to the present invention are "pale-colored" or "white-colored" (as defined herein). The pale color of the products of the invention is obtained by using white cement as the cementitious matrix. White cement, such as for example white ordinary Portland cement (WOPC) is similar to ordinary, gray Portland cement in all aspects except for its high degree of whiteness. Obtaining this color requires substantial modification to the method of manufacture, and because of this, it is more expensive than the gray product. White Portland cement differs physically from gray cement only in terms of its color. Its setting behavior and strength development are essentially the same as that expected in gray cement, and it meets standard specifications such as ASTM C 150 and EN 197. In practice, because much white cement is used in pre-cast concrete products, it is commonly made to a high-early strength specification such as ASTM C 150 Type III. The whiteness of the product is typically expressed in terms of a reflectance measurement, such as L^*a^*b L-value, or tristimulus.

The pale-colored fiber cement products of the present invention comprise 20 to 95 weight % of white cement as hydraulic binder. In particular embodiments, white cement in the products of the invention is white Portland cement.

In particular embodiments, the pale-colored fiber cement products of the present invention further comprise in their cementitious matrix a white pigment. In further particular embodiments, the white pigment is present in an amount of between about 3 weight % and about 6 weight %, such as more particularly in an amount of between about 3 weight % and about 5 weight %, such as most particularly in an amount of about 4.6 weight % of white pigment (compared to the total dry weight of the fiber cement composition). In yet further particular embodiments, the white pigment is chosen from the

group consisting of titanium oxide, a barium oxide, a barium sulphate and a barium containing mixture. In yet further particular embodiments, the white pigment is titanium oxide (TiO₂). In yet further particular embodiments, the white pigment is titanium oxide (TiO₂) and is present in an amount of about 4.6 weight % (compared to the total dry weight of the fiber cement composition).

5

The pale-colored fiber cement products of the present invention at least further comprise pigmented synthetic fibers.

In particular embodiments, the fiber cement products of the present invention comprise from about 0.1 to about 5 weight %, such as particularly from about 0.5 to about 4 weight % of pigmented synthetic
10 fibers, such as more particularly between about 1 to 3 weight % of pigmented synthetic fibers, such as most particularly about 2 weight % of pigmented synthetic fibers with respect to the total weight of the fiber cement product.

In further particular embodiments, the pigmented synthetic fibers in the pale-colored fiber cement
15 products of the present invention are selected from the group consisting of pigmented polypropylene fibers, pigmented polyvinylalcohol fibers, pigmented polyacrylonitrile fibers, polyethylene, pigmented polyamide fibers, pigmented polyester fibers, pigmented aramide fibers and pigmented carbon fibers. In yet further particular embodiments, the pigmented synthetic fibers in the pale-colored fiber cement products of the present invention are pigmented polypropylene fibers.

20 In particular embodiments, the pigmented synthetic fibers are polypropylene fibers having a thickness of about 70 dtex.

In particular embodiments, the pigmented synthetic fibers are milled pigmented polypropylene fibers. In particular embodiments, the synthetic fibers are milled polypropylene fibers having an average length of about 1 mm to about 2 mm.

25

The pigmented synthetic fibers in the pale-colored fiber cement products of the present invention are pigmented with at least one dark pigment chosen from the group consisting of a black pigment, a brown pigment, a red pigment, a blue pigment, a green pigment and a gray pigment. In particular
30 embodiments, the pigmented synthetic fibers are pigmented with a gray iron oxide, a black iron oxide, a brown iron oxide, or carbon black.

In particular embodiments of the present invention, the pigments suitable for pigmenting the synthetic fibers for use in the pale-colored fiber cement products of the present invention are essentially alkali-resistant, i.e. resistant to a pH of about 8 or higher, such as resistant to a pH of about 9 or higher, such as resistant to a pH of about 10 or higher, such as resistant to a pH of about 11 or higher, more
35 particularly resistant to a pH of higher than about 12 or higher than about 13.

In particular embodiments, the fiber cement products according to the invention are characterized in that they additionally comprise non-pigmented or pigment-free synthetic fibers in a weight % of about 0.1 to about 5, such as particularly from about 0.5 to about 4, such as more particularly between about 1 to 3 with respect to the total weight of the fiber cement product. Most particularly, pigment-free synthetic fibers are present in the pale-colored fiber cement products of the present invention in a weight % of about 2 weight % with respect to the total weight of the fiber cement product.

In particular embodiments, these pigment-free synthetic fibers are selected from the group consisting of polypropylene fibers, polyvinylalcohol fibers, polyacrylonitrile fibers, polyethylene fibers, polyamide fibers, polyester fibers, aramide fibers and carbon fibers. In yet further particular embodiments, these pigment-free synthetic fibers are polyvinylalcohol (PVA) fibers, such as but not limited to pigment-free PVA fibers with a thickness of about 8 dtex.

In further particular embodiments, natural fibers, such as cellulose fibers may in addition be added to the fiber cement formulations of the present invention. In these particular embodiments, the fiber cement products of the present invention may comprise from about 2 to about 5 weight %, such as particularly about 2 to about 4 weight % of cellulose fibers, such as more particularly about 3 weight % of cellulose fibers with respect to the total weight of the fiber cement product. These cellulose fibers may for example be Kraft softwood cellulose fibers, such as bleached Kraft softwood cellulose fibers.

In further particular embodiments, additional fibers may be added to the cement formulations and may be selected from the group consisting of glass fibers, rockwool fibers, slag wool fibers, wollastonite fibers, ceramic fibers and the like. In further particular embodiments, the fiber cement products of the present invention may additionally comprise fibrils fibrids, such as for example but not limited to, polyolefinic fibrils fibrids % in a weight % of about 0.1 to 3, such as "synthetic wood pulp".

In particular embodiments, the pale-colored fiber cement products of the present invention further comprise limestone (CaCO_3) in an amount of between about 5 weight % and about 15 weight %, such as between about 7 weight % and about 13 weight %, such as more particularly between about 9 weight % and about 11 weight %, such as most particularly about 10 weight % of CaCO_3 (compared to the total dry weight of the fiber cement composition of said fiber cement product). In particular, the present inventors have found that CaCO_3 improves the water channeling properties of the fiber cement products of the present invention. Without being bound to any hypothesis or theory, the inventors believe that this is because white cement has a relatively low specific surface area compared to ordinary gray cement and therefore tends to enclose water in a higher degree. However, entrapped

amounts of water are undesirable because these could be the cause of cracks and swelling of the fiber cement material upon exposure to rain and freeze-thaw conditions. The present inventors have managed to solve this issue by adding limestone. This ingredient ensures that a network of channels is created in between the cement particles of the fiber cement product, so as to ensure an optimal internal flow and channeling of water.

According to particular embodiments, the fiber cement products according to the invention optionally comprise further components. These further components in the fiber cement products of the present invention may be selected from the group consisting of water, sand, silica sand flour, condensed silica fume, microsilica, fly-ashes, ground quartz, the ground rock, clays, pigments, kaolin, metakaolin, blast furnace slag, carbonates, puzzolanas, aluminium hydroxide, wollastonite, mica, perlite, calcium carbonate, and other additives (e.g. colouring additives) etc. It will be understood that each of these components is present in suitable amounts, which depend on the type of the specific fiber cement product and can be determined by the person skilled in the art. In particular embodiments, the total quantity of such further components is preferably lower than 70 weight % compared to the total initial dry weight of the composition.

Further additives that may be present in the fiber cement products of the present invention may be selected from the group consisting of dispersants, plasticizers, antifoam agents and flocculants. The total quantity of additives is preferably between about 0.1 and about 2 weight % compared to the total initial dry weight of the composition.

In particular embodiments, the fiber cement products of the invention have a thickness of between about 5 mm and about 25 mm, in particular between about 5 mm and about 20 mm.

In particular embodiments, the fiber cement products of the invention have a length of between about 2 m and about 6 m, in particular between about 2 m and about 4 m, more in particular of about 2.40m or of about 3.50 m.

In particular embodiments, the fiber cement products of the invention have a width of between about 1 m and about 4 m, more in particular of about 1.20 m.

In particular embodiments, the pale-colored fiber cement products of the present invention are coated with a clear coating (as defined herein).

In further particular embodiments, the clear coating is a conventional (i.e. not radiation-curable) clear coating. Suitable conventional clear coatings are those with binders obtained by aqueous free radical or ionic emulsion polymerization. Acrylic and/or methacrylic (co)polymers are particularly preferred as binders of the conventional clear coatings. These acrylic and/or methacrylic (co)polymers are usually prepared by aqueous radically initiated emulsion polymerization of esters of acrylic acid and/or methacrylic acid with C1-C12 alkanols as well as a minor amount of acrylic and/or methacrylic acid as monomers. Preference is given in particular to esters of acrylic and methacrylic acid with C1-C8 alkanols; ethyl acrylate, n-butyl acrylate, ethylhexyl acrylate and methylmethacrylate are particularly preferred. The emulsion polymerization requires the use of surfactants as stabilizers. Non-ionic surfactants are preferred. Alcohol ethoxylates are particularly preferred. Conventional coatings with a hydroxyl number (measured according to ISO 4629) of at least 1 are preferred. Hydroxyl numbers of at least 1,5 are particularly preferred. Preferably the minimum film forming temperature during the drying of the conventional coating is below 60°C.

The conventional clear coating composition generally comprises, besides the polymeric binders and pigments, also usual auxiliaries, e.g. fillers, wetting agents, viscosity modifiers, dispersants, defoamers, preservatives and hydrophobisizers, biocides, fibers and other usual constituents. Examples of suitable fillers are aluminosilicates, silicates, alkaline earth metal carbonates, preferably calcium carbonate in the form of calcite or lime, dolomite, and also aluminum silicates or magnesium silicates, e.g. talc. The solids content of suitable conventional clear coatings is generally in the range from 20 to 60% by weight. The conventional clear coating compositions comprise as liquid component essentially water and, if desired, an organic liquid miscible with water, for example an alcohol. The conventional coating compositions are applied at a wet coating weight in the range from 50 to 500 g/m², in particular from 70 to 300 g/m², in a known manner, for example by spraying, troweling, curtain coating, knife application, brushing, rolling or pouring onto the cement bonded board, or by a combination of one or more applications.

In alternative particular embodiments, the clear coating is a radiation-curable clear coating. Radiation-curable coatings are known in the art and comprise at least one polymer A having ethylenically unsaturated double bonds, which is radiation-curable. Possible polymers A for the radiation-curable compositions are in principle any polymers having ethylenically unsaturated double bonds which can undergo radical-initiated polymerization on exposure to UV radiation or electron beam radiation. Care should be taken here that the content of ethylenically unsaturated double bonds in the polymer is sufficient to ensure effective crosslinking. The content of ethylenically unsaturated double bonds in A is generally in the range from 0,01 to 1,0 mol/100 g of A, more preferably from 0,05 to 0,8 mol/100 g of A and most preferably from 0,1 to 0,6 mol/100 g of A.

Suitable polymers A are polyurethane derivatives which contain ethylenically unsaturated double bonds, such as polyurethane acrylates.

The radiation-curable composition further comprises at least one chemically and radiation crosslinkable polymer B. Suitable polymers B are free isocyanate-bearing polyurethanes having ethylenically unsaturated double bonds. Polyurethane acrylates with free isocyanate groups are preferred. The reaction of the free isocyanate groups with moisture present in the air takes place at room temperature, in particular, in areas not exposed to radiation and hence not completely cured (back side, edges, cavities formed in the radiation-curable coating, ...). The free isocyanate content of B measured according to DIN EN ISO 11 909, ranges usually from 5 to 20% by weight. Preferably the free isocyanate content of B is between 8 and 20% by weight and more preferably between 10 and 18 % by weight. The weight ratio of B /A is preferably in the range of 0,03/0,2. A weight ratio of B/A in the range of 0,05/0,1 is particularly preferred. Besides the polymers A and B, the radiation-curable preparations may also contain a compound different from polymer A and polymer B and having a molecular weight of less than 800 g/mol and capable of polymerization by cationic or free-radical pathways. These compounds have generally at least one ethylenically unsaturated double bond and/or one epoxy group and a molecular weight being less than 800 g/mol. Such compounds generally serve to adjust to the desired working consistency of the radiation-curable preparations. This is particularly important if the preparation contains no other diluents, such as water and/or inert organic solvents, or contains these only to a subordinate extent. Such compounds are therefore also termed reactive diluents. The proportion of reactive diluents, based on the total amount of (A+B) and the reactive diluent in the radiation-curable preparation, is preferably in the range of 0 to 90% by weight, and most preferably in the range of from 5 to 50 % by weight. Preferred reactive diluents are the esterification products of di- or polyhydric alcohols with acrylic and/or methacrylic acid. Such compounds are generally termed polyacrylates or polyether acrylates. Hexanediol diacrylate, tripropylene glycol diacrylate and trimethylolpropane triacrylate are particularly preferred. The radiation-curable compositions may also comprise polymers which have cationically polymerizable groups, in particular epoxy groups. These include copolymers of ethylenically unsaturated monomers, the copolymers containing, as comonomers, ethylenically unsaturated glycidyl ethers and/or glycidyl esters of ethylenically unsaturated carboxylic acids. They also include the glycidyl ethers of OH-group-containing polymers, such as OH-group-containing polyethers, polyesters, polyurethanes and novolacs. They include moreover the glycidyl esters of polymers containing carboxylic acid groups. If it is desired to have a cationically polymerizable component, the compositions may comprise, instead of or together with the cationically polymerizable polymers, a low-molecular-weight, cationically polymerizable compound, for example a di- or polyglycidyl ether of a low-molecular-weight di- or polyol or the di- or polyester of a low-molecular weight di- or polycarboxylic acid.

The radiation-curable compositions comprise usual auxiliaries, such as thickeners, flow control agents, defoamers, UV stabilizers, emulsifiers, surface tension reducers and/or protective colloids. Suitable auxiliaries are well known to the person skilled in the coatings technology. Silicones, particularly polyether modified polydimethylsiloxane copolymers, may be used as surface additives to provide good substrate wetting and good anti-crater performance by reduction of surface tension of the coatings. Suitable stabilizers encompass typical UV absorbers, such as oxanilides, triazines, benzotriazoles (obtainable as Tinuvin™ grades from Ciba Geigy) and benzophenones. These may be used in combination with usual free-radical scavengers, for example sterically hindered amines, e.g. 2,2,6,6-tetramethylpiperidine and 2,6-di-tert-butylpiperidine (HALS compounds). Stabilizers are usually used in amounts of from 0,1 to 5,0% by weight and preferably from 0,3 to 2,5% by weight, based on the polymerizable components present in the preparation.

If curing of the radiation-curable coating is performed by UV radiation (step f), the preparations to be used comprise at least one photoinitiator. A distinction is to be made here between photoinitiators for free-radical curing mechanisms (polymerization of ethylenically unsaturated double bonds) and photoinitiators for cationic curing mechanisms (cationic polymerization of ethylenically unsaturated double bonds or polymerization of compounds containing epoxy groups). Photoinitiators are not needed for electron beam curable compositions.

Suitable photoinitiators for free-radical photopolymerization, i.e. polymerization of ethylenically unsaturated double bonds, are benzophenone and benzophenone derivatives, such as 4-phenylbenzophenone and 4-chlorobenzophenone, Michler's ketone, anthrone, acetophenone derivatives, such as 1-benzoylcyclohexan-1-ol, 2-hydroxy-2,2-dimethylacetophenone and 2,2-dimethoxy-2-phenylacetophenone, benzoin and benzoin ethers, such as methyl benzoin ether, ethyl benzoin ether and butyl benzoin ether, benzil ketals, such as benzil dimethyl ketal, 2-methyl-1-[4-(methylthio) phenyl]-2-morpholinopropan-1-one, anthraquinone and its derivatives, such as .beta.-methylanthraquinone and tertbutylanthraquinone, acylphosphine oxides, such as 2,4,6-trimethylbenzoyldiphenylphosphine oxide, ethyl-2,4,6-trimethylbenzoylphenylphosphinate and bisacylphosphine oxides. Suitable photoinitiators for cationic photopolymerization, i.e. the polymerization of vinyl compounds or compounds containing epoxy groups, are aryl diazonium salts, such as 4-methoxybenzenediazonium hexafluorophosphate, benzenediazonium tetrafluoroborate and toluenediazonium tetrafluoroarsenate, arylodonium salts, such as diphenyliodonium hexafluoroarsenate, arylsulfonium salts, such as triphenylsulfonium hexafluorophosphate, benzene- and toluenesulfonium hexafluorophosphate and bis[4-diphenylsulfoniophenyl] sulfide bishexafluorophosphate, disulfones, such as diphenyl disulfone and phenyl-4-tolyl disulfone, diazodisulfones, imidotriflates, benzoin tosylates, isoquinolinium salts, such as N-ethoxyisoquinolinium hexafluorophosphate, phenylpyridinium salts, such as N-ethoxy-4-

phenylpyridinium hexafluorophosphate, picolinium salts, such as N-ethoxy-2-picolinium hexafluorophosphate, ferrocenium salts, titanocenes and titanocenium salts.

The abovementioned photoinitiators are used, in amounts from 0,05 to 20% by weight, preferably from 0,1 to 10% by weight and in particular from 0,1 to 5% by weight, based on the polymerizable components of the radiation-curable composition.

The radiation-curable compositions are applied in a known manner, e.g. by spraying, troweling, knife application, brushing, rolling or pouring onto the cement bonded board. It is also conceivable that the preparation may be applied to the cement board by hot-melt processes or by powder-coating processes. The radiation-curable composition is preferably applied by roller-coating. The radiation-curable composition is usually applied to obtain a dry thickness in the range from 10 to 100 Pm, preferably from 50 to 80 Pm. The application may take place either at room temperature or at elevated temperature, but preferably not above 100 °C. The liquid coated surface is roll-covered with a radiation permeable film before applying radiation. Care is taken to have an intimate contact between the liquid coated panels and the controlled surface layer of the film, in order to remove entrapped bubbles and air pockets between the overlying film and the panel by the roller. This film provides protection against the radical chain-breaking reaction of oxygen, and avoids the use of inert gas atmosphere in the case of electron beam curing. Moreover, this covering film has a controlled gloss surface with a predetermined surface finish on the side in contact with the liquid coated panel surface. Suitable radiation permeable films are thin plastic films of polyester or polyolefins. The controlled surface gloss on the radiation permeable film can be obtained in various ways, such as embossing, printing, coating, etching or by the use of matting additives. Moreover, the radiation permeable film with its regularly distributed surface micro-roughness can possibly be texturized, e.g. allowing labeling.

The radiation curable coating may be cured by exposure to UV radiation of wavelength generally from 200 to 600 nm. Suitable examples of UV sources are high and medium pressure mercury, iron, gallium or lead vapor lamps. Medium pressure mercury vapor lamps are particularly preferred, e.g. the CK or CK1 sources from the company IST (Institut für Strahlungstechnologie). The radiation dose usually sufficient for crosslinking is in the range from 80 to 3000 mJ/cm². Any solvent present, in particular water, is dried out before the curing in a separate drying step preceding curing, for example by heating to temperatures in the range from 40 to 80 °C, or by exposure to IR radiation.

In case of electron beam curing, irradiation is performed with high-energy electrons (usually from 100 to 350 keV, by applying a high voltage to tungsten filaments inside a vacuum chamber), and the actual curing step takes place in an inert, oxygen-free atmosphere. After irradiation, the covering film is removed by peeling it off.

In other particular embodiments, the clear coating applied on the pale-colored fiber cement products of the invention is a combination of one or more layers of a conventional clear coating and one or more layers of a radiation curable clear coating.

5 In particular embodiments, at least one layer of the conventional clear coating composition and/or at least one layer of the radiation-curable clear coating of the products of the present invention comprises at least one white pigment. In further particular embodiments, at least one layer of the conventional clear coating and/or radiation curable clear coating composition comprises about 0.5 weight % to about 4 weight % (compared to the total dry weight of the coating composition) of a white
10 pigment. In further particular embodiments, at least one layer of the conventional clear coating and/or radiation curable clear coating comprises about 1% to about 2% (compared to the total dry weight of the fiber cement composition of said fiber cement product) of a white pigment. In yet further particular embodiments, at least one layer of conventional clear coating and/or radiation curable clear coating composition comprises about 1 weight % to about 2 weight % (compared to the total dry weight of the
15 coating composition) of TiO_2 .

In particular embodiments of the present invention, the white pigments, suitable for pigmenting the clear coating for application onto the pale-colored fiber cement products of the present invention, are essentially alkali-resistant pigments, i.e. resistant to a pH of about 8 or higher, such as resistant to a pH of about 9 or higher, such as resistant to a pH of about 10 or higher, such as resistant to a pH of
20 about 11 or higher, more particularly resistant to a pH of higher than about 12 or higher than about 13.

In a second aspect, the present invention provides methods for the manufacture of pale-colored fiber cement products according to the invention, which methods at least comprise the steps of:

- 25 a) Providing a fiber cement slurry at least comprising white cement and synthetic fibers, which synthetic fibers are pigmented with at least one dark pigment chosen from the group consisting of a black pigment, a brown pigment and a gray pigment;
- b) Manufacturing a fiber cement product by means of a fiber cement production process;
- c) Curing the fiber cement product, so as to obtain the pale-colored fiber cement product.

30

In the first step a) of the methods of the present invention, a fiber cement slurry can be prepared by using one or more sources of at least white cement, water and pigmented synthetic fibers in the amounts as previously disclosed herein. In certain specific embodiments, these one or more sources of at least white cement, water and pigmented synthetic fibers are operatively connected to a
35 continuous mixing device constructed so as to form a cementitious fiber cement slurry.

In particular embodiments, the present invention provides methods for the manufacture of pale-colored fiber cement products, wherein at least one white pigment is added in the fiber cement slurry during step a) of providing a fiber cement slurry. In further particular embodiments, the white pigment is added in an amount of between about 3 weight % and about 6 weight % (compared to the total dry weight of the fiber cement composition) of the fiber cement product. In further particular
5 embodiments, the at least one white pigment is TiO_2 .

Once a fiber cement slurry is obtained, the manufacture of the fiber cement products can be executed according to any known procedure. Indeed, in the methods of the invention, the step b) of providing a fiber cement product, can be performed according to any method known in the art for preparing
10 fiber cement products, which products at least comprise white cement, water and pigmented synthetic fibers.

The process most widely used for manufacturing fiber cement products is the Hatschek process, which is performed using a modified sieve cylinder paper making machine. Other manufacturing processes that can be used include the Magnani process, injection, flow-on, extrusion and others. In particular
15 embodiments, the fiber cement products of the present invention are provided by using the Hatschek process. The “green” or uncured fiber cement product is optionally post-compressed usually at pressures in the range from about 22 to about 30 MPa to obtain the desired density.

The processes according to the present invention may further comprise the step of cutting the fiber cement products to a predetermined length to form a fiber cement product. Cutting the fiber cement
20 products to a predetermined length can be done by any technique known in the art, such as but not limited to water jet cutting, air jet cutting or the like. The fiber cement products can be cut to any desirable length and width but preferably to the dimensions as disclosed previously herein for the products of the present invention. Thus, in particular embodiments, the pale-colored fiber cement
25 products of the present invention can be cut into specific dimensions so as to form fiber cement boards, panels, plates, sidings, planks, tiles etc.

It will be understood by the skilled person that the processes of the present invention may further comprise additional steps of processing the produced fiber cement products.

For instance, in certain particular embodiments, during the processes of the present invention, the fiber cement slurry and/or the fiber cement products may undergo various intermediate treatments, such as but
30 not limited to treatment with one or more hydrophobic agents, treatment with one or more flocculants, additional or intermediate pressing steps, etc.

As soon as the fiber cement products are formed, these are trimmed at the lateral edges. The border strips can optionally be recycled through immediate mixing with the recycled water and directing the mixture to
35 the mixing system again.

In step c) of the methods of the present invention, the obtained fiber cement products are cured. Indeed, after production, fiber cement products can be allowed to cure over a time in the environment in which they are formed, or alternatively can be subjected to a thermal cure (e.g. by autoclaving or the like).

In particular embodiments, the fiber cement products of the present invention are air-cured. This air-curing step involves curing the green fiber cement products under ambient conditions for about 2 to 4 weeks, such as for about 3 weeks.

It has been found by the present inventors that air-cured fiber cement products as produced according to the methods as disclosed herein perform particularly well, especially having regard to their mechanical characteristics, such as impact resistance and mechanical strength. This will become clear from the Examples as further described herein.

In yet further particular embodiments, the “green” fiber cement products may be first pre-cured to the air, after which the pre-cured product is further air-cured until it has its final strength to give the product its final properties.

In particular embodiments of the present invention, the processes may further comprise the step of thermally drying the obtained fiber cement products. After curing, the fiber cement product being a panel, sheet or plate, etc. may still comprise a significant weight of water, present as humidity. This may be up to 10 even 15 %w, expressed per weight of the dry product. The weight of dry product is defined as the weight of the product when the product is subjected to drying at 105°C in a ventilated furnace, until a constant weight is obtained.

In certain embodiments, the fiber cement product is dried. Such drying is done preferably by air drying and is terminated when the weight percentage of humidity of the fiber cement product is less than or equal to 8 weight %, even less than or equal to 6 weight %, expressed per weight of dry product, and most preferably between 4 weight % and 6 weight %, inclusive.

During step (a) of the methods of the present invention, one or more white pigments may be added to the fiber cement in order to increase the pale or white color intensity of the fiber cement product in production. Methods for coloring fiber cement products in the mass are known to the person skilled in the art.

This may for example (but not necessarily only) be achieved by adding one or more white pigments to the fiber cement slurry prior to the production of the fiber cement product.

In particular embodiments of the methods of the present invention, the at least one white pigment for use in the fiber cement products of the present invention is white titanium oxide. In further particular embodiments, the at least one white pigment for use in the fiber cement products of the present invention is white titanium oxide in a total amount of about 3 to 6 weight % (weight % total pigment compared to the total dry weight of the fiber cement composition).

In particular embodiments of the present invention, the white pigments suitable for use in the fiber cement products of the present invention are essentially alkali-resistant, i.e. resistant to a pH of about 8 or higher, such as resistant to a pH of about 9 or higher, such as resistant to a pH of about 10 or higher, such as resistant to a pH of about 11 or higher, more particularly resistant to a pH of higher than about 12 or higher than about 13.

In particular embodiments of the present invention, the methods may further comprise the step of surface treating the produced uncoated pale-colored fiber cement products. Surface treatments may include, without limitation, abrasive blasting, engraving, embossing and the like, of a decorative pattern onto or into the fiber cement product surface.

In particular embodiments of the present invention, the methods may further comprise the step of coating the produced pale-colored fiber cement products with a clear conventional coating and/or with a clear radiation-curable coating as described in detail herein.

In a third aspect, the present invention provides pale-colored fiber cement products obtainable by any of the methods according to the present invention.

In a fourth aspect, the present invention provides uses of the pale-colored fiber cement products according to the present invention as building materials.

In particular embodiments, the present invention provides uses of the pale-colored fiber cement products according to the present invention as an outer surface to walls, applied internally or externally, e.g. as façade plate, siding, etc. In other particular embodiments, the pale-colored fiber cement products according to the present invention can be used for decking or flooring applications, fencing applications and/or covering applications.

The invention will now be further illustrated in detail with reference to the following Examples.

EXAMPLES

It will be appreciated that the following examples, given for purposes of illustration, are not to be construed as limiting the scope of this invention. Although only a few exemplary embodiments of this invention have been described in detail above, those skilled in the art will readily appreciate that many modifications are possible in the exemplary embodiments without materially departing from the novel teachings and advantages of this invention. Accordingly, all such modifications are intended to be included within the scope of this invention that is defined in the following claims and all equivalents thereto. Further, it is recognized that many embodiments may be conceived that do not achieve all of the advantages of some embodiments, yet the absence of a particular advantage shall not be construed to necessarily mean that such an embodiment is outside the scope of the present invention.

It will become clear from the experimental results as described below that the fiber cement products of the present invention are characterized by an attractive esthetic appearance because of their pale-colored aspect and their original surface pattern as achieved through the presence of the dark-pigmented synthetic fibers (as shown in Figures 1 to 6).

Example 1: Manufacture of pale-colored fiber cement products according to the present invention

Fiber cement products were produced with the methods of the present invention as described herein according to the following specific embodiments.

1.1 Materials & Methods**1.1.1 Production of fiber cement slurry samples**

Formulations of an aqueous fiber cement slurry were prepared as shown in Table 1. Other additives may have been added to these formulations, without being essential to the findings of the present invention.

1.1.2 Manufacture of fiber cement product on mini-Hatschek machine

Cementitious products were manufactured by the Hatschek technique according to a pilot process reproducing the main characteristics of the products obtained by the industrial process.

The green sheets were pressed at 230 kg/cm² and air-cured by subjecting them to a curing at 60°C for 8 hours, and thereafter curing at ambient conditions. After two weeks, half of the formed fiber cement products were left uncoated and half of the formed fiber cement products were coated with a conventional clear coating comprising 1-2% of TiO₂ in the top layer. All the resulting products were

observed and photographed and reflectance measurements were done to determine the whiteness of the products.

Ingredient	Dry weight (kg)	Weight %
White cement	769	76.9
*Cellulose fibers	28	2.8
PVA fibers 8 dtex	19	1.9
White pigment	46	4.6
**Gray pigmented PP fibers 70 dtex	19	1.9
Limestone	100	10
Additives	19	1.9

Table 1. Fiber cement formulation of a pale-colored fiber cement product according to the present invention (PVA: polyvinyl alcohol; PP: polypropylene; Weight % refers to the mass of the component over the total mass of all components except free water, i.e. the dry matter.

**Kraft softwood bleached cellulose*

***PP synthetic fibers were pigmented with a gray pigment during production and milled afterwards. Milling of the PP fibers provided a length distribution of between about 0.2 mm and about 3 mm, with an average fiber length of between about 1 mm and about 2 mm. RGB color of the fibers was Red: 178; Green: 176; Blue: 170 (HEX code: B2 B0 AA).*

1.2 Results

The whiteness of the produced uncoated pale-colored fiber cement product according to the invention, expressed as L^*a^*b L-value, was $L^* = 87.98$, $a^* = 0.23$, $b^* = 4.48$ (Cie-Lab).

The whiteness of the produced coated pale-colored fiber cement product according to the invention, expressed as L^*a^*b L-value, was $L^* = 87.18$, $a^* = 0.05$, $b^* = 4.21$ (Cie-Lab).

Figures 1 to 6 show that the surface of the fiber cement products of the present invention displays the texture and color of the core materials, which provides the products with a natural yet modern look. In particular, the pale-colored fiber cement products of the present invention expose the natural texture of both the cement (which is white-colored or pale-colored) and the synthetic fibers (which are dark-colored), creating an appealing contrast between both components.

Claims

1. A pale-colored fiber cement product at least comprising white cement and synthetic fibers,
wherein the synthetic fibers are pigmented with at least one dark pigment chosen from the group
5 consisting of a black pigment, a brown pigment, a blue pigment, a red pigment, a green pigment
and a gray pigment.
2. The pale-colored fiber cement product according to claim 1, wherein said synthetic fibers are
polypropylene fibers.
- 10 3. The pale-colored fiber cement product according to claims 1 or 2, wherein said synthetic fibers are
polypropylene fibers having a thickness of about 70 dtex.
4. The pale-colored fiber cement product according to any of claims 1 to 3, wherein said synthetic
15 fibers are milled polypropylene fibers having an average length of about 1 mm to about 2 mm.
5. The pale-colored fiber cement product according to any of claims 1 to 4, wherein said synthetic
fibers are pigmented with at least one dark pigment, which is a gray iron oxide, a black iron oxide,
a brown iron oxide, or carbon black.
- 20 6. The pale-colored fiber cement product according to any of claims 1 to 5, which further comprises
a white pigment.
7. The pale-colored fiber cement product according to claim 6, wherein said white pigment is
25 titanium oxide (TiO₂).
8. The pale-colored fiber cement product according to claim 6 or 7, wherein said white pigment is
present in an amount of between about 3 weight % and about 6 weight % (compared to the total
dry weight of the fiber cement composition) of said fiber cement product.
- 30 9. The pale-colored fiber cement product according to any of claims 1 to 8, which further comprises
limestone (CaCO₃) in an amount of between about 5 weight % and about 15 weight % (compared
to the total dry weight of the fiber cement composition of said fiber cement product).
- 35 10. The pale-colored fiber cement product according to any of claims 1 to 9, which is coated with a
clear coating.

11. The pale-colored fiber cement product according to claim 10, wherein said clear coating comprises between about 0.5 weight % to about 4 weight % (compared to the total dry weight of the fiber cement composition of said fiber cement product) of a white pigment.

5

12. The pale-colored fiber cement product according to claim 11, wherein said white pigment is titanium oxide (TiO₂).

10

13. A method for the manufacture of a pale-colored fiber cement product according to any of claims 1 to 12, comprising at least the steps of:

d) Providing a fiber cement slurry at least comprising white cement and synthetic fibers, which synthetic fibers are pigmented with at least one dark pigment chosen from the group consisting of a black pigment, a brown pigment and a gray pigment;

e) Manufacturing a fiber cement product by means of a fiber cement production process;

15

f) Curing the fiber cement product, so as to obtain said pale-colored fiber cement product.

14. The method according to claim 13, wherein said step c) of curing the fiber cement product comprises air-curing the fiber cement product.

20

15. Use of a pale-colored fiber cement product according to any of claims 1 to 12 as a building material.

25

30

35

FIGURES

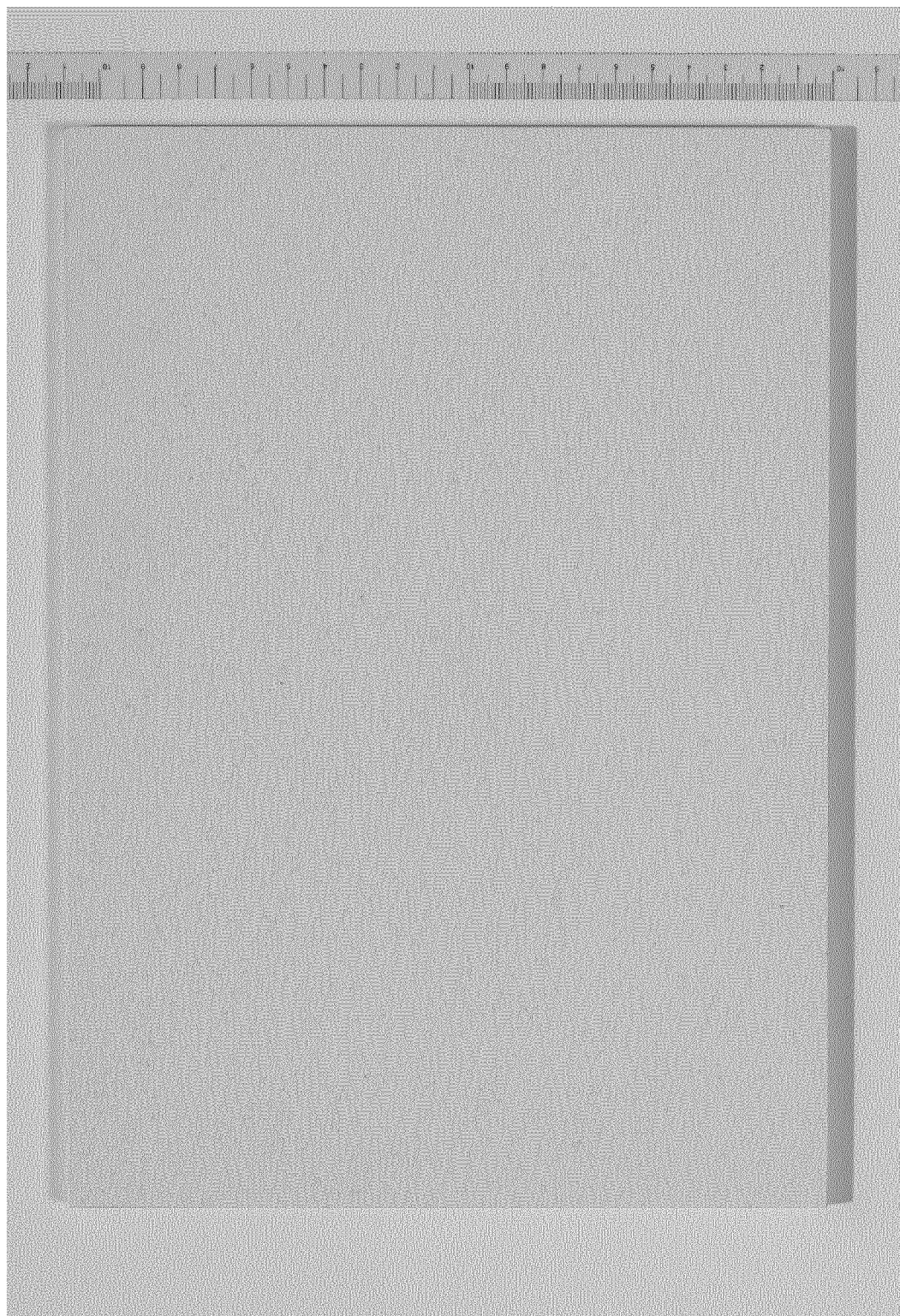


Figure 1

**Figure 2**

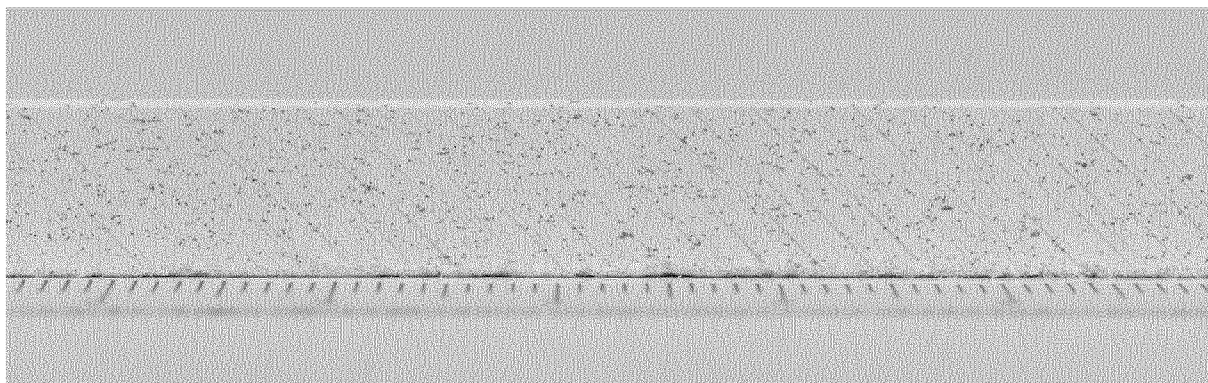


Figure 3

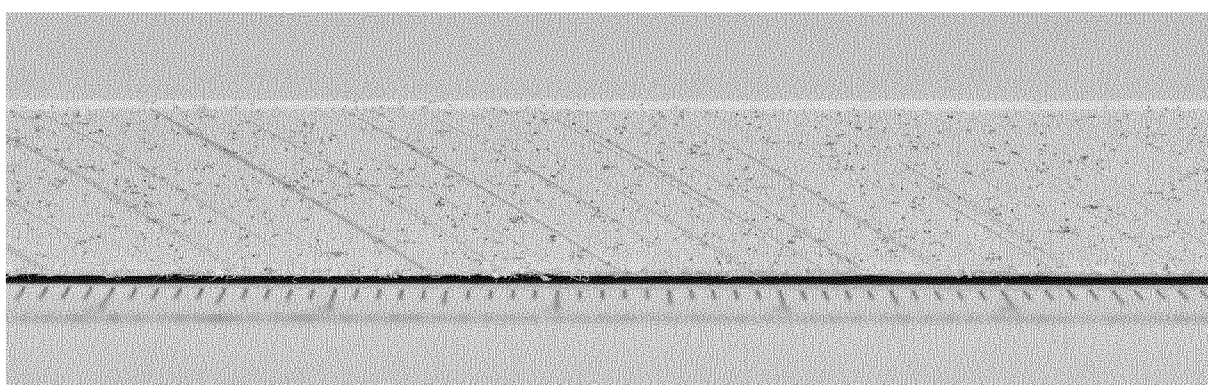


Figure 4

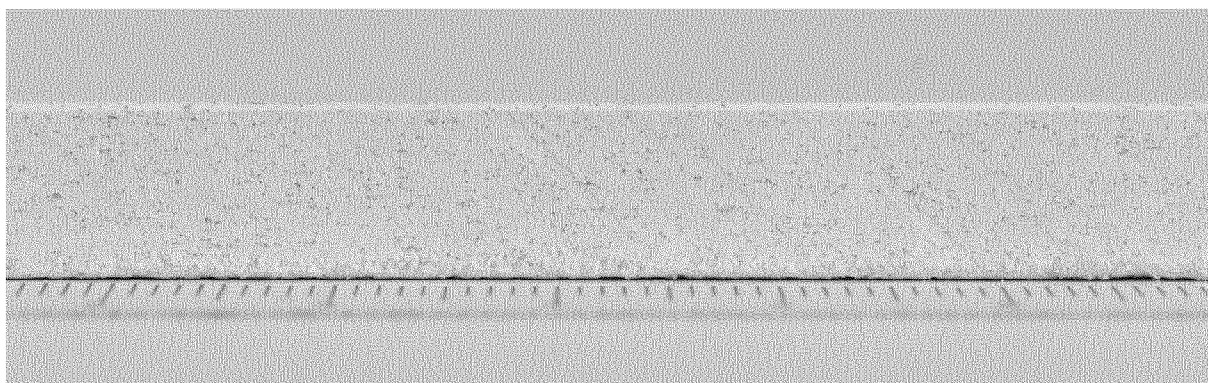


Figure 5

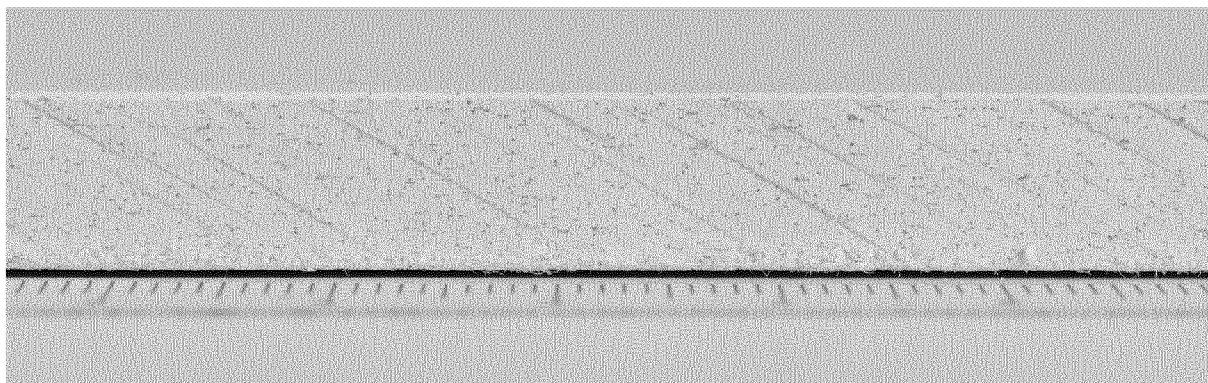


Figure 6

INTERNATIONAL SEARCH REPORT

International application No

PCT/EP2018/057774

A. CLASSIFICATION OF SUBJECT MATTER

INV. C04B28/04 C04B16/06
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

C04B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP 2 172 434 A1 (REDCO SA [BE]) 7 April 2010 (2010-04-07) paragraphs [0004], [0006], [0010], [0017], [0019] - paragraphs [0021], [0026]; tables 1-3 -----	1-15
A	WO 2016/202680 A1 (ETERNIT AG [DE]) 22 December 2016 (2016-12-22) pages 1, 8, lines 11-14, 22-28; claim 1; example 1 -----	1-15
A	CN 101 955 343 A (WENGUANG CHEN) 26 January 2011 (2011-01-26) WPI abstract and machine translated document -----	1-15



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

13 June 2018

Date of mailing of the international search report

27/06/2018

Name and mailing address of the ISA/

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040,
Fax: (+31-70) 340-3016

Authorized officer

Philippart, Anahí

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/EP2018/057774

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 2172434	A1	07-04-2010	BR PI0920780 A2 22-12-2015
			CO 6351769 A2 20-12-2011
			DK 2172434 T3 01-06-2015
			EP 2172434 A1 07-04-2010
			ES 2537053 T3 02-06-2015
			JP 5770091 B2 26-08-2015
			JP 2012504540 A 23-02-2012
			PE 00722012 A1 23-02-2012
			PT 2172434 E 17-07-2015
			WO 2010037628 A1 08-04-2010
WO 2016202680	A1	22-12-2016	EP 3106448 A1 21-12-2016
			EP 3307696 A1 18-04-2018
			WO 2016202680 A1 22-12-2016
CN 101955343	A	26-01-2011	NONE



(11) **EP 2 172 434 B1**

(12) **EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention
of the grant of the patent:
11.03.2015 Bulletin 2015/11

(51) Int Cl.:
C04B 16/06 (2006.01) C04B 28/02 (2006.01)

(21) Application number: **08165671.2**

(22) Date of filing: **02.10.2008**

(54) **Fibre-cement product compositions and shaped products obtained therefrom.**

Zusammensetzung für Faserzementprodukte und daraus hergestellte Formprodukte

Compositions de produit de fibrociment et produits formés obtenus à partir de celles-ci

(84) Designated Contracting States:
**AT BE BG CH CY CZ DE DK EE ES FI FR GB GR
HR HU IE IS IT LI LT LU LV MC MT NL NO PL PT
RO SE SI SK TR**

(43) Date of publication of application:
07.04.2010 Bulletin 2010/14

(73) Proprietor: **REDCO S.A.**
1880 Kapelle-op-den-Bos. (BE)

(72) Inventor: **De Lhoneux, Benoit,**
1880 Kappelle-op-den-Bos, (BE)

(74) Representative: **Van Steenlandt, Wim August**
Maria et al
Redco NV-SA
Research And Development Company
Kuiermansstraat 1
1880 Kapelle-op-den-Bos (BE)

(56) References cited:
EP-A- 0 363 891 EP-A- 1 854 770
FR-A- 2 808 795 JP-A- 2001 139 360
JP-A- 2002 011 715 JP-A- 2004 352 556

EP 2 172 434 B1

Note: Within nine months of the publication of the mention of the grant of the European patent in the European Patent Bulletin, any person may give notice to the European Patent Office of opposition to that patent, in accordance with the Implementing Regulations. Notice of opposition shall not be deemed to have been filed until the opposition fee has been paid. (Art. 99(1) European Patent Convention).

Description**Field of the invention**

5 [0001] The invention concerns a fibre-cement product composition comprising reinforcing fibres comprising polypropylene fibres (A) and other synthetic organic fibres (B).

[0002] The invention relates also to shaped fibre-cement products manufactured from said composition. Roof and façade elements, flat and corrugated sheets and slates can be cited amongst others as examples of shaped fibre-cement products.

10

State of the art

[0003] Shaped fibre-cement products are manufactured starting from an aqueous suspension comprising hydraulic binders, reinforcing and processing fibres, and possibly fillers and additives. This aqueous suspension is mixed in order to obtain a uniform distribution of the components. This suspension is then dewatered. The so obtained green fresh product can be shaped into a flat sheet, a corrugated sheet or a tube. The green shaped product is then hardened under atmospheric conditions or under specific pressure, temperature and humidity conditions.

15 [0004] The Hatschek process is most widely known for the manufacturing of fibre-cement products. This process, initially applied to the asbestos-cement, is exhaustively described in the book "Asbestzement" by Harald Klos (Springer Verlag, 1967). Other manufacturing processes known by the man skilled in the art which can be cited are Magnani, Mazza, Flow-on, extrusion and injection. The Hatschek process, particularly suited for the manufacture of flat sheets, corrugated sheets and tubes, is based on the use of a dewatering cylindrical sieve. In this way, a layer originating from a diluted suspension of fibres, cement, fillers and additives contained in a vat is transferred to a felt, through a cylindrical sieve; this layer is then enrolled on a forming drum until the required thickness of the sheet is obtained.

20 [0005] The fibre-cement sheet shaped on the forming drum is cut and removed from the drum, once the desired thickness is obtained. This sheet is then subjected to a forming step, which in the case of corrugated sheets consists of putting it between corrugated templates, for instance metal corrugated templates which have been oiled. Afterwards, it is submitted to a hardening stage at room temperature (air curing).

For certain applications the green product is compressed between the forming and the curing stage (post-compression). We call these pressed fibre-cement products opposed to non-pressed fibre-cement products. The pressed fibre-cement products are compressed at pressures equal to or higher than 4,9 MPa. Usually, the applied pressures are comprised between 9,8 MPa and 24,5 MPa.

30 [0006] The reinforcing and processing fibres have to be alkali-resistant (e.g. to saturated calciumhydroxide solutions). They also have to be easily dispersable in an aqueous diluted cement dispersion. They have to remain uniformly dispersed upon the addition of other additives as well. The good dispersion of fibres is important on the one hand to make sure that these fibres do not form agglomerates, and on the other hand to ensure the homogeneous concentration of the fibres in the finished fibre-cement product. The fibres used as reinforcing agents must also have good mechanical properties. The literature contains publications related to the use of natural or synthetic organic and inorganic fibres. Thus fibres of cellulose, polyamide, polyester, polyacrylonitrile (PAN), polypropylene (PP) and poly (vinylalcohol) (PVA) were used for the reinforcement. In the same way, work has been done with glass, steel, aramide and carbon fibres. Unfortunately, no natural or synthetic fibre has all the previously mentioned properties. Besides, it is important to manufacture shaped fibre-cement products with good mechanical properties and at an interesting cost price. Accordingly, it is known to use hydraulic setting compositions comprising synthetic reinforcing fibres. Among reinforcement fibres currently used, fibres of polyacrylonitrile (PAN) and poly (vinylalcohol vinyl) (PVA) are generally preferred. Separately or in combination, these fibres make it possible to manufacture shaped fibre-cement products which have a high tensile strength and flexural resistance. Unfortunately, PVA and PAN fibres do not confer to the shaped products a sufficient impact resistance, especially after ageing during exterior exposure. The polypropylene (PP) fibres have an excellent resistance to alkalis, even at temperatures close to 110 °C. These fibres are durable and inexpensive. However, PP fibres only are in general technically insufficient to reinforce cement containing materials.

45 [0007] Document JP2004-352556 discloses hydraulic compositions comprising PVA reinforcing fibres having a titre of 2 or 2,2 dtex and polypropylene fibres characterized by a titer of 2,2 dtex. However, the fibre-cement plates obtained from such compositions have an insufficient impact resistance when they are used for example for roofing applications, and more particularly after natural ageing during exposure to carbon dioxide present in the air. Patent application EP-A-1854770 describes compositions for the manufacture of fibre-cement articles comprising poly (vinylalcohol) fibres characterized by a titre of at least 4,0 dtex and lower than 15,0 dtex, and synthetic organic fibres selected among fibres made of poly (vinylalcohol) with a titre of at least 1,5 dtex and lower than 3,0 dtex, or of polymers or copolymers of propylene having a titre of at least 0,7 dtex and lower than 3,0 dtex or their blends. The products manufactured from these compositions have an enhanced impact resistance with respect to the prior art, but there is still a need for im-

50

provement.

Summary of the invention

5 **[0008]** It is a purpose of the invention to propose a composition for the manufacture of fibre-cement products comprising polypropylene fibres (A) and synthetic organic fibres (B), which discards the disadvantages of the existing compositions.

[0009] It is a purpose of the invention to propose a composition for fibre-cement products which is easy to implement and comprising inexpensive reinforcing fibres resistant to alkalis, and which present a homogeneous and stable dispersion as well as a high reinforcement capacity. Moreover, it is a question of proposing a composition of fibre-cement products
10 with an excellent processability, a good flexural resistance and a high and durable impact resistance, even after ageing during external exposure, and whose cost is not prohibitory.

[0010] To this end, the composition according to the invention is **characterized in that** it comprises polypropylene fibres (A) and synthetic organic fibres (B), **characterized in that** :

- 15 - the polypropylene fibres (A) have a titre higher than 6,0 dtex and lower than 20,0 dtex.; and
- the synthetic organic fibres (B) are selected among poly(vinylalcohol) fibres (B1) with a titre of at least 0,5 dtex and lower than 15,0 dtex, or polypropylene fibres (B2) having a titre of at least 0,5 dtex and lower than 3,0 dtex (B2) or their blends.

20 **[0011]** Compositions comprising polypropylene fibres (A) having a titre not higher than 6,0 dtex result in fibre-cement articles with a lower impact resistance. Compositions comprising polypropylene fibres (A) having a titre of at least 20, 0 dtex suffer from a bad dispersability. Preferably, the composition according to the present invention comprises polypropylene fibres (A) having a titre of at least 10,0 dtex and lower than 18,0 dtex.

[0012] The composition according to the present invention comprises synthetic organic fibres (B) selected among poly(vinylalcohol) fibres (B1) with a titre of at least 0,5 dtex and lower than 15,0 dtex, or polypropylene fibres (B2) having
25 a titre of at least 0,5 dtex and lower than 3,0 dtex (B2) or their blends. Compositions comprising poly(vinylalcohol) fibres (B1) having a titre lower than 0,5 dtex suffer from a bad processability, whereas poly(vinylalcohol) fibres (B1) having a titre of at least 15 dtex suffer from bad dispersion and lead to fibre-cement products which do not have the required mechanical properties. Compositions comprising poly(vinylalcohol) fibres (B1) with a titre of at least 1,0 dtex and lower
30 than 10,0 dtex are preferred. Compositions comprising polypropylene fibres (B2) characterized by a titre lower than 0,5 dtex give rise to processing problems during the manufacturing of fibre-cement products. Compositions comprising polypropylene fibres (A) and polypropylene fibres (B2), the latter characterized by a titre of at least 3,0 dtex, cause dispersion problems and hence lead to fibre-cement products with inferior mechanical properties. Compositions comprising polypropylene fibres (B2) with a titre of at least 0,7 dtex and lower than 2,5 dtex are preferred.

35 **[0013]** Preferably, the polypropylene fibres (A) of the composition according to the present invention have a length in the range of from 6 mm to 30 mm. Fibres (A) with a length of from 8 to 25 mm are particularly preferred. Good results are obtained with fibres(A) characterized by a length of from 10 to 15 mm. Compositions comprising polypropylene fibres (A) characterized by a length shorter than 6 mm or longer than 30 mm lead to fibre-cement articles with an inferior impact resistance.

40 Preferably, the length of the other synthetic fibres (B) of the composition according to the present invention is in the range of from 2 to 20 mm. Synthetic fibres (B) characterized by a length of from 4 to 10 mm are particularly preferred.

[0014] According to a particular embodiment, the composition according to the invention is **characterized in that** it comprises fibres (A) and fibres (B) characterized by a tenacity of at least 8 cN/dtex.

Fibre-cement products comprising fibres (A) and (B) whose tenacity is lower than 8 cN/dtex do not have the required
45 mechanical properties.

[0015] The composition according to the present invention comprises preferably from 0,05 to 5,0 weight % of fibres (A) with respect to the total dry weight of the composition. In order to make reading easier and for clarity, the expression "weight percentage of fibre" used in the following description must be understood as related to fibres in a composition, like "weight percentage of fibre weight compared to the initial dry total weight of the composition".

50 Products manufactured from compositions comprising less than 0, 05 weight % of fibres (A) suffer from a low impact resistance. Compositions comprising more than 5, 0 weight % of fibres (A) give fibre-cement products having insufficient mechanical properties due to a bad dispersion of fibres in the cement matrix. Compositions comprising from 0, 1 to 1,5 weight % of fibres (A) are particularly preferred.

[0016] According to an advantageous embodiment, the composition according to the invention is **characterized in that** it comprises from 0, 5 to 5 weight % of fibres (B) with respect to the total initial dry weight of the composition. Indeed,
55 the fibre-cement products manufactured using compositions comprising less than 0, 5 weight % of fibres (B) weight suffer from a flexural resistance which is too low. In addition, products manufactured from compositions comprising more than 5 weight% of fibres (B) have insufficient mechanical properties due to a bad dispersion of fibres in the cement

matrix. Advantageously, the composition according to the present invention comprises from 0, 5 to 3, 5 weight % of fibres (B). Good results were obtained with compositions comprising from 0,5 to 2,5 weight % of fibres made of poly(vinylalcohol) (B1) and from 0,3 to 1,0 weight % of polypropylene fibres (B2).

[0017] The section of the fibres (A) and (B) can be circular or of irregular form, for example in form of X or Y. The fibres can be textured while they are stretched or afterwards. According to a particular embodiment, the fibres (A) and/or (B2) can also be obtained starting from an extruded polypropylene film. The fibres can then present the shape of ribbon. Preferably, the polypropylene fibres (A) and (B2) are multifilaments with a circular cross-section and obtained by melt-spinning through a spinnerette. The fibres (A) and (B2) are made of polymers, co- or terpolymers of propylene and can be obtained from any type of polypropylene resin usually used. At least a part of the fibres (A) and/or (B2) can possibly comprise fillers. Preferably, they can moreover possibly comprise a hydrophilizing agent such as an alkaline metal salt of an alkylphosphate, such as a potassium or sodium salt, comprising advantageously from 8 to 18 carbon atoms. According to an alternative mode of execution, the fibres (A) and/or (B2) can be made of high isotacticity polypropylene. According to another form of execution of the invention, the fibres (A) and/or (B2) can comprise coextruded bicomponent fibres, consisting for example, of a core and an external layer, the latter containing fillers, preferably alkaline earth metal carbonate particles, such as for example, calcium carbonate, magnesium carbonate or their blends. According to an advantageous procedure of this invention, the fibres (A) and/or (B2) have been submitted to a surface oxidation treatment, such as corona discharge or plasma, in order to improve their affinity to the cement matrix. According to a particularly advantageous alternative of this invention, the fibres (A) and/or (B2) can have undergone a surface oxidation treatment, followed by a treatment using wetting agents, which can be applied by spraying of or by immersion in a hydrophilic avivage or more preferably an aqueous dispersion of polar organic polymers or a dispersion of olefinic homopolymers or copolymers of olefinic monomers modified after synthesis by polar groups chosen preferably among maleic anhydride, acrylic acid, or the methacrylic acid, and obtained for example by grafting.

[0018] According to another preferred embodiment of the present invention, the fibres (A) are characterized by a Young's modulus of at least 160cN/dtex. Polypropylene fibres (A) having an elongation at breakage not higher than 17% are preferred. The use of fibres (A) with a Young's modulus of at least 160 cN/dtex and/or an elongation at break not higher than 17% gives fibre-cement articles with enhanced impact properties.

[0019] The composition according to the present invention preferably further comprises cellulose fibres. Cellulose fibres obtained from chemical wood pulp are preferred. Kraft pulp is particularly preferred. The cellulose fibres can be bleached or unbleached. Suitable pulps are processed from softwood, e.g. Pinus Radiata or hardwood. Good results were obtained with cellulose fibres from unbleached, softwood kraft pulp. Cellulose fibres characterized by a Kappa number in the range of 20 to 40, more particularly in the range of 20 to 30 are especially preferred. Cellulose fibres refined to a Shopper Riegler degree in the range of 15 to 85, more particularly in the range of 25 to 70 give satisfactory results. Preference is given to cellulose fibres with a length determined according to TAPPI method T271 in the range of from 0,8 to 4 mm. Cellulose fibres with an alkali soluble content as measured according to TAPPI method T212 below 3,5 weight% are suitable. Preferable compositions comprise from 0,5 to 12 weight% of cellulose fibres. Particularly preferred compositions comprise from 1 to 10 weight% of cellulose fibres. Good results were obtained with compositions comprising from 1 to 5 weight% of cellulose fibres.

[0020] According to a particular embodiment, the composition according to the invention is **characterized in that** it comprises besides cellulose fibres, the fibres (A) and the fibres (B), other reinforcing fibres chosen among inorganic or organic fibres. Preferably, the organic fibres are selected among fibres of polyacrylonitrile, polyamide, polyester, aramide and carbon. Advantageously, the inorganic fibres are selected among glass fibres, rockwool, slag wool, wollastonite fibres, ceramic fibres and similars. The composition according to the present invention can further comprise fibrils, for example, polyolefinic fibrils.

[0021] According to a particular embodiment, the composition according to the invention is **characterized in that** it comprises cement as hydraulic binder. Advantageously, cement is selected among Portland cement, cement with high alumina content, Portland cement of iron, the trass-cement, slag cement, plaster, calcium silicates formed by autoclave treatment and combinations of particular binders. Portland cement is particularly well suited.

[0022] According to a particular embodiment, the composition according to the invention is **characterized in that** it possibly comprises fillers and additives. The additives are preferably selected among the dispersants, plasticizers and the flocculants. The fillers are advantageously selected among the fly-ashes, amorphous silica, ground quartz, the ground rock, clays, blast furnace slag, carbonates, pozzolanas, etc. The total quantity of fillers is, preferably, lower than 50 weight % compared to the total initial dry weight of the composition.

[0023] It is an object of the invention to provide fibre-cement products having a satisfactory flexural resistance combined with an excellent impact resistance, even after ageing. For this reason, the fibre-cement product according to the invention is **characterized in that** it is manufactured starting from a composition according to the present invention. The product according to the invention has a good Charpy impact resistance, measured according to standard ASTM D- 256-81 (method B), even after ageing during exposure to carbon dioxide. In addition, the product according to the present invention has a high flexural modulus. According to a particular embodiment, the product according to the invention is

preferably a roofing or façade element, a flat or corrugated sheet. The composition according to the invention is particularly suited to the manufacture of corrugated sheets. According to another particular embodiment, the product has the shape of a pipe, of a tank storage element or of all other accessories of various shapes.

5 Detailed description of particular embodiments

[0024] It will be obvious for a person skilled in the art that the present invention is not limited to what was disclosed and described particularly above. All new characteristics and each combination of these characteristics belong to the scope of the invention. The numerical references in the claims do not limit the scope of their protection. The use of the verbs "to comprise or to include" and their conjugated forms does not exclude the presence of other elements than those cited in the claims. The use of the article "a or an" in front of an element, does not exclude the presence of a plurality of such elements. The invention is described hereafter in a detailed way using particular examples of embodiment.

15 EXAMPLES

[0025] The characteristics of the fibres are given in table 1.

Table 1

Fibre	Type	Titre (dtex)	Length (mm)	Tenacity (cN/dtex)	E-modulus (cN/dtex)	Elongation at break (%)
Fibre (A) (1)	PP ^(a)	11,4	13	11,0	188	12,4
Fibre (A)(2)	PP ^(a)	11,4	25	11,0	188	12,4
Fibre (B1)(1)	PVA ^(b)	2,0	6	14,3	359	5,7
Fibre (B1)(2)	PVA ^(b)	7,0	6	11,5	290	6,4
Fibre (B2)	PP ^(a)	0,9	6	9,5	116	21,9
(a) PP : polypropylene (b) PVA : poly(vinylalcohol)						

Preparation of the blends and production on Mini-Hatschek machine (MiH)

[0026] Cementitious products were manufactured by the Hatschek technique, according to a pilot method reproducing the main characteristics of the products obtained by industrial methods. The compositions which have been used after strong dilution with water, are mentioned in tables II and III (concentrations of solids expressed in weight % with respect to the total dry matter). The cellulose fibres SUKP 65SR refer to an unbleached kraft pulp of coniferous trees refined to 65° Schopper-Riegler and P30 indicates Portland cement.

[0027] The sheets were hardened during one night at 50 °C, and afterwards under plastic cover sheet during 7 days at room temperature.

Measurement of the Charpy impact resistance

[0028] The Charpy impact resistance (expressed in kJ/m²) is measured according to standard ASTM D-256-81, method B, using an apparatus Zwick DIN 5102.100/00 on air-dry MiH samples of 15*120 mm and a span of 100 mm. Ten MiH samples are measured in the two directions (machine direction and direction perpendicular to this) 2 weeks after the production.

[0029] The impact resistance of the samples in table III has also been measured after ageing in an oven of 600 L at 60 °C and 90 % of relative humidity, with injection of 1,5 l CO₂/min during 24 hours; the CO₂ concentration ranges thus from 7 % at the beginning of conditioning to 12 % at the end of the conditioning.

Measurement of flexural resistance

[0030] The flexural resistance (expressed in MPa) is determined by a flexural test on three points using an apparatus UTS, a span of 146 mm and a test speed of 20 mm/minute on air-dry MiH samples of 50*160 mm. Ten samples are measured in the two directions (machine direction and direction perpendicular to this), 2 weeks after the production. The

EP 2 172 434 B1

apparatus records the curve stress/strain. Values of SMOR (maximum stress) are mentioned in tables II and III.

[0031] The results of the impact and flexural resistance measurements mentioned in tables II and III are expressed in % compared to a reference.

[0032] In table II, comparative example 1 is taken as reference for comparative example 2 and example 1, comparative example 3 is taken as reference for comparative example 4 and example 2, and comparative example 5 is taken as reference for example 3.

[0033] In table III, comparative example 7 is taken as reference for examples 4-6.

Table II - Examples 1-3 and comparative examples 1-5

	Comp Ex 1	Comp Ex 2	Ex 1	Comp Ex 4	Comp Ex 4	Ex 2	Comp Ex 5	Ex 3
COMPOSITION (wt%)								
Fibres (A)(1)			0,6			0,6		0,6
Fibres (B1)(1)	2,0	1,4	1,4					
Fibres (B1)(2)				2,0	1,4	1,4		
Fibres (B2)		0,6			0,6		2,0	1,4
SUKP 65SR	3,0	3,0	3,0	3,0	3,0	3,0	3,0	3,0
Amorphous silica	6,4	6,4	6,4	6,4	6,4	6,4	6,4	6,4
Ground CaCO ₃	10,0	10,0	10,0	10,0	10,0	10,0	10,0	10,0
P30	78,6	78,6	78,6	78,6	78,6	78,6	78,6	78,6
PROPERTIES								
Charpy Impact unaged (%/reference)	100	104	178	100	96	165	100	155
SMOR (%/reference)	100	93	88	100	92	81	100	85

[0034] The results in table II show that compositions comprising fibres (A) (examples 1-3) have an improved impact resistance at a level which can not be achieved by the use of fibres (B1) (comparative examples 1 and 3) or fibres (B2) (comparative example 5) nor by any blend of the the fibres (B1) and (B2) (comparative examples 2 and 4). The partial substitution of PVA fibres (B1)(1) by PP fibres (B2) leads to fibre-cement products with only slightly improved impact properties (comparative example 2 versus comparative example 1).

Table III - Examples 4-6 and comparative example 6

	Comp. Ex 6	Ex 4	Ex 5	Ex 6
COMPOSITION (wt%)				
Fibres (A)(1)		0,5		0,2
Fibres (A)(2)			0,5	
Fibres (B1)(1)	0,8	0,8	0,8	0,8
Fibres (B1)(2)	1,0	1,0	1,0	1,0
Fibres (B2)	0,5			0,5
SUKP 65SR	3,0	3,0	3,0	3,0
Amorphous silica	6,4	6,4	6,4	6,4
Ground CaCO ₃	12,0	12,0	12,0	12,0
P30	76,3	76,1	76,3	76,1
PROPERTIES				
Charpy Impact unaged (%/reference)	100	154	145	129
Charpy Impact CO ₂ aged (%/reference)	100	158	137	132

(continued)

PROPERTIES				
SMOR (MPa) (%/reference)	100	93	92	100

5

[0035] Table III shows that fibres (A) improve the impact resistance both aged (after carbonation) and unaged and that the best impact results are obtained by using fibres (A)(1) with a length of 13 mm (example 4 versus example 5).

10

[0036] Compositions comprising an amount of fibres (A) and (B1) (examples 4 and 5) have a higher impact strength than compositions comprising an equivalent amount of fibres (B1) and (B2), and have a flexural strength which is maintained at about 90 % compared to a composition comprising only fibres (B1) and (B2)(comparative example 6). Example 6 shows that the addition of a minor quantity of fibres (A) to a composition comprising fibres (B1)(1), (B1)(2) and (B2) considerably improves the impact resistance, measured both on aged and unaged samples, while the flexural strength is maintained.

15

Fibre-cement product manufactured from compositions comprising fibres (A) and fibres (B) according to the present invention have better balanced impact resistance and flexural strength properties.

[0037] The present invention was described in specific terms of execution which are an illustration of the invention and which should not be considered as restrictive.

20

Claims

25

1. Composition for the manufacture of fibre-cement products comprising polypropylene fibres (A) and other synthetic organic fibres (B), **characterized in that** :

- the polypropylene fibres (A) have a titre higher than 6,0 dtex and lower than 20,0 dtex; and
- the synthetic organic fibres (B) are selected among poly(vinylalcohol) fibres (B1) with a titre of at least 0,5 dtex and lower than 15,0 dtex, or polypropylene fibres (B2) having a titre of at least 0,5 dtex and lower than 3,0 dtex (B2) or their blends.

30

2. Composition according to claim 1, **characterized in that** the poly(vinylalcohol) fibres (B1) have a titre of at least 1,0 dtex and lower than 10,0 dtex.

35

3. Composition according to claim 1 or claim 2, **characterized in that** the polypropylene fibres (B2) are **characterized by** a titre of at least 0,7 dtex and lower than 2,5 dtex.

40

5. Composition according to one of the preceding claims, **characterized in that** the polypropylene fibres (A) have a length of from 6 mm to 30 mm.

45

6. Composition according to one of the preceding claims, **characterized in that** the fibres (A) and (B) have a tenacity of at least 8 cN/dtex.

50

7. Composition according to one of the preceding claims, **characterized in that** it comprises from 0,05 to 5,0 weight % of fibres (A) with respect to the total initial dry weight of the composition.

8. Composition according to one of the preceding claims, **characterized in that** it comprises from 0,5 to 5, 0 weight % of fibres (B) with respect to the total initial dry weight of the composition.

9. Composition according to claim 7, **characterized in that** it comprises from 0,1 to 1,5 weight % of fibres (A) .

10. Composition according to claim 8, **characterized in that** it comprises from 0,5 to 3,5 weight % of fibres (B).

55

11. Composition according to any of the preceding claims, **characterized in that** the polypropylene fibres (A) are **characterized by** a Young modulus of at least 160 cN/dtex.

12. Composition according to any of the preceding claims, **characterized in that** the polypropylene fibres (A) are **characterized by** an elongation at break not higher than 1 7%.

13. Fibre-cement product manufactured by means of a composition according to any of claims 1 to 12.

14. Fibre-cement product according to claim 13, **characterized in that** it is a flat or corrugated sheet.

Patentansprüche

1. Zusammensetzung für die Herstellung von Faserzementprodukten mit Polypropylen-Fasern (A) und anderen synthetischen organischen Fasern (B), **dadurch gekennzeichnet, dass:**

- die Polypropylen-Fasern (A) einen Titer höher als 6,0 dtex und niedriger als 20,0 dtex haben und
- die synthetischen organischen Fasern (B) aus Poly(vinylalkohol)-Fasern (B 1) mit einem Titer von mindestens 0,5 dtex und niedriger als 15,0 dtex oder Polypropylen-Fasern (B2) mit einem Titer von mindestens 0,5 dtex und niedriger als 3,0 dtex (B2) oder deren Mischungen ausgewählt werden.

2. Zusammensetzung nach Anspruch 1, **dadurch gekennzeichnet, dass** die Poly(vinylalkohol)-Fasern (B 1) einen Titer von mindestens 1,0 dtex und niedriger als 10,0 dtex haben.

3. Zusammensetzung nach Anspruch 1 oder Anspruch 2, **dadurch gekennzeichnet, dass** die Polypropylen-Fasern (B 2) einen Titer von mindestens 0,7 dtex und niedriger als 2,5 dtex haben.

4. Zusammensetzung nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** die Polypropylen-Fasern (A) einen Titer von mindestens 10,0 dtex und niedriger als 18,0 dtex haben.

5. Zusammensetzung nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** die Polypropylen-Fasern (A) eine Länge von 6 mm bis 30 mm haben.

6. Zusammensetzung nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** die Fasern (A) und (B) eine Festigkeit von mindestens 8 cN/dtex haben.

7. Zusammensetzung nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** sie 0,05 bis 5,0 Gewichtsprozent der Fasern (A) in Bezug auf das anfängliche Gesamtrockengewicht der Zusammensetzung enthält.

8. Zusammensetzung nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** sie 0,5 bis 5,0 Gewichtsprozent der Fasern (B) in Bezug auf das anfängliche Gesamtrockengewicht der Zusammensetzung enthält.

9. Zusammensetzung nach Anspruch 7, **dadurch gekennzeichnet, dass** sie 0,1 bis 1,5 Gewichtsprozent der Fasern (A) enthält.

10. Zusammensetzung nach Anspruch 8, **dadurch gekennzeichnet, dass** sie 0,5 bis 3,5 Gewichtsprozent der Fasern (B) enthält.

11. Zusammensetzung nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** die Polypropylen-Fasern (A) einen Elastizitätsmodul von mindestens 160 cN/dtex haben.

12. Zusammensetzung nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** die Polypropylen-Fasern (A) durch eine Bruchdehnung von weniger als 17 % gekennzeichnet sind.

13. Mittels einer Zusammensetzung nach einem der Ansprüche 1 bis 12 hergestellte Faserzementprodukte.

14. Faserzementprodukt nach Anspruch 13, **dadurch gekennzeichnet, dass** es eine Tafel oder eine Wellplatte ist.

Revendications

1. Composition pour la fabrication de produits en fibrociment comprenant des fibres de polypropylène (A) et d'autres fibres organiques synthétiques (B), **caractérisée en ce que** :
5
 - les fibres de polypropylène (A) présentent un titre supérieur à 6,0 dtex et inférieur à 20,0 dtex ; et
 - les fibres organiques synthétiques (B) sont sélectionnées parmi les fibres d'alcool (poly)vinyle (B1) présentant un titre minimal de 0,5 dtex et inférieur à 15,0 dtex ou les fibres de polypropylène (B2) présentant un titre minimal de 0,5 dtex et inférieur à 3,0 dtex (B2) dans leurs mélanges.
10
2. Composition selon la revendication 1, **caractérisée en ce que** les fibres d'alcool (poly)vinyle (B1) présentent un titre minimal de 1,0 dtex et inférieur à 10,0 dtex.
3. Composition selon la revendication 1 ou la revendication 2, **caractérisée en ce que** les fibres de polypropylène (B2) présentent un titre minimal de 0,7 dtex et inférieur à 2,5 dtex.
15
4. Composition selon l'une des revendications précédentes, **caractérisée en ce que** les fibres de polypropylène (A) présentent un titre minimal de 10,0 dtex et inférieur à 18,0 dtex.
- 20 5. Composition selon l'une des revendications précédentes, **caractérisée en ce que** les fibres de polypropylène (A) présentent une longueur variant entre 6 et 30 mm.
6. Composition selon l'une des revendications précédentes, **caractérisée en ce que** les fibres (A) et (B) présentent une ténacité minimale de 8 cN / dtex.
25
7. Composition selon l'une des revendications précédentes, **caractérisée en ce qu'elle** comprend entre 0,05 et 5,0 % en poids de fibres (A) par rapport au poids à sec initial total de la composition.
8. Composition selon l'une des revendications précédentes, **caractérisée en ce qu'elle** comprend entre 0,5 et 5,0 % en poids de fibres (B) par rapport au poids à sec initial total de la composition.
30
9. Composition selon la revendication 7, **caractérisée en ce qu'elle** comprend entre 0, 1 et 1,5 % en poids de fibres (A).
10. Composition selon la revendication 8, **caractérisée en ce qu'elle** comprend entre 0,5 et 3,5 % en poids de fibres (B).
35
11. Composition selon l'une quelconque des revendications précédentes, **caractérisée en ce que** les fibres de polypropylène (A) présentent un module d'Young minimal de 160 cN / dtex.
12. Composition selon l'une quelconque des revendications précédentes, **caractérisée en ce que** les fibres de polypropylène (A) présentent un allongement à la rupture maximal de 17 %.
40
13. Produit en fibrociment fabriqué au moyen d'une composition selon l'une quelconque des revendications 1 à 12.
- 45 14. Produit en fibrociment selon la revendication 13, **caractérisé en ce qu'il** est une plaque lisse ou ondulée.

50

55

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- JP 2004352556 A [0007]
- EP 1854770 A [0007]

Non-patent literature cited in the description

- **HARALD KLOS.** Asbestzement. Springer Verlag, 1967 [0004]



(51) International Patent Classification:

C04B 41/00 (2006.01) C04B 111/80 (2006.01)
C04B 41/52 (2006.01) C04B 111/82 (2006.01)
C04B 41/71 (2006.01)

(21) International Application Number:

PCT/EP2016/063192

(22) International Filing Date:

9 June 2016 (09.06.2016)

(25) Filing Language:

English

(26) Publication Language:

English

(30) Priority Data:

15172110.7 15 June 2015 (15.06.2015) EP

(71) Applicant: ETERNIT AG [DE/DE]; Im Breitspiel 20,
69126 Heidelberg (DE).

(72) Inventors: HOQUE-CHOWDHURY, Heidi; Goethes-
trasse 10, 69181 Leimen (DE). SCHMIDT, Gerhard;
Ewald Renz Strasse 27A, 76669 Bad Schönborn (DE).

(74) Agents: VAECK, Elke et al.; Kuiermansstraat 1, 1880
Kapelle-op-den-Bos (BE).

(81) Designated States (unless otherwise indicated, for every
kind of national protection available): AE, AG, AL, AM,

AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY,
BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM,
DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT,
HN, HR, HU, ID, IL, IN, IR, IS, JP, KE, KG, KN, KP, KR,
KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG,
MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM,
PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC,
SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN,
TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States (unless otherwise indicated, for every
kind of regional protection available): ARIPO (BW, GH,
GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ,
TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU,
TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE,
DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU,
LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK,
SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ,
GW, KM, ML, MR, NE, SN, TD, TG).

Declarations under Rule 4.17:

— of inventorship (Rule 4.17(iv))

Published:

— with international search report (Art. 21(3))

(54) Title: COATED FIBER CEMENT PRODUCTS AND METHODS FOR THE PRODUCTION THEREOF

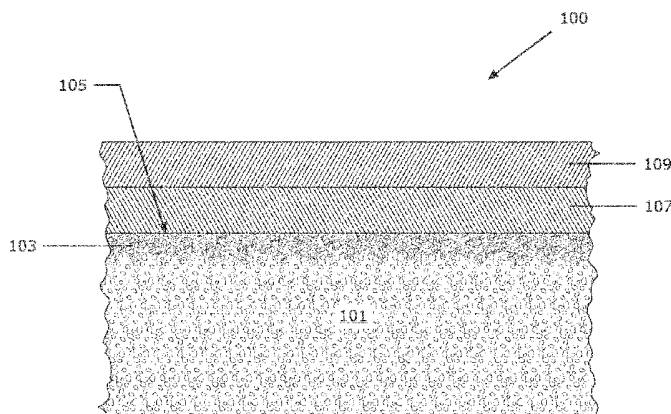


Fig. 2

(57) Abstract: The present invention relates to coated fiber cement products as well as to methods for manufacturing such products. In particular, the present invention provides processes for manufacturing coated fiber cement products, these processes comprising the steps of: (i) providing a cured fiber cement product having at least one surface; (ii) optionally applying a primer to the at least one surface of the cured fiber cement product; (iii) providing a first layer of a first radiation curable composition to the at least one surface; (iv) partially curing the first layer of radiation curable composition by radiation; (v) providing a second layer of a second radiation curable composition comprising pigments; and (vi) curing the first and the second layer of radiation curable composition by radiation. Finally, the present invention provides coated fiber cement products obtainable by such processes and uses of these fiber cement products as building materials. In particular embodiments, the coated fiber cement products produced by the processes of the present invention can be used to provide an outer surface to walls, both internal as well as external, a building or construction, e.g. as façade plate, siding, etc.



COATED FIBER CEMENT PRODUCTS AND METHODS FOR THE PRODUCTION THEREOF

Field of the invention

The present invention relates to coated fiber cement products as well as to methods for manufacturing such products. The present invention further relates to various uses of these coated
5 fiber cement products, in particular as building materials.

Background of the invention

Coated fiber cement products are well known and widely used as building materials.

10 European patent EP1914215B1 describes such coated fiber cement products.

A remaining disadvantage of the known coated fiber cement products is, however, that the pigments present in the coating layer(s) seem to chemically disintegrate gradually in time. This results in the formation of visible brownish spots within the coating layer(s), which is undesirable for obvious esthetical reasons.

15 Up to now, there is no efficient strategy to manage this problem.

Summary of the invention

An object of the present invention is to provide improved coated fiber cement products, as well as processes for the production thereof, which products do not suffer from the phenomenon of
20 chemical disintegration of pigments in the coating layer(s) and the undesirable visible consequences thereof.

Without being bound to or limited by any theory or hypothesis, further experimental research performed by the present inventors appeared to reveal that the chemical destabilization, disintegration and/or destruction of the pigments in the different coating layer(s) of coated fiber
25 cement products is caused by the alkaline pH of the moisture, that is still present within the fiber cement product but is gradually driven out and migrates through the pigmented coating layers. As a consequence, any pigments present in these coating layer(s), which are typically alkaline instable, are damaged and disintegrate to form visible brownish spots at the surface of the fiber cement products.

30 The present invention provides processes where such migration of the pigments through the coating layers is substantially limited and in most cases even prevented.

According to a first aspect, the present invention provides processes for manufacturing coated fiber cement products, wherein these processes comprise the steps of:

- (i) providing a cured fiber cement product having at least one surface;
- (ii) optionally applying a primer to the at least one surface of the cured fiber cement product;
- (iii) providing a first layer of a first radiation curable composition to the at least one surface;
- (iv) partially curing the first layer of radiation curable composition by radiation;
- 5 (v) providing a second layer of a second radiation curable composition to the partially cured first layer, the second radiation curable composition comprising pigments;
- (vi) curing the first and the second layer of radiation curable composition by radiation.

10 In particular embodiments of these processes, the second radiation curable composition comprises organic pigments.

In certain particular embodiments of these processes, the second radiation curable composition comprises one to five different pigments.

15 In further particular embodiments of these processes, the second coating has a hiding power of about 90% to about 100%.

In still further particular embodiments of these processes, the second coating has a pigment volume concentration (PVC) in the range of about 2 to about 10 %.

20

In yet further particular embodiments of these processes, the thickness of the second radiation curable composition layer ranges from about 10 μ m to about 120 μ m.

25 In certain particular embodiments of these processes, the first radiation curable composition is pigment-free.

In particular embodiments of these processes, the thickness of the first radiation curable composition layer ranges from about 5 μ m to about 100 μ m.

30 In further particular embodiments of these processes, the step of partially curing the first layer of radiation curable composition is done by irradiation using about 100 to about 800 mJ/cm².

In yet further particular embodiments of these processes, the first and the second radiation curable compositions are UV-curable compositions.

In other further particular embodiments of these processes, the first and the second radiation curable compositions are electron beam curable compositions.

5 In particular embodiments of these processes, the first and the second radiation curable compositions are isocyanate-bearing polyurethanes having ethylenically unsaturated double bonds.

In further particular embodiments of these processes, the second radiation curable composition layer is covered with a radiation permeable film prior to the curing step.

10 In further particular embodiments of these processes, the curing step is preceded by a treatment of the second radiation curable composition layer by means of an excimer laser.

In a second aspect, the present invention provides fiber cement products obtainable by the processes of the present invention.

15

In a third aspect, the present invention uses of the fiber cement products obtainable by the processes of the present invention as building materials. In particular embodiments, the fiber cement products produced by the processes of the present invention can be used to provide an outer surface to walls, both internal as well as external, a building or construction, e.g. as façade plate, siding, etc.

20

The independent and dependent claims set out particular and preferred features of the invention. Features from the dependent claims may be combined with features of the independent or other dependent claims, and/or with features set out in the description above and/or hereinafter as appropriate.

25

The above and other characteristics, features and advantages of the present invention will become apparent from the following detailed description, taken in conjunction with the accompanying drawings, which illustrate, by way of example, the principles of the invention. This description is given for the sake of example only, without limiting the scope of the invention. The reference figures
30 quoted below refer to the attached drawings.

Brief description of the drawings

Figure 1 is a schematic view of a process according to the invention.

Figure 2 shows a schematic view of a cross section of a fiber cement product according to the invention.

5

The same reference signs refer to the same, similar or analogous elements in the different figures.

Description of illustrative embodiments

10 It is to be noted that the term “comprising”, used in the claims, should not be interpreted as being restricted to the means listed thereafter; it does not exclude other elements or steps. It is thus to be interpreted as specifying the presence of the stated features, steps or components as referred to, but does not preclude the presence or addition of one or more other features, steps or components, or groups thereof. Thus, the scope of the expression “a device comprising means A and B” should not
15 be limited to devices consisting only of components A and B. It means that with respect to the present invention, the only relevant components of the device are A and B.

Throughout this specification, reference to “one embodiment” or “an embodiment” are made. Such references indicate that a particular feature, described in relation to the embodiment is included in
20 at least one embodiment of the present invention. Thus, appearances of the phrases “in one embodiment” or “in an embodiment” in various places throughout this specification are not necessarily all referring to the same embodiment, though they could. Furthermore, the particular features or characteristics may be combined in any suitable manner in one or more embodiments, as would be apparent to one of ordinary skill in the art.

25

The following terms are provided solely to aid in the understanding of the invention.

As used herein, the singular forms “a”, “an”, and “the” include both singular and plural referents unless the context clearly dictates otherwise.

30 The terms “comprising”, “comprises” and “comprised of” as used herein are synonymous with “including”, “includes” or “containing”, “contains”, and are inclusive or open-ended and do not exclude additional, non-recited members, elements or method steps.

The recitation of numerical ranges by endpoints includes all numbers and fractions subsumed within the respective ranges, as well as the recited endpoints.

The term “about” as used herein when referring to a measurable value such as a parameter, an amount, a temporal duration, and the like, is meant to encompass variations of +/-10% or less, preferably +/-5% or less, more preferably +/-1% or less, and still more preferably +/-0.1% or less of and from the specified value, insofar such variations are appropriate to perform in the disclosed invention. It is to be understood that the value to which the modifier “about” refers is itself also specifically, and preferably, disclosed.

The terms “(fiber) cementitious slurry” or “(fiber) cement slurry” as referred to herein generally refer to slurries at least comprising water, fibers and cement. The fiber cement slurry as used in the context of the present invention may also further comprise other components, such as but not limited to, limestone, chalk, quick lime, slaked or hydrated lime, ground sand, silica sand flour, quartz flour, amorphous silica, condensed silica fume, microsilica, metakaolin, wollastonite, mica, perlite, vermiculite, aluminum hydroxide, pigments, anti-foaming agents, flocculants, and other additives.

“Fiber(s)” present in the fiber cement slurry as described herein may be for example process fibers and/or reinforcing fibers which both may be organic fibers (typically cellulose fibers) or synthetic fibers (polyvinylalcohol, polyacrilonitrile, polypropylene, polyamide, polyester, polycarbonate, etc.).

“Cement” present in the fiber cement slurry as described herein may be for example but is not limited to Portland cement, cement with high alumina content, Portland cement of iron, trass-cement, slag cement, plaster, calcium silicates formed by autoclave treatment and combinations of particular binders. In more particular embodiments, cement in the products of the invention is Portland cement.

The terms “predetermined” and “predefined” as used herein when referring to one or more parameters or properties generally mean that the desired value(s) of these parameters or properties have been determined or defined beforehand, i.e. prior to the start of the process for producing the products that are characterized by one or more of these parameters or properties.

A “(fiber cement) sheet” as used herein, also referred to as a panel or a plate, is to be understood as a flat, usually rectangular element, a fiber cement panel or fiber cement sheet being provided out of

fiber cement material. The panel or sheet has two main faces or surfaces, being the surfaces with the largest surface area. The sheet can be used to provide an outer surface to walls, both internal as well as external a building or construction, e.g. as façade plate, siding, etc.

- 5 The term “pigment volume concentration (abbreviated as PVC)” as used herein generally refers to the amount of pigment(s) versus the total amount of solids (i.e. pigment(s), binder(s), other solids) in a coating composition and can be calculated via the following mathematical formula:

“Pigment volume concentration” (expressed in %) = “PVC” (expressed in %) =

Volume of pigment/ (Volume of solids) * 100 (expressed in %) =

- 10 Volume of pigment/ (Volume of pigment + Volume of solid binder) * 100 (expressed in %) =

Volume of pigment/ (Volume of pigment + Volume of non-volatile binder) * 100 (expressed in %)

- The term “UV-curable” refers to a composition that can polymerize upon application of UV irradiation. Typically, this at least implies the presence of photo-polymerizable monomers or
15 oligomers, together with photoinitiators and/or photosensitizers.

The terms “mass-coloured”, “coloured in the mass”, “through-coloured” when referring to a fiber cement product has the meaning that at least part of the, and preferably the entire, internal structure of that fiber cement product comprises at least one pigment.

20

The term “hiding power” as used herein is the property of a coating which enables it to hide the surface over which it is applied. The hiding power is directly linked to the film application method and the film thickness. In a coating with strong hiding power, the pigment particles scatter the light so strongly that it hardly reaches the substrate. If residual light is reflected from the substrate, it is so
25 strongly scattered that it does not reach the eye. There are a number of standard test methods available. For instance, BS 3900-D4 (i.e. also referred to as ISO 2814), BS 3900-D7 (i.e. also referred to as ISO 6504/1) or BS 3900-D11 (also referred to as ISO 6504/3) are standard method for determining the hiding power of coatings.

- 30 The term “transparent” or “transparency” when referring to a coating composition or a coating layer refers to the physical characteristic of allowing light to pass through the coating without being scattered. Transparency can be measured with any method known in the art. For instance, a haze meter measures the transparency, haze, see-through quality, and total transmittance of a coating, based on how much visible light is diffused or scattered when passing through the coating. Haze is

measured with a wide angle scattering test in which light is diffused in all directions which results in a loss of contrast. That percentage of light that when passing through deviates from the incident beam greater than 2.5 degrees on average is defined as haze. See through quality is measured with a narrow angle scattering test in which light is diffused in a small range with high concentration. This test measures the clarity with which finer details can be seen through the coating being tested. The haze meter also measures total transmittance. Total transmittance is the measure of the total incident light compared to the light that is actually transmitted (e.g. total transmittance). So the incident light may be 100%, but because of absorption and reflection the total transmittance may only be 94%. The data gained from the haze meter can be transferred to a PC for further data processing to ensure a consistent product.

The invention will now be further explained in detail with reference to various embodiments. It will be understood that each embodiment is provided by way of example and is in no way limiting to the scope of the invention. In this respect, it will be clear to those skilled in the art that various modifications and variations can be made to the present invention without departing from the scope or spirit of the invention. For instance, features illustrated or described as part of one embodiment, can be used in another embodiment to yield a still further embodiment. Thus, it is intended that the present invention covers such modifications and variations as encompassed within the scope of the appended claims and equivalents thereof.

The present invention provides improved coated fiber cement products, as well as processes for the production thereof, which products do not suffer from the phenomenon of chemical disintegration of pigments in the coating layer(s) and the undesirable visible consequences thereof.

Extensive experimental research performed by the present inventors appeared to reveal that the chemical destabilization, disintegration and/or destruction of the pigments in the different coating layer(s) of coated fiber cement products is caused by the alkaline pH of the moisture, that is still present within the fiber cement product but is gradually driven out and migrates through the pigmented coating layers. As a consequence, any pigments present in these coating layer(s), which are typically alkaline instable, are damaged and disintegrate to form visible brownish spots at the surface of the fiber cement products.

The present invention provides processes where such migration of the pigments through the coating layers is substantially limited and in most cases even prevented.

Thus, in a first aspect, the present invention provides processes for providing coated fiber cement products, wherein these processes comprise the steps of:

- (i) providing a cured fiber cement product having at least one surface;
- (ii) optionally applying a primer to the at least one surface of the cured fiber cement product;
- 5 (iii) providing a first layer of a first radiation curable composition to the at least one surface;
- (iv) partially curing the first layer of radiation curable composition by radiation;
- (v) providing a second layer of a second radiation curable composition to the partially cured first layer, the second radiation curable composition comprising pigments;
- (vi) curing the first and the second layer of radiation curable composition by radiation.

10

The first step of the processes of the invention comprises providing a cured fiber cement product having at least one surface, which step can be performed according to any method known in the art for preparing fiber cement products.

15

For example, a fiber cement slurry can first be prepared by one or more sources of at least cement, water and fibers. In certain specific embodiments, these one or more sources of at least cement, water and fibers are operatively connected to a continuous mixing device constructed so as to form a cementitious fiber cement slurry. In particular embodiments, when using cellulose fibers or the equivalent of waste paper fibers, a minimum of about 3%, such as about 4%, of the total slurry mass of these cellulose fibers is used. In further particular embodiments, when exclusively cellulose fibers are used, between about 4% to about 12%, such as more particularly, between about 7% and about 10%, of the total slurry mass of these cellulose fibers is used. If cellulose fibers are replaced by short mineral fibers such as rock wool, it is most advantageous to replace them in a proportion of 1.5 to 3 times the weight, in order to maintain approximately the same content per volume. In long and cut fibers, such as glass fiber rovings or synthetic high-module fibers, such as polypropylene, polyvinyl acetate, polycarbonate or acrylonitrile fibers the proportion can be lower than the proportion of the replaced cellulose fibers. The fineness of the fibers (measured in Shopper-Riegler degrees) is in principle not critical to the processes of the invention. Yet in particular embodiments, it has been found that a range between about 15 DEG SR and about 45 DEG SR can be particularly advantageous for the processes of the invention.

25
30

Once a fiber cement slurry is obtained, the manufacture of the fiber-reinforced cement products can be executed according to any known procedure. The process most widely used for manufacturing fiber cement products is the Hatschek process, which is performed using a modified sieve cylinder paper making machine. Other manufacturing processes include the Magnani process, injection,

extrusion, flow-on and others. In particular embodiments, the fiber cement products of the present invention are provided by using the Hatschek process. The “green” or uncured fiber cement product is optionally post-compressed usually at pressures in the range from about 22 to about 30 MPa to obtain the desired density.

5

The processes according to the present invention may further comprise the step of cutting the fiber cement products to a predetermined length to form a fiber cement product. Cutting the fiber cement products to a predetermined length can be done by any technique known in the art, such as but not limited to water jet cutting, air jet cutting or the like. The fiber cement products can be cut to any desirable length, such as but not limited to a length of between about 1 m and about 15 m, such as between about 1 m and about 10 m, more particularly between about 1 m and about 5 m, most particularly between about 1 m and about 3 m.

10

It will be understood by the skilled person that the processes of the present invention may further comprise additional steps of processing the produced fiber cement products.

15

For instance, in certain particular embodiments, during the processes of the present invention, the fiber cement slurry and/or the fiber cement products may undergo various intermediate treatments, such as but not limited to treatment with one or more hydrophobic agents, treatment with one or more flocculants, additional or intermediate pressing steps, etc.

20

As soon as the fiber cement products are formed, these are trimmed at the lateral edges. The border strips can optionally be recycled through immediate mixing with the recycled water and directing the mixture to the mixing system again.

25

After manufacturing, the obtained fiber cement products are cured. Indeed, after production, fiber cement products can be allowed to cure over a time in the environment in which they are formed, or alternatively can be subjected to a thermal cure (e.g. by autoclaving or the like).

In further particular embodiments, the “green” fiber cement product is cured, typically by curing to the air (air cured fiber cement products) or under pressure in presence of steam and increased temperature (autoclave cured). For autoclave cured products, typically sand is added to the original fiber cement slurry. The autoclave curing in principle results in the presence of 11.3 Å (angstrom) Tobermorite in the fiber cement product.

30

In yet further particular embodiments, the “green” fiber cement product may be first pre-cured to the air, after which the pre-cured product is further air-cured until it has its final strength, or autoclave-cured using pressure and steam, to give the product its final properties.

- 5 In particular embodiments of the present invention, the processes may further comprise the step of thermally drying the obtained fiber cement products. After curing, the fiber cement product being a panel, sheet or plate, may still comprise a significant weight of water, present as humidity. This may be up to 10 even 15 %w, expressed per weight of the dry product. The weight of dry product is defined as the weight of the product when the product is subjected to drying at 105°C in a ventilated
10 furnace, until a constant weight is obtained.

In certain embodiments, the fiber cement product is dried. Such drying is done preferably by air drying and is terminated when the weight percentage of humidity of the fiber cement product is less than or equal to 8 weight %, even less than or equal to 6 weight %, expressed per weight of dry product, and most preferably between 4 weight % and 6 weight %, inclusive.

- 15 The optional step of providing a primer on the surface of the fiber cement products involves the use of a primer coating composition comprising a (i.e. at least one) binder and optionally a pigment.

Binders and pigments for primers are known in the art and are not critical to the invention as long as the primers are alkaline stable and suitable for use on fiber cement surfaces.

- In particular embodiments, the primer is a conventional coating used in the process according to the
20 invention and is not curable by radiation or by chemical crosslinking. Suitable primer coatings are those with binders obtained by aqueous free radical or ionic emulsion polymerization. Acrylic and/or methacrylic (co)polymers are particularly preferred as binders of the primer coatings.

- These acrylic and/or methacrylic (co)polymers are usually prepared by aqueous radically initiated emulsion polymerization of esters of acrylic acid and/or methacrylic acid with C1-C12 alkanols as well
25 as a minor amount of acrylic and/or methacrylic acid as monomers. Preference is given in particular to esters of acrylic and methacrylic acid with C1-C8 alkanols; ethyl acrylate, n-butyl acrylate, ethylhexyl acrylate and methylmethacrylate are particularly preferred. The emulsion polymerization requires the use of surfactants as stabilizers. Non-ionic surfactants are preferred. Alcohol ethoxylates are particularly preferred. Primer coatings with a hydroxyl number (measured according to ISO 4629)
30 of at least 1 are preferred. Hydroxyl numbers of at least 1,5 are particularly preferred.

Preferably, the minimum film forming temperature during the drying of the primer coating is below 60°C.

At least one layer of the primer coating composition comprises at least one pigment. Typical pigments are metal oxides, such as titanium dioxide, iron oxides, spinell pigments, titanates and other oxides, or organic alkaliresistant pigments such as phtalocyanines and azo compounds.

Preferably, the pigment volume concentration of the pigmented layer of the conventional coating is in the range of from about 0,01 to about 25%. Pigment volume concentrations in the range of from 0,05 to 20% are particularly preferred.

The primer coating composition generally comprises, besides the polymeric binders and pigments, also usual auxiliaries, e.g. fillers, wetting agents, viscosity modifiers, dispersants, defoamers, preservatives and hydrophobisizers, biocides, fibers and other usual constituents. Examples of suitable fillers are aluminosilicates, silicates, alkalineearth metal carbonates, preferably calcium carbonate in the form of calcite or lime, dolomite, and also aluminum silicates or magnesium silicates, e.g. talc.

The solids content of suitable primer coatings is generally in the range from about 20% to about 60% by weight.

The primer coating compositions comprise as liquid component essentially water and, if desired, an organic liquid miscible with water, for example an alcohol.

The primer coating compositions are applied at a wet coating weight in the range from about 50 to about 500 g/m², in particular from about 70 to about 300 g/m², in a known manner, for example by spraying, trowelling, knife application, brushing, rolling or pouring onto the cement bonded board, or by a combination of one or more applications.

In particular embodiments, the primer coating composition used in the processes of the present invention is a styrole acrylate primer.

In particular embodiments, the primer coating composition used in the processes of the present invention is "Natura Walzgrundierung".

A further step in the processes of the invention comprises providing a first layer of a first radiation curable composition to the at least one surface of the fiber cement product.

Subsequently, the first layer of the first radiation curable composition is partially cured. "Partially curing" in the context of the present invention means that only part of the bonds in the first radiation curable composition are activated by radiation, such that the curing of the first radiation curable composition is not complete after the partial curing step. Partially curing is also referred to in the art as gelling.

Subsequently, a second layer of a second radiation curable composition is applied to the partially cured first layer. Finally, the first and the second layer of radiation curable compositions are cured by radiation.

5 The combination of steps of partially curing the first layer followed by applying a second pigmented layer followed by curing the second layer has two important advantageous consequences.

First, the second layer, when applied onto the partially cured surface of the first layer, is able to react with the remaining unreacted double bonds (that are exposed at the surface) of the first layer. This phenomenon causes the two layers to bond together very strongly, providing a stronger product in
10 its entirety.

Secondly, because of the fact that the first layer is only partially (i.e. incompletely cured), the surface of the first layer forms a water-impermeable interface. This water tight interface remains present after application of the second layer. In the final two-layer coating system, this results in a water impermeable interface present in between the first and the second coating layer. The presence of
15 such a water tight interface has the advantage that alkaline humidity, which is typically present in the fiber cement product, is prevented from migrating from the fiber cement material (through the first coating layer) into the second coating layer. As previously described, alkaline humidity, when contacting the pigments of the second layer, causes the pigments to lose their color or to be completely destroyed. However, because of the presence of the water-impermeable interface
20 between the first and the second layer, this alkaline humidity will thus not be brought into contact with the pigments in the second coating layer, visually present at the outer surface of the fiber cement product. As such, the pigments that are visibly present onto the surface of the fiber cement product are prevented from alkaline destruction.

25 Both the first layer of the first coating composition and the second layer of the second coating composition are coating layers that are curable by radiation.

The first and the second coating compositions, each comprise at least one polymer having ethylenically unsaturated double bonds and which is radiation curable. In particular embodiments,
30 the at least one radiation curable polymer present in the first coating composition is different from the at least one radiation curable polymer present in the second coating composition. In alternative embodiments, the at least one radiation curable polymer present in the first coating composition is identical to the at least one radiation curable polymer present in the second coating composition.

Possible radiation-curable polymers for both the first and the second radiation-curable coating compositions are in principle any polymers which have ethylenically unsaturated double bonds and which can undergo radical-initiated polymerization on exposure to UV radiation or electron beam radiation.

5

The monomers having unsaturated double bonds such as acryl amide monomers, meth acrylic acid monomers, (meth) acrylic acid monomers, N - vinyl pyrrolidone and crotonic acid are preferred to be the polymerizable monomer.

10 Care should be taken here that the content of ethylenically unsaturated double bonds in the polymer is sufficient to ensure effective crosslinking. The content of ethylenically unsaturated double bonds in the is generally in the range from about 0,01 to about 1,0 mol/100g of polymer, more preferably from about 0,05 to about 0,8 mol/100 g of polymer and most preferably from about 0,1 to about 0,6 mol/100 g of polymer. Suitable polymers are for example but not limited to polyurethane derivatives
15 which contain ethylenically unsaturated double bonds, such as polyurethane acrylates.

According to certain embodiments, the first radiation curable composition is a UV-curable composition, the UV-curable composition comprising a first polymer A comprising polyurethane derivate containing ethylenically unsaturated double bonds, and a second polymer B being free
20 isocyanate-bearing polyurethanes having ethylenically unsaturated double bonds.

According to certain embodiments, the second radiation curable composition is a UV-curable composition, the UV-curable composition comprising a first polymer A comprising polyurethane derivate containing ethylenically unsaturated double bonds, and a second polymer B being free isocyanate-bearing polyurethanes having ethylenically unsaturated double bonds.

25

Suitable polymers A are polyurethane derivatives which contain ethylenically unsaturated double bonds, such as polyurethane acrylates.

The radiation-curable composition applied in the process comprises at least one chemically and radiation crosslinkable polymer B.

30

Suitable polymers B are free isocyanate-bearing polyurethanes having ethylenically unsaturated double bonds. Polyurethane acrylates with free isocyanate groups are preferred. The free isocyanate content of B measured according to DIN EN ISO 11 909, ranges usually from 5 to 20% by weight.

Preferably the free isocyanate content of B is between 8 and 20% by weight and more preferably between 10 and 18 % by weight.

The weight ratio of B /A is preferably in the range of 0,03/0,2. A weight ratio of B/A in the range of
5 0,05/0,1 is particularly preferred.

Besides the polymers A and B, the radiation-curable preparations may also contain a compound different from polymer A and polymer B and having a molecular weight of less than 800 g/mol and capable of polymerization by cationic or free-radical pathways. These compounds have generally at
10 least one ethylenically unsaturated double bond and/or one epoxy group and a molecular weight being less than 800 g/mol. Such compounds generally serve to adjust to the desired working consistency of the radiation-curable preparations. This is particularly important if the preparation contains no other diluents, such as water and/or inert organic solvents, or contains these only to a subordinate extent. Such compounds are therefore also termed reactive diluents. The proportion of
15 reactive diluents, based on the total amount of (A+B) and the reactive diluent in the radiation-curable preparation, is preferably in the range of 0 to 100% by weight, and most preferably in the range of from 5 to 50 % by weight.

Besides the radiation-curable polymer, the radiation-curable coating composition may also contain a
20 different compound having a molecular weight of less than about 800 g/mol and capable of polymerization by cationic or free-radical pathways. These compounds have generally at least one ethylenically unsaturated double bond and/or one epoxy group and a molecular weight being less than about 800 g/mol. Such compounds generally serve to adjust to the desired working consistency of the radiation-curable preparations. This is particularly important if the preparation contains no
25 other diluents, such as water and/or inert organic solvents, or contains these only to a subordinate extent. Such compounds are therefore also termed reactive diluents. The proportion of reactive diluents, based on the total amount of polymer and the reactive diluent in the radiation-curable preparation, is preferably in the range of about 0% to about 90% by weight, and most preferably in the range from about 5% to about 50% by weight. Preferred reactive diluents are the esterification
30 products of di- or polyhydric alcohols with acrylic and/or methacrylic acid. Such compounds are generally termed polyacrylates or polyether acrylates. Hexanediol diacrylate, tripropylene glycol diacrylate and trimethylolpropane triacrylate are particularly preferred.

Radiation-curable coating compositions may also comprise polymers which have cationically polymerizable groups, in particular epoxy groups. These include copolymers of ethylenically

unsaturated monomers, the copolymers containing, as comonomers, ethylenically unsaturated glycidyl ethers and/or glycidyl esters of ethylenically unsaturated carboxylic acids. They also include the glycidyl ethers of OH-group-containing polymers, such as OH-group-containing polyethers, polyesters, polyurethanes and novolacs. They include moreover the glycidyl esters of polymers containing carboxylic acid groups. If it is desired to have a cationically polymerizable component, the compositions may comprise, instead of or together with the cationically polymerizable polymers, a low-molecular-weight, cationically polymerizable compound, for example a di- or polyglycidyl ether of a low-molecular-weight di- or polyol or the di- or polyester of a low-molecular-weight di- or polycarboxylic acid.

The radiation-curable compositions comprise usual auxiliaries, such as thickeners, flow control agents, defoamers, UV stabilizers, emulsifiers, surface tension reducers and/or protective colloids. Suitable auxiliaries are well known to the person skilled in the coatings technology. Silicones, particularly polyether modified polydimethylsiloxane copolymers, may be used as surface additives to provide good substrate wetting and good anti-crater performance by reduction of surface tension of the coatings. Suitable stabilizers encompass typical UV absorbers, such as oxanilides, triazines, benzotriazoles (obtainable as Tinuvin™ grades from Ciba Geigy) and benzophenones. These may be used in combination with usual free-radical scavengers, for example sterically hindered amines, e.g. 2,2,6,6-tetramethylpiperidine and 2,6-di-tert-butylpiperidine (HALS compounds). Stabilizers are usually used in amounts of from about 0,1% to about 5,0% by weight and preferably from about 0,3% to about 2,5% by weight, based on the polymerizable components present in the preparation.

The second coating composition used in the processes of the invention further comprises one or more pigments. In particular embodiments, the one or more pigments present in the second coating composition provide color, hiding, and/or are present as extenders. In particular embodiments, the one or more pigments included in the second coating composition can be inorganic or organic pigments. Such pigments include but are not limited to those in the form of titanium oxide, iron oxides, calcium carbonate, spinell pigments, titanates, clay, aluminum oxide, silicon dioxide, magnesium oxide, magnesium silicate, barium metaborate monohydrate, sodium oxide, potassium oxide, talc, barytes, zinc oxide, zinc sulfite and mixtures thereof, phthalocyanines and azo compounds.

In particular embodiments, the second coating composition comprises one to five different pigments, such as one, two, three, four or five different pigments, which can each independently be organic or inorganic pigments.

In further particular embodiments, the one or more pigments included in the second coating composition are organic pigments, such as but not limited to azo-compounds or azo-pigments, quinazidones and/or phthalocyanines.

- 5 In still further particular embodiments of these processes, the second coating composition has a pigment volume concentration (PVC) (as defined herein) in the range of about 2% to about 10 %, such as between about 3% and about 9%, such as between about 4% and 8%, such as a PVC of about 5%, about 6% or about 7%.
- 10 In still further particular embodiments of these processes, the first coating composition is pigment-free. As such, the first coating layer is a transparent (as defined herein) or semi-transparent coating layer. Semi-transparency can be obtained by adding one or more fillers or pigments to the first radiation curable composition. A transparent layer is also referred to in the art as a "clear coat(ing)".
- 15 The first and second coating compositions used for providing the first and second radiation-curable coating layers onto the surface of the fiber cement products of the invention may further comprise usual auxiliaries, e.g. fillers, surfactants, wetting agents, dispersants, defoamers, colorants, waxes, and other usual constituents. Examples of suitable fillers are aluminosilicates, silicates, alkaline-earth metal carbonates, preferably calcium carbonate in the form of calcite or lime, dolomite, and also
- 20 aluminum silicates or magnesium silicates, e.g. talc.

In addition to the above, the coating composition used for providing the first and second radiation-curable coating layers on the surface of the fiber cement products of the invention further may comprise one or more additives included for properties, such as regulating flow and leveling, sheen,

25 foaming, yellowing, resistance to stains, cleaner, burnish, block, mildew, dirt, or corrosion, and for retaining color and gloss.

Examples of suitable surface-active dispersing or wetting agents include those available under the trade designations, such as EFKA 4310, EFKA PX 4330, EFKA 7701 (BASF).

30

Examples of suitable defoamers include but are not limited to BYK 057, BYK 088, BYK 1790, BYK 1791, BYK 1794, BYK 1798 (BYK Cera), EFKA 2721 (BASF).

In addition, coating compositions used for providing the first and second radiation-curable coating layers on the surface of the fiber cement products of the invention may include one or more functional extenders to increase coverage, reduce cost, achieve durability, alter appearance, control rheology, and/or influence other desirable properties. Examples of functional extenders include, for example, barium sulphate, aluminum silicate, magnesium silicate, barium sulphate, calcium carbonate, clay, gypsum, silica, and talc.

In further particular embodiments of the processes according to the invention, the second coating has a hiding power (as defined herein) of about 90% to about 100%.

In particular embodiments, the first coating composition is applied as a wet coating weight in the range from about 10 to about 100 g/m², in particular from about 20 to about 90 g/m², more in particular from about 40 to about 80 g/m². In further particular embodiments, the first coating composition is applied as a wet coating weight in about 70 g/m² on the surface of the fiber cement product. In further particular embodiments, the thickness of the first radiation curable composition layer ranges from about 5µm to about 100µm.

In particular embodiments, the second coating composition is applied as a wet coating weight in the range from about 10 to about 200 g/m², in particular from about 50 to about 190 g/m², more in particular from about 100 to about 180 g/m². In further particular embodiments, the first coating composition is applied as a wet coating weight in about 160 g/m² on the surface of the fiber cement product. In further particular embodiments, the thickness of the second radiation curable composition layer ranges from about 10µm to about 120µm.

The combination of the above-described criteria of thicknesses and/or pigment volume concentrations and/or hiding powers for both the first and the second coating compositions causes that the first coating layer is substantially made invisible through the second layer.

Preferred results are obtained by the application of a first layer of non-pigmented radiation curable composition, and the subsequent application of a second layer of the same radiation curable composition, the latter however comprising at least one pigment.

The first and second coating compositions are applied in any known manner, for example by spraying, trowelling, knife application, brushing, rolling, curtain coating or pouring onto the cement bonded board, or by a combination of one or more applications. In particular embodiments, the

coating composition is preferably applied by roller coating. It is also conceivable that the preparation may be applied to the cement board by hot-melt processes or by powder-coating processes. The radiation-curable composition is preferably applied by roller-coating. The application may take place either at room temperature or at elevated temperature, but preferably not above 100 °C.

5

Thus, the coating compositions described herein can be applied to a surface of a fiber cement product using a brush, blade, roller, sprayer (e.g., air-assisted or airless, electrostatic), vacuum coater, curtain coater, flood coater or any suitable device that promotes an even distribution of the coating composition over the surface, even if the surface is damaged, worn, or cracked. The coating compositions may be applied to provide a smooth surface, colored surface or textured surface. A portion or an entire surface of the fiber cement product may be coated at one time. In addition or as an alternative, all or a portion of the surface may be coated more than one time to achieve the desired thickness, gloss, and/or surface effect. The amount of coverage obtained by a quantity of the composition will vary depending on the desire and/or condition of the surface to be covered and the thickness of the coating applied.

10

15

In the processes of the invention, the step (iv) of partially curing the first coating layer of the first radiation-curable coating composition and the step (vi) of curing the first and second layers of the first and second radiation-curable coating compositions, respectively, so as to obtain a fiber cement product of the invention can be performed using any suitable radiation curing method known in the art.

20

For example, radiation curing of the coating compositions may include curing by heat curing, dual-curing, UV radiation curing, electron beam (EB) curing, LED curing and other curing technologies within a thermoplastic or thermosetting system.

25

Also, the step (iv) of partially curing the first layer and step (vi) of curing the second layer of radiation curable composition by radiation may include curing by heat curing, dual-curing, UV radiation curing, electron beam (EB) curing, LED curing in combination with Excimer technology.

30

If curing is performed by UV radiation, the preparations to be used comprise at least one photoinitiator. A distinction is to be made here between photoinitiators for free-radical curing mechanisms (polymerization of ethylenically unsaturated double bonds) and photoinitiators for cationic curing mechanisms (cationic polymerization of ethylenically unsaturated double bonds or

polymerization of compounds containing epoxy groups). Photoinitiators are not needed for electron beam curable compositions.

Suitable photoinitiators for free-radical photopolymerization, i.e. polymerization of ethylenically unsaturated double bonds, are benzophenone and benzophenone derivatives, such as 4-phenylbenzophenone and 4-chlorobenzophenone, Michler's ketone, anthrone, acetophenone derivatives, such as 1-benzoylcyclohexan-1-ol, 2-hydroxy-2,2-dimethylacetophenone and 2,2-dimethoxy-2-phenylacetophenone, benzoin and benzoin ethers, such as methyl benzoin ether, ethyl benzoin ether and butyl benzoin ether, benzil ketals, such as benzil dimethyl ketal, 2-methyl-1-[4-(methylthio)phenyl]-2-morpholinopropan-1-one, anthraquinone and its derivatives, such as .beta.-methylantraquinone and tertbutylantraquinone, acylphosphine oxides, such as 2,4,6-trimethylbenzoyldiphenylphosphine oxide, ethyl-2,4,6-trimethylbenzoylphenylphosphinate and bisacylphosphine oxides.

Suitable photoinitiators for cationic photopolymerization, i.e. the polymerization of vinyl compounds or compounds containing epoxy groups, are aryl diazonium salts, such as 4-methoxybenzenediazonium hexafluorophosphate, benzenediazonium tetrafluoroborate and toluenediazonium tetrafluoroarsenate, arylodonium salts, such as diphenyliodonium hexafluoroarsenate, arylsulfonium salts, such as triphenylsulfonium hexafluorophosphate, benzene- and toluenesulfonium hexafluorophosphate and bis [4-diphenylsulfoniophenyl] sulfide bishexafluorophosphate, disulfones, such as diphenyl disulfone and phenyl-4-tolyl disulfone, diazodisulfones, imidotriflates, benzoin tosylates, isoquinolinium salts, such as N-ethoxyisoquinolinium hexafluorophosphate, phenylpyridinium salts, such as N-ethoxy-4-phenylpyridinium hexafluorophosphate, picolinium salts, such as N-ethoxy-2-picolinium hexafluorophosphate, ferrocenium salts, titanocenes and titanocenium salts.

The above-mentioned photoinitiators are used, in amounts from about 0,05% to about 20% by weight, preferably from about 0,1% to about 10% by weight and in particular from about 0,1% to about 5% by weight, based on the polymerizable components of the radiation-curable composition.

In particular embodiments, the photo-initiator used for UV-curing in the processes of the present invention is Irgacure® 184. Irgacure® 184 is a highly efficient non-yellowing photoinitiator used to initiate the photo polymerization of chemically unsaturated prepolymers e.g., acrylates – in combination with mono- or multifunctional vinyl monomers.

In particular embodiments, the photo-initiator used for UV-curing in the processes of the present invention is Irgacure® 819. Irgacure® 819 is a versatile photoinitiator for radical polymerization of unsaturated resins upon UV light exposure. It is especially suitable for white pigmented formulations, the curing of glass-fiber-reinforced polyester/styrene systems and for clear coats for outdoor use in combinations with light stabilizers. Thick-section curing is also possible with this photoinitiator.

The radiation-curable coating composition may be cured by exposure to a UV radiation of wavelength generally from about 200 nm to about 600 nm. Suitable examples of UV sources are high and medium pressure mercury, iron, gallium or lead vapor lamps as well as LED arrays. Medium pressure mercury vapor lamps and LED arrays are particularly preferred, e.g. the CK or CK1 sources from the company IST (Institut für Strahlungstechnologie). The radiation dose usually sufficient for obtaining some degree of crosslinking is in the range from about 80 to about 3000 mJ/cm².

In particular embodiments of the invention, in order to fully cure a radiation curable composition applied as a surface coating, more than 1000 mJ/cm² of radiation is necessary.

In particular embodiments of the invention, the step of partially curing the first layer of radiation curable composition is done by irradiation using about 100 to about 800 mJ/cm².

Any solvent present, in particular water, is dried out before the curing in a separate drying step preceding curing, for example by heating to temperatures in the range from about 40°C to about 80°C, or by exposure to IR radiation.

In case of electron beam curing, irradiation is performed with high-energy electrons (usually from 100 to 350 keV), by applying a high voltage to tungsten filaments inside a vacuum chamber), and the actual curing step takes place in an inert, oxygen-free atmosphere.

In further particular embodiments of these processes, the second radiation curable composition layer is covered with a radiation permeable film prior to the curing step. In particular, according to some embodiments, the second radiation curable coating layer may be roll-covered with a radiation permeable film before applying radiation. Care is taken to have an intimate sealing contact between the liquid coated panels and the controlled surface layer of the film, in order to remove entrapped bubbles and air pockets between the overlying film and the panel by the roller. This film provides protection against the radical chain-breaking reaction of oxygen, and avoids the use of inert gas atmosphere in the case of electron beam curing. Moreover, this covering film may have a controlled gloss surface with a predetermined surface finish on the side in contact with the liquid coated panel surface. Suitable radiation permeable films are thin plastic films of polyester or polyolefins. The controlled surface gloss on the radiation permeable film can be obtained in various ways, such as

embossing, printing, coating, etching or by the use of matting additives. Moreover, the radiation permeable film with its regularly distributed surface micro-roughness can possibly be texturized, e.g. allowing labelling.

- 5 In further particular embodiments of these processes, the curing step is preceded by a treatment of the second radiation curable composition layer by means of an excimer laser.

The irradiation with an excimer laser influences, i.e. reduces, the gloss of the second layer at its surface, which is typically the outer surface of the fiber cement product. Thus, optionally, after having provided the second radiation curable coating layer, and prior to the curing of the second layer, the irradiation with an excimer laser may be applied. This results in a low-gloss effect of the uncured second coating layer, which is subsequently fully cured with irradiation, e.g. UV irradiation. Further finishing techniques may also be applied, including but not limited to PVC flowing or wood flowing.

- 15 In a second aspect, the present invention provides fiber cement products obtainable by the processes of the present invention.

In the context of the present invention, fiber cement products are to be understood as cementitious products comprising cement and synthetic (and optionally natural) fibers. The fiber cement products are made out of fiber cement slurry, which is formed in a so-called "green" fiber cement product, and then cured.

Dependent to some extent on the curing process used, the fiber cement slurry typically comprises water, process or reinforcing fibers which are synthetic organic fibers (and optionally also natural organic fibers, such as cellulose), cement (e.g. Portland cement), limestone, chalk, quick lime, slaked or hydrated lime, ground sand, silica sand flour, quartz flour, amorphous silica, condensed silica fume, microsilica, kaolin, metakaolin, wollastonite, mica, perlite, vermiculite, aluminum hydroxide (ATH), pigments, anti-foaming agents, flocculants, and/or other additives.

In particular embodiments, the fiber cement products of the invention have a thickness of between about 4 mm and about 200 mm, in particular between about 6 mm and about 200 mm, more in particular between about 8 mm and about 200 mm, most in particular between about 10 mm and about 200 mm.

The fiber cement products as referred to herein include roof or wall covering products made out of fiber cement, such as fiber cement sidings, fiber cement boards, flat fiber cement sheets, corrugated

fiber cement sheets and the like. According to particular embodiments, the fiber cement products according to the invention can be roofing or façade elements, flat sheets or corrugated sheets. According to further particular embodiments, the fiber cement products of the present invention are fiber cement sheets.

5

The fiber cement products of the present invention comprise from about 0.1 to about 5 weight%, such as particularly from about 0.5 to about 4 weight% of fibers, such as more particularly between about 1 to 3 weight% of fibers with respect to the total weight of the fiber cement product.

10 According to particular embodiments, the fiber cement products according to the invention are characterized in that they comprise fibers chosen from the group consisting of cellulose fibers or other inorganic or organic reinforcing fibers in a weight % of about 0.1 to about 5. In particular
embodiments, organic fibers are selected from the group consisting of polypropylene, polyvinylalcohol polyacrylonitrile fibers, polyethyelene, cellulose fibres (such as wood or annual kraft
15 pulps), polyamide fibers, polyester fibers, aramide fibers and carbon fibers. In further particular embodiments, inorganic fibers are selected from the group consisting of glass fibers, rockwool fibers, slag wool fibers, wollastonite fibers, ceramic fibers and the like. In further particular embodiments, the fiber cement products of the present invention may comprise fibrils fibrids, such as for example but not limited to, polyolefinic fibrils fibrids % in a weight % of about 0.1 to 3, such as “synthetic
20 wood pulp”.

According to certain particular embodiments, the fiber cement products of the present invention comprise 20 to 95 weight % cement as hydraulic binder. Cement in the products of the invention is selected from the group consisting of Portland cement, cement with high alumina content, Portland
25 cement of iron, trass-cement, slag cement, plaster, calcium silicates formed by autoclave treatment and combinations of particular binders. In more particular embodiments, cement in the products of the invention is Portland cement.

According to particular embodiments, the fiber cement products according to the invention
30 optionally comprise further components. These further components in the fiber cement products of the present invention may be selected from the group consisting of water, sand, silica sand flour, condensed silica fume, microsilica, fly-ashes, amorphous silica, ground quartz, the ground rock, clays, pigments, kaolin, metakaolin, blast furnace slag, carbonates, puzzolanas, aluminium hydroxide, wollastonite, mica, perlite, calcium carbonate, and other additives (e.g. colouring additives) etc. It

will be understood that each of these components is present in suitable amounts, which depend on the type of the specific fiber cement product and can be determined by the person skilled in the art. In particular embodiments, the total quantity of such further components is preferably lower than 70 weight % compared to the total initial dry weight of the composition.

5

Further additives that may be present in the fiber cement products of the present invention may be selected from the group consisting of dispersants, plasticizers, antifoam agents and flocculants. The total quantity of additives is preferably between about 0.1 and about 1 weight % compared to the total initial dry weight of the composition.

10

The process for the manufacture of the fiber cement products most widely used is the Hatschek process, which is a modified sieve cylinder paper making machine. Other manufacturing processes are the Magnani process, injection, extrusion, flow-on and others. The Fiber-reinforced cement products are preferably manufactured by the Hatschek process. The green or uncured sheet is optionally post-compressed usually at pressures in the range from 22 to 30 MPa to obtain the desired density and subsequently air-cured for about 5 hours in an oven at a temperature not higher than 80°C.

15

The sheets are possibly but not necessarily autoclaved, generally within 1 week after production of the uncured sheet, and cured at temperatures in the range of from 160°C to 190°C while subjected to pressures ranging generally from about 0,7 MPa to 1,3 MPa during preferably about 6 to 24 hours.

20

In a third aspect, the present invention provides uses of the coloured fiber cement products provided with a coloured coating according to the present invention as a building material. These fiber cement building materials may be porous materials comprising one or more different materials such as a gypsum composite, cement composite, geopolymer composite or other composites having an inorganic binder. The surface of the material may be sanded, machined, extruded, molded or otherwise formed into any desired shape by various processes known in the art. The fiber cement building materials may be fully cured, partially cured or in the uncured "green" state. Fiber cement building materials may further include gypsum board, fiber cement board, fiber cement board reinforced by a mesh or continuous fibers, gypsum board reinforced by short fibers, a mesh or continuous fibers, inorganic bonded wood and fiber composite materials, geopolymer bonded wood and fiber boards, concrete roofing tile material, and fiber-plastic composite material.

25

30

In particular embodiments, the fiber cement products of the invention are fiber cement sheets produced by the processes of the present invention and can be used to provide an outer surface to walls, both internal as well as external a building or construction, e.g. as façade plate, siding, etc.

5 **EXAMPLES**

It will be appreciated that the following examples, given for purposes of illustration, are not to be construed as limiting the scope of this invention. Although only a few exemplary embodiments of this invention have been described in detail above, those skilled in the art will readily appreciate that many modifications are possible in the exemplary embodiments without materially departing from the novel teachings and advantages of this invention. Accordingly, all such modifications are intended to be included within the scope of this invention that is defined in the following claims and all equivalents thereto. Further, it is recognized that many embodiments may be conceived that do not achieve all of the advantages of some embodiments, yet the absence of a particular advantage shall not be construed to necessarily mean that such an embodiment is outside the scope of the present invention.

Example 1: Production of fiber cement sheets provided with double coating system according to the processes of the invention

20 The invention will now be illustrated by means of one particular non-limiting embodiment of the processes of the invention.

Figure 1 shows a schematically view of the process steps of a process according to the invention. Figure 2 shows a schematically view of a cross section of a fiber cement product 100, being a fiber cement boards, according to the second aspect of the invention made using the process of figure 1.

25 In a first step 10, a cured fiber cement board 101 is provided. In this embodiment, an air cured fiber cement board “Eterplan” is provided. This board 101 was manufactured starting from an aqueous hydraulic-setting suspension comprising one or more cementitious binders, processing fibers, and optionally reinforcing fibers, processing aids, additives and/or fillers. This aqueous suspension with a solid content generally ranging from 2 to 10% was mixed so as to obtain a substantially uniform distribution of the components. The suspension was then dewatered, and the fresh product (green product) was shaped in the form of a plane sheet, which is optionally post-compressed to densify and subsequently left to harden under atmospheric conditions (air-curing) or under specific pressure, temperature and humidity conditions (autoclaving).

In a next step 12, the board 101 was provided at one of its surfaces 105 with an adhesion primer 103 to promote the adhesion of the next composition coating layers. The adhesion primer used was "Natura Walzgrundierung".

5 In a consecutive step 14, a first layer 107 of a first UV-radiation curable composition was provided to the surface 105. This was done by roller coating.

The first radiation curable composition is a transparent composition, to provide a transparent coating layer, being 2K- UV- 4500, 2K- UV- DP- 2010.

The wet amount of composition applied was about 70g/m² to provide a first coating layer.

10 In step 16, this first layer of radiation curable composition was partially cured or gelled by UV-radiation. A UV lamp was used for this partially curing.

The UV-radiation was applied with an irradiation of between about 100 and about 800mJ/cm² of fiber cement product surface. As such, this first layer was only partially cured. Partial curing can be tested using the standard ISO 2409, in which the amount of double bonds that are unreacted is determined. It was determined that when the amount of remaining unreacted double bonds was
15 between about 20% and 50%, the first coating was appropriately partially cured.

In a consecutive step 18, a second layer 109 of a UV-radiation curable composition was provided on top of the first, partially cured, layer 107. This was done by roller coating.

The second radiation curable composition was substantially the same radiation curable composition as used for the first layer, but being provided with pigment.

20 In a first embodiment, the pigment added was "Novoprem BLS02", available from Clariant, of which an amount of about 5wt% was added to the composition. The layer was applied in a wet amount of about 160g/m² to provide a cured coating layer with thickness of about 120µm.

In a second embodiment, the pigment added was "Hostaprem Red E5B02" of which an amount of about 5wt% was added to the composition. The layer was applied in a wet amount of 160g/m² to
25 provide a cured coating layer with thickness of about 120µm.

In step 20, this first and second layer of radiation curable composition were cured by UV-radiation. A UV-lamp was used for this curing. The UV-radiation was applied with an irradiation energy of about 2000 mJ/cm² of fiber cement product surface. As such, the first and second layers were fully cured.

Both embodiments were subjected to an outdoor exposure of 2.5 years. None of both showed any traces of brownish spots.

As a reference, the same substrate as substrate 101 was coated with the adhesion primer with 1.6% "Novoprem BLS02".

- 5 This reference sample was subjected to the same outdoor exposure and did show after 2.5 years, brownish spots.

The same two embodiments and the reference were subjected to a standard Xenon test (DIN 53387). The fiber cement products were irradiated with a Xenon lamp at wavelengths between about 300
10 and about 400 nm at a temperature of about 38°C and a relative humidity of about 70%
A raining system was applied in accordance with method A of the DIN standard 53387. In this method, spraying was done with de-ionized water for a period of 18 minutes. The products were dried for about 102 minutes.

- 15 After Xenon test of 170h, for the reference sample, clearly brownish spots were present, whereas even after 1000h of Xenon test, the two embodiments according to the invention remained free of brown spots.

In alternative embodiments, the process steps 19 and 21 were applied, where before the UV-curing
20 step 20, a UV-radiation permeable foil with an imprinted pattern was roll-coated on the second, uncured composition layer 109. After curing step 20, the foil was again removed from the cured composition surface. As the pattern was oriented towards the composition layer 109, the cured composition coating layer 109 showed the mirror image of the pattern, thereby e.g. reducing the gloss of the fiber cement coated product.

- 25 In yet alternative embodiments, the process steps 19 and 21 were applied, where before the UV-curing step 20, the second radiation curable composition layer was treated with an excimer laser.
The irradiation with an excimer laser influenced, i.e. reduced, the gloss of the second layer at its surface, which became visible at the outer surface of the fiber cement product. This resulted in a low-gloss effect of the uncured second coating layer, which was subsequently fully cured with
30 irradiation, e.g. UV irradiation. Eventually, the finished fiber cement product also showed a reduced gloss.

It is to be understood that although preferred embodiments and/or materials have been discussed for providing embodiments according to the present invention, various modifications or changes may be made without departing from the scope and spirit of this invention.

5

10

15

20

25

30

Claims

1. A process for manufacturing coated fiber cement products, wherein said process comprises the steps of:

- 5 (i) providing a cured fiber cement product having at least one surface;
(ii) optionally applying a primer to the at least one surface of the cured fiber cement product;
(iii) providing a first layer of a first radiation curable composition to the at least one surface;
(iv) partially curing the first layer of radiation curable composition by radiation;
(v) providing a second layer of a second radiation curable composition to the partially cured first
10 layer, the second radiation curable composition comprising pigments; and
(vi) curing the first and the second layer of radiation curable composition by radiation.

2. The process according to claim 1, wherein said second radiation curable composition comprises organic pigments.

15

3. The process according to any one of the preceding claims, wherein said second radiation curable composition comprises between one and five different pigments.

4. The process according to any one of the preceding claims, wherein said second radiation
20 curable composition has a hiding power of between about 90% and 100%.

5. The process according to any one of the preceding claims, wherein second radiation curable composition has a pigment volume concentration (PVC) in the range of between about 2% and about 10%.

25

6. The process according to any one of the preceding claims wherein the thickness of said second radiation curable composition layer ranges between about 10 μ m and about 120 μ m.

7. The process according to any one of the preceding claims, wherein said first radiation curable
30 composition is pigment-free.

8. The process according to any one of the preceding claims, wherein the thickness of said first radiation curable composition layer ranges between about 10 μ m and about 100 μ m.

9. The process according to any one of the preceding claims, wherein said step of partially curing said first layer of said first radiation curable composition is done by irradiation using about 100 to about 800 mJ/cm² of irradiation energy.

10. The process according to any one of claims 1 to 9, wherein said first and said second radiation curable composition are UV-curable compositions.

11. The process according to any one of claims 1 to 9, wherein said first and said second radiation curable composition are electron beam curable compositions.

12. The process according to any one of the preceding claims, wherein said first radiation curable composition and said second radiation curable composition are isocyanate-bearing polyurethanes having ethylenically unsaturated double bonds.

13. The process according to any one of the preceding claims, wherein said second radiation curable composition layer is covered with a radiation permeable film prior to said curing step.

14. The process according to any one of the preceding claims, wherein said curing step is preceded by a treatment of said second layer by means of an excimer laser.

15. A fiber cement product obtainable by the process according to any one of the preceding claims.

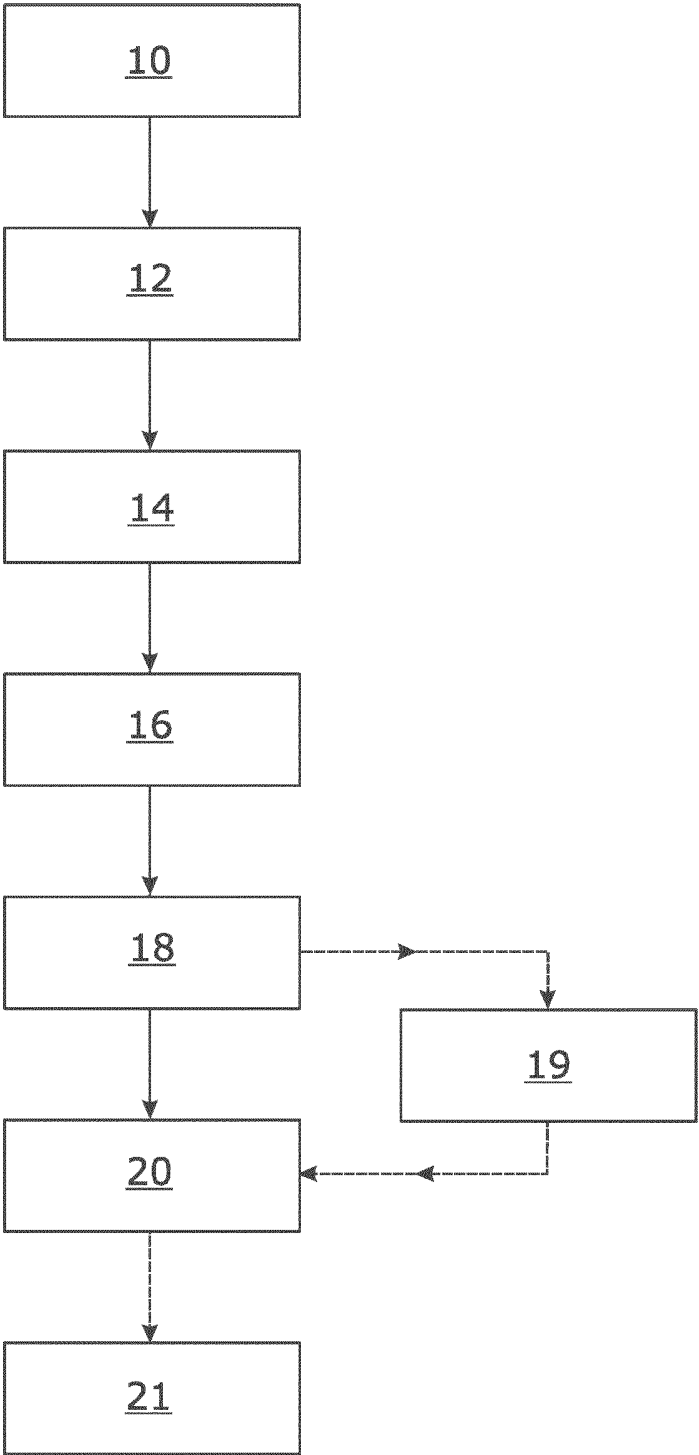


Fig. 1

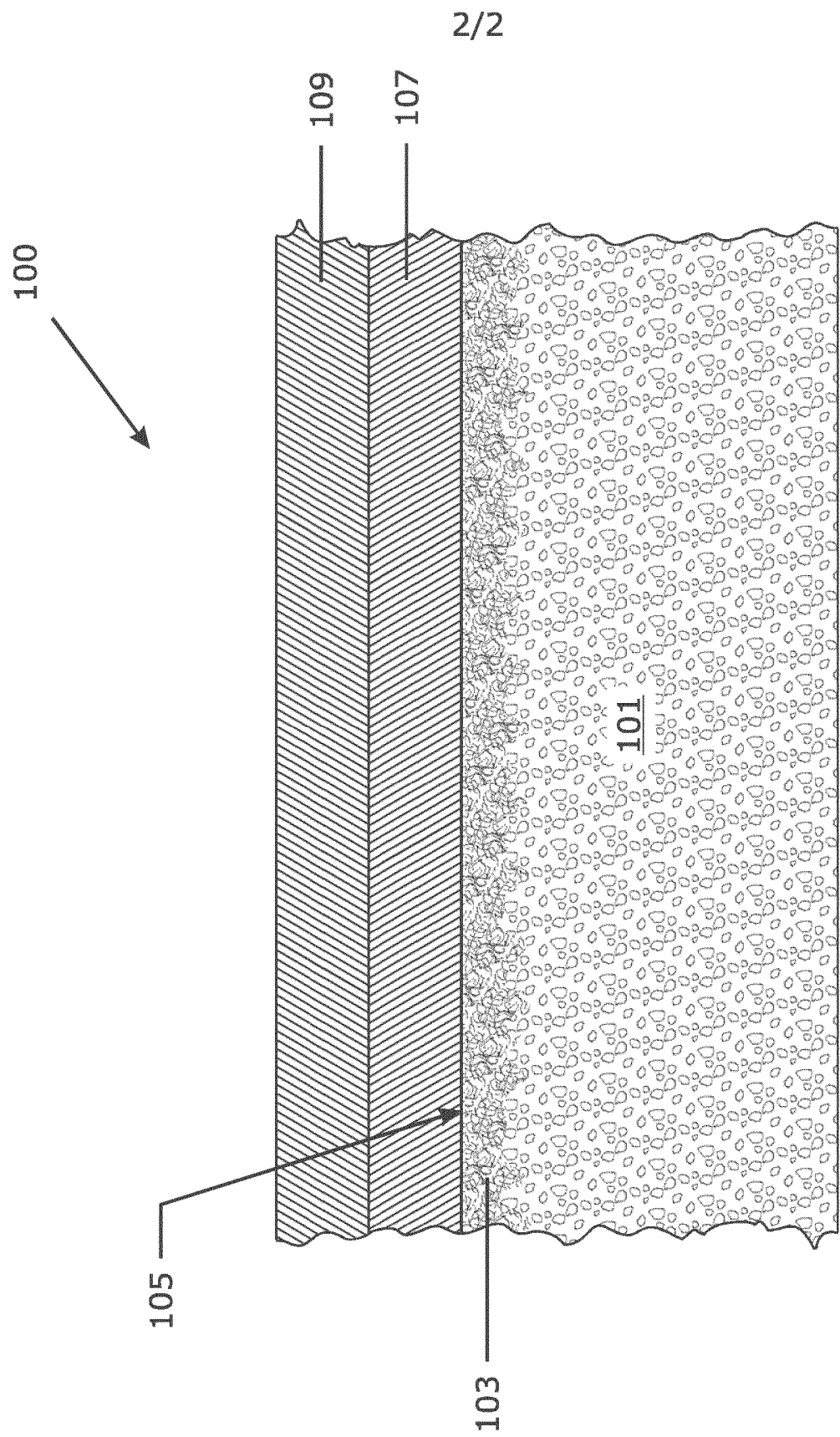


Fig. 2

INTERNATIONAL SEARCH REPORT

International application No

PCT/EP2016/063192

A. CLASSIFICATION OF SUBJECT MATTER

INV. C04B41/00 C04B41/52 C04B41/71
ADD. C04B111/80 C04B111/82

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

C04B C09D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0 894 780 A1 (BASF AG [DE]) 3 February 1999 (1999-02-03)	15
Y	paragraphs [0032], [0033], [0077] - [0083]; claims 15-17; examples 5-10 -----	1-14
X	WO 2007/090131 A1 (VALSPAR SOURCING INC [US]; WU SHAOBING [US]; EVANSON KEVIN W [US]; BOH) 9 August 2007 (2007-08-09)	15
Y	paragraphs [0021] - [0024], [0036], [0064], [0088] - [0090], [0092]; claims 1,2,4 -----	1-14
X	US 5 871 824 A (BATES ROBERT ERNEST [NZ]) 16 February 1999 (1999-02-16)	1-12,15
Y	column 2, line 29; claims 1,2,5,11 column 3, line 9 - line 46 column 4, lines 25,34-42 ----- -/-	1-15



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

25 July 2016

Date of mailing of the international search report

02/08/2016

Name and mailing address of the ISA/

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040,
Fax: (+31-70) 340-3016

Authorized officer

Bonneau, Sébastien

INTERNATIONAL SEARCH REPORT

International application No

PCT/EP2016/063192

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 6 617 413 B1 (BRUCHMANN BERND [DE] ET AL) 9 September 2003 (2003-09-09)	1-13,15
Y	column 8, line 10 - line 15 column 11, lines 37-42 column 11, line 64 - column 12, line 46 column 13, line 16 - line 38 abstract	1-15
Y	----- EP 1 914 215 B1 (ETERNIT AG [DE]; REDCO NV [BE]) 13 May 2009 (2009-05-13) cited in the application paragraphs [0031], [0032], [0036], [0039] - [0042], [0054] - [0056]; claims 1,3	1-15
A	----- WO 2013/151442 A1 (BAKKEN MORTEN [NO]) 10 October 2013 (2013-10-10) the whole document -----	1-15

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/EP2016/063192

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 0894780	A1	03-02-1999	DE 19732621 A1 04-02-1999
			EP 0894780 A1 03-02-1999
			JP 4382173 B2 09-12-2009
			JP H11130561 A 18-05-1999
			MY 117138 A 31-05-2004
			NO 983477 A 01-02-1999
			US 6136383 A 24-10-2000

WO 2007090131	A1	09-08-2007	AU 2007211045 A1 09-08-2007
			CA 2636435 A1 09-08-2007
			CN 101379007 A 04-03-2009
			EP 1979293 A1 15-10-2008
			US 2007259166 A1 08-11-2007
			US 2007259188 A1 08-11-2007
			WO 2007090131 A1 09-08-2007

US 5871824	A	16-02-1999	AU 725266 B2 12-10-2000
			AU 1637597 A 25-09-1997
			US 5871824 A 16-02-1999
			US 6096388 A 01-08-2000

US 6617413	B1	09-09-2003	AT 255609 T 15-12-2003
			CA 2356685 A1 06-07-2000
			CN 1334833 A 06-02-2002
			DE 19860041 A1 29-06-2000
			DE 59907967 D1 15-01-2004
			EP 1144476 A1 17-10-2001
			ES 2212662 T3 16-07-2004
			JP 5105387 B2 26-12-2012
			JP 5466658 B2 09-04-2014
			JP 2002533542 A 08-10-2002
			JP 2011099119 A 19-05-2011
			KR 20010099893 A 09-11-2001
			US 6617413 B1 09-09-2003
			WO 0039183 A1 06-07-2000

EP 1914215	B1	13-05-2009	AR 063309 A1 21-01-2009
			AT 431322 T 15-05-2009
			CL 2007002966 A1 18-04-2008
			CN 101528640 A 09-09-2009
			CO 6210748 A2 20-10-2010
			DK 1914215 T3 07-09-2009
			EP 1914215 A1 23-04-2008
			JP 5074509 B2 14-11-2012
			JP 2010507033 A 04-03-2010
			PE 10782008 A1 14-08-2008
			RU 2009118393 A 27-11-2010
			WO 2008046803 A1 24-04-2008

WO 2013151442	A1	10-10-2013	NO 337077 B1 18-01-2016
			WO 2013151442 A1 10-10-2013



(12) 发明专利申请

(10) 申请公布号 CN 101955343 A

(43) 申请公布日 2011. 01. 26

(21) 申请号 201010268975. 4

(22) 申请日 2010. 08. 31

(71) 申请人 陈文光

地址 350319 福建省福清市高山镇凤岗工业
区龙光漆业有限公司

(72) 发明人 陈文光

(74) 专利代理机构 福州智理专利代理有限公司
35208

代理人 林捷华

(51) Int. Cl.

C04B 28/04 (2006. 01)

权利要求书 1 页 说明书 4 页

(54) 发明名称

一种节能找平腻子粉

(57) 摘要

本发明涉及一种节能找平腻子粉,其特征是由下列原料按重量百分比配制而成,其中:白水泥 20% -30%、灰质钙粉 5% -10%、重质碳酸钙粉 40% -60%、50-100 目的轻质砂 5% -15%、增强纤维 0.1% -1%、聚乙烯醇 0.1-1.5%、纤维素 0.1% -1.8%、聚合物粉末 1% -3%;其中轻质砂为聚苯颗粒、玻化微珠,或者膨胀珍珠岩之择一物质,增强纤维为 2mm 聚丙烯纤维,纤维素为羧甲基纤维素。本发明除具有高强度、耐水性好、无毒无味、耐黄变等特点外,由于添加了具有保温隔热功能的轻质砂,使得本发明的腻子粉在保证基本性能的同时,还具有质轻、保温、隔热好、耐磨、耐腐蚀、电绝缘性能好、防辐射等显著特点。

1. 一种节能找平腻子粉,其特征是由下列原料按重量百分比配制而成,其中:白水泥 20% -30%、灰质钙粉 5% -10%、重质碳酸钙粉 40% -60%、50-100 目的轻质砂 5% -15%、增强纤维 0.1% -1%、聚乙烯醇 0.1-1.5%、纤维素 0.1% -1.8%、聚合物粉末 1% -3%;其中轻质砂为聚苯颗粒、玻化微珠,或者膨胀珍珠岩之择一物质,增强纤维为 2mm 聚丙烯纤维,纤维素为羧甲基纤维素。

2. 根据权利要求 1 所述的一种节能找平腻子粉,其特征是优选原料重量百分比为:425# 白水泥 28%、灰质钙粉 7%、重质碳酸钙粉 51%、80 目聚苯颗粒 9%、2mm 聚丙烯纤维 0.5%、聚乙烯醇 0.9%、羧甲基纤维素 1.1%、聚合物粉末 2.5%。

3. 根据权利要求 1 所述的一种节能找平腻子粉,其特征是优选原料重量百分比为:425# 白水泥 28%、灰质钙粉 8%、重质碳酸钙粉 55%、70 目玻化微珠 5%、2mm 聚丙烯纤维 0.6%、聚乙烯醇 0.7%、羧甲基纤维素 0.8%、聚合物粉末 1.9%。

4. 根据权利要求 1 所述的一种节能找平腻子粉,其特征是优选原料重量百分比为:425# 白水泥 29%、灰质钙粉 7%、重质碳酸钙粉 44%、100 目膨胀珍珠岩 15%、2mm 聚丙烯纤维 0.7%、聚乙烯醇 0.7%、羧甲基纤维素 1.3%、聚合物粉末 2.3%。

一种节能找平腻子粉

技术领域：

[0001] 本发明属于建材领域，特别涉及一种用于内外墙打底的一种节能找平腻子粉。

背景技术：

[0002] 目前建筑行业用以内外墙打底的材料繁多，传统有采用石膏、滑石粉、石灰膏、白水泥渗入 107 胶，搅拌成膏状进行施工刮底，随着人们对环保的重视，尤其内墙打底方面，已摒弃了 107 胶，大部分采用腻子粉调水打底。腻子粉主要由重质碳酸钙、白水泥等材料加工而成，打底固化后硬度适中，便于砂平。现有腻子粉的主要指标是抗龟裂、不起皮、不脱落，具有一定的硬度和耐水性。随着社会进步，人们对腻子粉的功能要求也逐渐提高，除了一般的要求外，还需考虑节能环保的诉求。

[0003] 目前腻子粉多以无机胶凝材料为基料，辅以大比例的填料，如石英粉、滑石粉、方解石粉等，以增加腻子的固体含量和改善施工性能，但这些填料大大增大了腻子粉本身的比重，为腻子的包装运输和施工过程增加了极大的不便，且增加了生产成本和施工成本。

[0004] 如何开发出一种即环保、节能、施工便利，又能满足特定功能需求的腻子粉已成为今后腻子发展的趋势，而目前，在国内同时具备轻质隔热保温特性的节能找平腻子粉还未见相关报道。

发明内容：

[0005] 本发明的目的是提供一种用水调制、含有纤维、具有轻质特性和保温隔热功能的节能找平腻子粉。

[0006] 本发明技术方案是这样实现的：一种节能找平腻子粉，其特征是由下列原料按重量百分比配制而成，其中：白水泥 20% -30%、灰质钙粉 5% -10%、重质碳酸钙粉 40% -60%、50-100 目的轻质砂 5% -15%、增强纤维 0.1% -1%、聚乙烯醇 0.1-1.5%、纤维素 0.1% -1.8%、聚合物粉末 1% -3%；其中轻质砂为聚苯颗粒、玻化微珠，或者膨胀珍珠岩之择一物质，增强纤维为 2mm 聚丙烯纤维，纤维素为羧甲基纤维素。

[0007] 与现有技术相比，发明配方所选用的原材料中，添加了具有隔热保温作用的轻质砂和防龟裂作用的增强纤维，与传统的墙体腻子粉相比，使用此配方生产出来的腻子粉具有保温、隔热、吸音等功能特性，同时还具有环保、附着力强、易打磨、抗龟裂、耐水、厚质等优点。而且由于轻质砂比重仅为普通填料的 1/5-1/8，采用该轻质填料大大减轻了腻子粉的重量，为其包装运输和施工过程增加了极大的便利，且大大降低了生产成本和施工成本，符合现如今节能减排的发展趋势。

具体实施方式：

[0008] 实施例一：

[0009] 生产 100 份节能找平腻子粉为例，优选加工好的原料，按成分所占重量比例分别为：425# 白水泥 28%、灰质钙粉 7%、重质碳酸钙粉 51%、80 目聚苯颗粒 9%、2mm 聚丙烯纤

维 0.5%、聚乙烯醇 0.9%、羧甲基纤维素 1.1%、聚合物粉末 2.5%。

[0010] 在容器中先放入大约一半量的白水泥、灰质钙粉、重质碳酸钙粉和聚苯颗粒,搅拌 10 分钟后;而后加入聚丙烯纤维、聚乙烯醇、羧甲基纤维素和聚合物粉末,搅拌 10 分钟后;再加入剩余的白水泥、灰质钙粉、重质碳酸钙粉和聚苯颗粒,继续搅拌 30 分钟出料,排气后装袋,并可按袋装标准称重后封口。按照上述配比混合调制的腻子粉,加水调成膏状,可用于墙面打底。

[0011] 按照所述制备方式制备本发明的一种节能找平腻子粉,其各项性能指标如下:

[0012]

项目	单位	无裂纹	实测值
容器中状态	/	无结块、均匀	符合
施工性	/	刮涂无障碍	符合
干燥时间(表干)	h	≤ 5	< 4
打磨性	/	手工可打磨	符合
耐水性(96h)	/	无异常	无异常
耐碱性 [饱和 $\text{Ca}(\text{OH})_2$ 溶液, 48h]	/	无异常	无异常
初期干燥抗裂性(6h)	/	无裂纹	无裂纹
粘结强度	Mpa	> 0.6	0.77
吸水量	g/10min	≤ 2	1.3
腻子膜柔韧性(直径 100mm)	/	无裂纹	无裂纹
干密度	kg/m ³	/	892
导热系数	W/(m $\cdot$ K)	/	0.77
测试环境条件: $(23 \pm 2) ^\circ\text{C}$, $(50 \pm 5) \% \text{RH}$			

[0013]

[0014] 实施例二:

[0015] 按上例相同的工艺,并按下列优选原料的比例范围,将原料混合搅拌,其中 425# 白水泥 28%、灰质钙粉 8%、重质碳酸钙粉 55%、70 目玻化微珠 5%、2mm 聚丙烯纤维 0.6%、聚乙烯醇 0.7%、羧甲基纤维素 0.8%、聚合物粉末 1.9%。

[0016] 按照所述制备方式制备本发明的一种节能找平腻子粉,其各项性能指标如下:

[0017]

项目	单位	无裂纹	实测值
容器中状态	/	无结块、均匀	符合
施工性	/	刮涂无障碍	符合
干燥时间（表干）	h	≤ 5	< 4
打磨性	/	手工可打磨	符合
耐水性（96h）	/	无异常	无异常
耐碱性 [饱和 $\text{Ca}(\text{OH})_2$ 溶液, 48h]	/	无异常	无异常
初期干燥抗裂性（6h）	/	无裂纹	无裂纹
粘结强度	Mpa	> 0.6	0.81
吸水量	g/10min	≤ 2	1.7
腻子膜柔韧性（直径100mm）	/	无裂纹	无裂纹
干密度	kg/m ³	/	1160
导热系数	W/(m $\cdot$ k)	/	0.81
测试环境条件：(23 $\pm$ 2)℃，(50 $\pm$ 5)%R $\cdot$ H			

[0018]

[0019] 实施例三：

[0020] 按上例相同的工艺,准备好原料,并按下列优选原料的比例范围,将原料混合搅拌,其中 425# 白水泥 29%、灰质钙粉 7%、重质碳酸钙粉 44%、100 目膨胀珍珠岩 15%、2mm 聚丙烯纤维 0.7%、聚乙烯醇 0.7%、羧甲基纤维素 1.3%、聚合物粉末 2.3%。

[0021] 按照所述制备方式制备本发明的一种节能找平腻子粉,其各项性能指标如下：

[0022]

项目	单位	无裂纹	实测值
容器中状态	/	无结块、均匀	符合
施工性	/	刮涂无障碍	符合
干燥时间（表干）	h	≤ 5	< 4
打磨性	/	手工可打磨	符合
耐水性（96h）	/	无异常	无异常
耐碱性 [饱和 和 $\text{Ca}(\text{OH})_2$ 溶液, 48h]	/	无异常	无异常
初期干燥抗裂性（6h）	/	无裂纹	无裂纹
粘结强度	Mpa	> 0.6	0.78
吸水量	g/10min	≤ 2	1.6
腻子膜柔韧性（直径 100mm）	/	无裂纹	无裂纹
干密度	kg/m ³	/	809
导热系数	W/(m $\cdot$ K)	/	0.45
测试环境条件：(23 $\pm$ 2) ℃，(50 $\pm$ 5) %R $\cdot$ H			

[0023] 测试本发明腻子样品,发现本发明腻子粉有很突出的隔热保温功能,导热系数低,打磨性能好,附着力优异,耐水抗渗。而且干密度较低,极大地减轻运输和施工的负荷,纯属节能产品。

1 PALE-COLORED FIBER CEMENT PRODUCTS AND METHODS FOR THE PRODUCTION THEREOF

Field of the invention

- 5 The present invention relates to pale-colored fiber cement products. The present invention further relates to methods for the production of these pale-colored fiber cement products as well as to uses thereof in the building industry.

Background of the invention

- 10 Pale-colored or white-colored fiber cement products are known in the art. Obtaining the white color is achieved either by using white cement as a basic component or by coating ordinary gray fiber cement-based products with a white-colored paint. The latter way is most commonly applied because it is simple to do, less expensive compared to the use of white cement, and because it allows to obtain any desired white color shade.

Summary of the invention

The present inventors have now developed new and inventive pale-colored fiber cement products at least comprising white cement and synthetic fibers. The pale-colored fiber cement products of the present invention are esthetically appealing and have very good mechanical and physical properties.

- 20 More specifically, the fiber cement products of the present invention at least comprise white cement and synthetic fibers, wherein the synthetic fibers are pigmented with at least one dark pigment chosen from the group consisting of a black pigment, a brown pigment, a blue pigment, a red pigment, a green pigment and a gray pigment. EP2172434 discloses a fiber cement product composition comprising synthetic fibers. ■ 2 ■ pigment.

- While developing the new fiber cement products, the inventors have found that it is essential to color
25 the synthetic fibers with a pigment, rather than applying a dye or an ink. In fact, dark-colored fibers stained with a dye or an ink, proved to be unsuitable for the production of the pale-colored fiber cement products of the present invention. It was observed by the present inventors that after incorporating dye-stained or ink-stained fibers in the fiber cementitious products, the dye or ink caused bleeding effects and stains throughout the white cementitious matrix or, in other cases, the
30 fibers simply completely lost their color and as a result also their visibility. Without being bound to any hypothesis or theory, the inventors believe that the aqueous alkaline environment of the cementitious matrix causes an alteration in the chemical structure of the specific dye (or ink), thereby breaking the chemical bond between the dye (or ink) and the fiber or thereby causing a decolorization.

WO 2018/178079

PCT/EP2018/057774

2

Accordingly, the inventors looked for a solution to solve the above problems and have surprisingly found that when using a pigment to color the synthetic fibers, the bleeding or decoloring issues did not occur.

The resulting pale-colored fiber cement products of the present invention are esthetically appealing, especially because the surface of these products displays the texture and color of the core materials, which provides the products with a natural yet modern look. In particular, the pale-colored fiber cement products of the present invention expose the natural texture of both the cement (which is white-colored or pale-colored) and the synthetic fibers (which are dark-colored), creating an appealing contrast between both components. Furthermore, the pale-colored products of the present invention are mechanically strong and highly resistant to cracks and wearing, even under harsh and adverse weather conditions. An additional advantage of the products according to the present invention is that, since the inner core and the surface consist of the same material, any faults or damage that may occur during the life-time of the products will be less visible compared to coated products, which typically have a surface color which is different from the inner mass color.

Presently, there is an increasing demand from architects and designers to develop new fiber cement products, visualizing the natural fiber cement core material. Of course, such natural looking building products have to fulfill the same standard national requirements with regard to mechanical and physical properties (i.e. mechanical strength, hygric movement etc.) as their corresponding predecessors. The present inventors have met this increasing market demand with the products of the present invention.

Accordingly, in a first aspect, the present invention provides pale-colored fiber cement products at least comprising white cement and synthetic fibers, wherein the synthetic fibers are pigmented with at least one dark pigment chosen from the group consisting of a black pigment, a brown pigment, a blue pigment, a red pigment, a green pigment and a gray pigment.

In particular embodiments, the synthetic fibers comprised in the pale-colored fiber cement products of the present invention are polypropylene fibers. In further particular embodiments, the synthetic fibers are polypropylene fibers having a thickness of about 70 dtex. In further particular embodiments, the synthetic fibers are milled polypropylene fibers. In yet further particular embodiments, the synthetic fibers are milled polypropylene fibers having an average length of about 1 mm to about 2 mm.

In particular embodiments, the synthetic fibers comprised in the pale-colored fiber cement products of the present invention are pigmented with at least one dark pigment, such as an iron oxide, carbon black, a manganese oxide, cobalt blue, a cobalt oxide, a chromium oxide, copper phthalocyanine, or

WO 2018/178079

PCT/EP2018/057774

3

ultramarine blue. In particular embodiments, the synthetic fibers comprised in the pale-colored fiber cement products of the present invention are pigmented with at least one dark pigment, which is an inorganic pigment.

5

In particular embodiments, the pale-colored fiber cement products of the present invention further comprise a white pigment. In further particular embodiments, the white pigment is present in an amount of between about 3 weight % and about 6 weight % (compared to the total dry weight of the fiber cement composition) of the fiber cement product. In yet further particular embodiments, the white pigment is chosen from the group consisting of a titanium oxide, a barium oxide, a barium sulfate and a barium containing mixture. In yet further particular embodiments, the white pigment is titanium oxide (TiO₂).

In particular embodiments, the pale-colored fiber cement products of the present invention further comprise limestone (CaCO₃) in an amount of between about 5 weight % and about 15 weight % (compared to the total dry weight of the fiber cement composition of said fiber cement product). In particular, the present inventors have found that CaCO₃ improves the water channeling properties of the fiber cement products of the present invention. Without being bound to any hypothesis or theory, the inventors believe that this is because white cement has a relatively low specific surface area compared to ordinary gray cement and therefore tends to enclose water in a higher degree. However, entrapped amounts of water are undesirable because these could be the cause of cracks and swelling of the fiber cement material upon exposure to rain and freeze-thaw conditions. The present inventors have managed to solve this issue by adding limestone. This ingredient ensures that a network of channels is created in between the cement particles of the fiber cement product, so as to ensure an optimal internal flow and channeling of water.

In particular embodiments, the pale-colored fiber cement products of the present invention are coated with a clear coating. In particular embodiments, the pale-colored fiber cement products of the present invention are coated with a clear coating, which clear coating comprises about 0.5% to about 4% (compared to the total dry weight of the fiber cement composition of said fiber cement product) of a white pigment. In further particular embodiments, the clear coating comprises about 1% to about 2% (compared to the total dry weight of the fiber cement composition of said fiber cement product) of a white pigment. In yet further particular embodiments, the clear coating comprises about 1% to about 2% (compared to the total dry weight of the fiber cement composition of said fiber cement product) of titanium oxide (TiO₂).

WO 2018/178079

PCT/EP2018/057774

4

In particular embodiments, the pale-colored fiber cement products of the present invention are coated with a clear coating, which is a clear synthetic coating, such as a clear acrylic coating. In alternative particular embodiments, the clear coating is a UV-curable clear coating.

5

In a second aspect, the present invention provides methods for the manufacture of pale-colored fiber cement products according to the invention, which methods at least comprise the steps of:

- a) Providing a fiber cement slurry at least comprising white cement and synthetic fibers, which synthetic fibers are pigmented with at least one dark pigment chosen from the group consisting of a black pigment, a brown pigment and a gray pigment;
- b) Manufacturing a fiber cement product by means of a fiber cement production process;
- c) Curing the fiber cement product, so as to obtain the pale-colored fiber cement product.

10

In particular embodiments, step c) of the methods according to the present invention comprises air-curing the fiber cement product.

15

In particular embodiments, the present invention provides methods for the manufacture of pale-colored fiber cement products, wherein step b) of manufacturing a fiber cement product is performed by means of a fiber cement production process chosen from the group consisting of a Hatschek process, a Magnani process, an extrusion process and a flow-on method. In further particular embodiments, the present invention provides methods for the manufacture of pale-colored fiber cement products, wherein step b) of manufacturing a fiber cement product is performed by means of a Hatschek production process.

20

In particular embodiments, the present invention provides methods for the manufacture of pale-colored fiber cement products, wherein at least one white pigment is added in the fiber cement slurry during step (i) of providing a fiber cement slurry. In further particular embodiments, the white pigment is added in an amount of between about 3 weight % and about 6 weight % (compared to the total dry weight of the fiber cement composition) of the fiber cement product. In further particular embodiments, the at least one white pigment is TiO₂.

25
30

In a third aspect, the present invention provides pale-colored fiber cement products obtainable by any of the methods according to the present invention.

WO 2018/178079

PCT/EP2018/057774

5

In a fourth aspect, the present invention provides uses of the pale-colored fiber cement products according to the present invention as building materials.

In particular embodiments, the present invention provides uses of the pale-colored fiber cement products according to the present invention as an outer surface to walls, applied internally or externally, e.g. as façade plate, siding, etc. In other particular embodiments, the pale-colored fiber cement products according to the present invention can be used for decking applications, fencing applications and/or covering applications.

The independent and dependent claims set out particular and preferred features of the invention.

Features from the dependent claims may be combined with features of the independent or other dependent claims, and/or with features set out in the description above and/or hereinafter as appropriate.

The above and other characteristics, features and advantages of the present invention will become apparent from the following detailed description, taken in conjunction with the accompanying drawings, which illustrate, by way of example, the principles of the invention. This description is given for the sake of example only, without limiting the scope of the invention. The reference figures quoted below refer to the attached drawings.

Brief description of the drawings

Figure 1 is a full picture of the top surface of a pale-colored fiber cement product according to the present invention.

Figure 2 is a detail picture of the top surface of a pale-colored fiber cement product according to the present invention.

Figures 3 to 6 are full pictures of sections of pale-colored fiber cement products according to the present invention.

The same reference signs refer to the same, similar or analogous elements in the different figures.

Detailed description of the invention

It is to be noted that the term “comprising”, used in the claims, should not be interpreted as being restricted to the means listed thereafter; it does not exclude other elements or steps. It is thus to be interpreted as specifying the presence of the stated features, steps or components as referred to, but does not preclude the presence or addition of one or more other features, steps or components, or

WO 2018/178079

PCT/EP2018/057774

6

groups thereof. Thus, the scope of the expression “a device comprising means A and B” should not be limited to devices consisting only of components A and B. It means that with respect to the present invention, the only relevant components of the device are A and B.

5 Throughout this specification, reference to “one embodiment” or “an embodiment” are made. Such references indicate that a particular feature, described in relation to the embodiment is included in at least one embodiment of the present invention. Thus, appearances of the phrases “in one embodiment” or “in an embodiment” in various places throughout this specification are not necessarily all referring to the same embodiment, though they could. Furthermore, the particular
10 features or characteristics may be combined in any suitable manner in one or more embodiments, as would be apparent to one of ordinary skill in the art.

The following terms are provided solely to aid in the understanding of the invention.

15 As used herein, the singular forms “a”, “an”, and “the” include both singular and plural referents unless the context clearly dictates otherwise.

The terms “comprising”, “comprises” and “comprised of” as used herein are synonymous with “including”, “includes” or “containing”, “contains”, and are inclusive or open-ended and do not exclude additional, non-recited members, elements or method steps.

20

The recitation of numerical ranges by endpoints includes all numbers and fractions subsumed within the respective ranges, as well as the recited endpoints.

The term “about” as used herein when referring to a measurable value such as a parameter, an
25 amount, a temporal duration, and the like, is meant to encompass variations of +/-10% or less, preferably +/-5% or less, more preferably +/-1% or less, and still more preferably +/-0.1% or less of and from the specified value, insofar such variations are appropriate to perform in the disclosed invention. It is to be understood that the value to which the modifier “about” refers is itself also specifically, and preferably, disclosed.

30

The terms “(fiber) cementitious slurry” or “(fiber) cement slurry” as referred to herein generally refer to slurries at least comprising water, fibers and cement. The fiber cement slurry as used in the context of the present invention may also further comprise other components, such as but not limited to, limestone, chalk, quick lime, slaked or hydrated lime, ground sand, silica sand flour, quartz flour,

WO 2018/178079

PCT/EP2018/057774

7

amorphous silica, condensed silica fume, microsilica, metakaolin, wollastonite, mica, perlite, vermiculite, aluminum hydroxide, pigments, anti-foaming agents, flocculants, and other additives.

“Fiber(s)” present in the fiber cement slurry as described herein may be for example process fibers and/or reinforcing fibers which both may be organic fibers (typically cellulose fibers) or synthetic fibers (polyvinyl alcohol, polyacrylonitrile, polypropylene, polyamide, polyester, polycarbonate, etc.).

“Cement” present in the fiber cement slurry as described herein may be for example but is not limited to Portland cement, cement with high alumina content, Portland cement of iron, trass-cement, slag cement, plaster, calcium silicates formed by autoclave treatment and combinations of particular binders.

“White cement” present in the fiber cement slurry for the manufacture of the fiber cement products of the present invention may be for example but is not limited to white Portland cement.

The terms “predetermined” and “predefined” as used herein when referring to one or more parameters or properties generally mean that the desired value(s) of these parameters or properties have been determined or defined beforehand, i.e. prior to the start of the process for producing the products that are characterized by one or more of these parameters or properties.

The term “cementitious” as in “cementitious product” or “cementitious material” as used herein refers to any product or material comprising cement, such as but not limited to Portland cement, cement with high alumina content, Portland cement of iron, trass-cement, slag cement, plaster, calcium silicates formed by autoclave treatment and combinations of particular binders. In more particular embodiments, cement in the products of the invention is Portland cement.

The term “fiber cement product” as used herein refer to products at least comprising fibers and cement. The fiber cement products as used in the context of the present invention may also further comprise other components, such as but not limited to, limestone, chalk, quick lime, slaked or hydrated lime, ground sand, silica sand flour, quartz flour, amorphous silica, condensed silica fume, microsilica, metakaolin, wollastonite, mica, perlite, vermiculite, aluminum hydroxide, pigments, anti-foaming agents, flocculants, and other additives.

WO 2018/178079

PCT/EP2018/057774

8

A “(fiber cement) sheet” as used herein, also referred to as a panel or a plate, is to be understood as a flat, usually rectangular element, a fiber cement panel or fiber cement sheet being provided out of fiber cement material. The panel or sheet has two main faces or surfaces, being the surfaces with the largest surface area. The sheet can be used to provide an outer surface to walls, both internal as well as external a building or construction, e.g. as façade plate, siding, etc.

The term “fiber cement layer” as used herein generally, and particularly in the context of the present invention, refers to any flat, optionally substantially rectangular, layer or cake essentially consisting of a fiber cement composition and having a thickness of at least about 1 mm, in particular between about 1 mm and 200 mm, more particularly between about 2 mm and about 150 mm, most particularly between about 4 mm and about 100 mm, such as between about 8 mm and about 10 mm.

A “Hatschek fiber cement layer” or a “Hatschek layer” as interchangeably used herein refers to a fiber cement layer (as defined herein), which is produced according to a Hatschek process, which at least comprises the steps of:

- (i) building a fiber cement film on a sieve, which sieve rotates so as to be in contact with a fiber cement slurry in a vat;
- (ii) transferring the fiber cement film from the sieve to the felt transport belt, and
- (iii) accumulating the fiber cement film on an accumulator roll via the felt transport belt.

In the context of the present invention, the use of the term “fiber cement film” refers to such a thin layer of fiber cement being applied onto the felt transport belt by one or more sieves rotating in a fiber cement slurry that is present in one or more vats of the Hatschek process. As may be understood from the aforementioned, series of thin fiber cement layers are produced on the one or more sieves from the Hatschek machine and subsequently superimposed and transferred from the one or more sieves to the transport belt, resulting in one or more uncured Hatschek fiber cement layers after accumulation on an accumulation roll. Thus, it will be clear that, when referring to “a fiber cement film” in the context of the present invention, it is to be understood that this term encompasses, where applicable, both the meaning of one single fiber cement film having a thickness of between about 0.01 mm and about 0.9 mm, such as in particular between about 0.05 mm and about 0.5 mm, such as between about 0.1 mm and about 0.4 mm, such as about 0.3 mm. (i.e. one thin layer of fiber cement also called a mono-layer, a single layer or a primary layer, that is applied onto the felt transport belt by a sieve from a vat of the Hatschek process) as well as the meaning of a layer comprising two or more superimposed fiber cement layers, each having a thickness of between about 0.01 mm and about 0.9 mm, such as in particular between about 0.05 mm and about 0.5 mm, such as between about 0.1 mm and about 0.4 mm, such as about 0.3 mm (i.e. two or more superimposed thin layers of fiber cement

WO 2018/178079

PCT/EP2018/057774

9

applied onto the felt transport belt by two or more sieves from a vat of the Hatschek process). The skilled person will understand, depending on the particular configuration of the Hatschek section, that when referring to processes of the invention in general both meanings of the term “fiber cement film” as described above will be applicable, while in more particular embodiments only one of both meanings are applicable. For instance, in a particular case where only one sieve is used in the Hatschek section for performing the processes of the invention, “a fiber cement film” as used herein means only one single layer having a thickness of between about 0.01 mm and about 0.9 mm that is applied onto the felt transport belt by the sieve from a vat of the Hatschek process. On the other hand, where two or more sieves are used in the Hatschek section for performing the processes of the invention, “a fiber cement film” as used herein means a superposition of two or more single layers, each having a thickness of between about 0.01 mm and about 0.9 mm, which are applied onto the felt transport belt by the sieve from a vat of the Hatschek process.

The term “water-permeable” as used herein when referring to a water-permeable (region of a) transport belt generally, and particularly in the context of the present invention, means that the material of which the water-permeable (region of the) belt is made allows water to flow through its structure to a certain extent.

The “water-permeability” as used herein when referring to the water-permeability of a (region of a) transport belt generally, and particularly in the context of the present invention, refers to the extent or degree to which the material of which the water-permeable (region of the) belt is made, allows water to flow through its structure. Suitable materials for water-permeable transport belts are known to the person skilled in the art, such as but not limited to felts.

A “non-hydrophobized (fiber cement) product” or a “non-hydrophobized fiber cement (film) layer” as used in the present context refers to a product, such as a fiber cement product or a fiber cement (film) layer, which has not been treated before, during or after its production, with a hydrophobizing agent. In particular, a “non-hydrophobized fiber cement product” or a “non-hydrophobized fiber cement sheet” as used herein will only comprise “fiber cement film layers”, which are non-hydrophobized.

The terms “pale-colored” and “white-colored” when referring to a fiber cement product are used interchangeably herein and have the meaning that at least part of the, and preferably the entire, internal structure of that fiber cement product comprises white cement as the main ingredient.

WO 2018/178079

PCT/EP2018/057774

10

The terms “internal (fiber cement) structure”, “inner (fiber cement) structure”, “internal (fiber cement) mass” or “inner (fiber cement) mass” as referred to interchangeably herein are used to indicate the fiber cement material present in a fiber cement product, which material is not visible with the eye when looking at the product from the outside.

5

The terms “external (fiber cement) structure” or “external (fiber cement) surface” as referred to interchangeably herein are used to indicate the fiber cement material which is exposed and visible on the outside of a fiber cement product.

A “transparent pigment” as used herein is meant to indicate a pigment of which the pigment particles have the property of transmitting visible light. Thus, a “transparent pigment” as used herein is a pigment, of which the majority of pigment particles are smaller than the wave length of visible light.

An “opaque pigment” as used herein is meant to indicate a pigment of which the pigment particles do not have the property of transmitting visible light. Thus, an “opaque pigment” as used herein is a pigment of which the majority of pigment particles are greater than the wave length of visible light.

A “semi-opaque pigment” (also referred to in the art as a semi-transparent pigment) as used herein is meant to indicate a pigment of which only a certain but significant percentage of pigment particles have the property of transmitting visible light. Thus, a “semi-opaque pigment” as used herein is a pigment of which a certain but significant percentage of pigment particles are greater than the wave length of visible light and of which the remaining percentage of pigment particles are smaller than the wave length of visible light.

The term “pigment” as used herein refers to a dry insoluble substance, usually pulverized, which when suspended in a liquid vehicle becomes a paint, ink, etc. Pigments typically consist of tiny solid particles that are used to enhance the appearance by providing color and/or to improve the physical (functional) properties of the paint or ink. Pigments used to provide color generally range from 0.2 to 0.4 microns in diameter. Functional pigments are typically 2-4 microns in diameter, but they may be as large as 50 microns.

The term “prime pigment” as used herein refers to any pigment (as defined herein), which is capable of providing whiteness and/or color to a substance while also contributing significantly to the hiding power of said substance. Prime pigments can be subdivided in white pigments and color pigments.

The term “white pigment” as referred to herein means a prime pigment, capable of scattering light and providing whiteness and hiding in flat or glossy paint or ink. White inorganic pigments include but

WO 2018/178079

PCT/EP2018/057774

11

are not limited to antimony pigments including Antimony White: Sb_2O_3 ; lead pigments (toxic) including White Lead $(\text{PbCO}_3)_2 \cdot \text{Pb}(\text{OH})_2$; titanium pigments including Titanium White: titanium (IV) oxide TiO_2 and ; zinc pigments including Zinc White: Zinc Oxide (ZnO).

5 The term “color pigment” as referred to herein means a prime pigment, capable of selectively absorbing light and providing color to a paint or ink. There are two main types of color pigments: organic pigments, which include the brighter colors but are not highly durable in exterior use and inorganic pigments, which are not as bright as organic colors but are the most durable exterior pigments.

10

The term “inorganic pigment” as used herein refers to naturally occurring mineral coloring compounds typically consisting of metallic salts. Inorganic pigments are usually oxides or sulphides of one or more metals.

15 Inorganic pigments include for instance but are not limited to:

- Blue inorganic pigments:

○ aluminum pigments, including ultramarine: a complex naturally occurring pigment of sulfur-containing sodio-silicate ($\text{Na}_{8-10}\text{Al}_6\text{Si}_6\text{O}_{24}\text{S}_{2-4}$);

○ cobalt pigments, including Cobalt Blue and Cerulean Blue: cobalt(II) stannate;

20 ○ copper pigments, including Egyptian Blue: a synthetic pigment of calcium copper silicate ($\text{CaCuSi}_4\text{O}_{10}$) and Han Blue $\text{BaCuSi}_4\text{O}_{10}$; and

○ iron pigments, including Prussian Blue: a synthetic pigment of ferric hexacyanoferrate ($\text{Fe}_7(\text{CN})_{18}$);

- Green inorganic pigments

25 ○ cadmium pigments, including Viridian: a dark green pigment of hydrated chromium(III) oxide (Cr_2O_3) and Cadmium Green: a light green pigment consisting of a mixture of Chromium Yellow (CrS) and Viridian (Cr_2O_3);

○ chromium pigments, including Chrome Green;

- copper pigments, including Paris Green: copper(II) acetoarsenite ($\text{Cu}(\text{C}_2\text{H}_3\text{O}_2)_2 \cdot 3\text{Cu}(\text{AsO}_2)_2$) and

30 Scheele's Green (also called Schloss Green): copper arsenite CuHAsO_3 ;

- Yellow inorganic pigments

○ arsenic pigments including Orpiment natural monoclinic arsenic sulfide (As_2S_3);

○ cadmium pigments including Cadmium Yellow: cadmium sulfide (CdS);

○ chromium pigments including Chrome Yellow: natural pigment of lead(II) chromate (PbCrO_4);

WO 2018/178079

PCT/EP2018/057774

12

- cobalt pigments including Aureolin (also called Cobalt Yellow): Potassium cobaltinitrite ($\text{Na}_3\text{Co}(\text{NO}_2)_6$);
- iron pigments including Yellow Ochre: a naturally occurring clay of hydrated iron oxide ($\text{Fe}_2\text{O}_3 \cdot \text{H}_2\text{O}$);
- 5 ○ lead pigments including Naples Yellow;
- titanium pigments including Titanium Yellow;
- tin pigments including Mosaic gold: stannic sulfide (SnS_2);
- Orange inorganic pigments
- cadmium pigments including Cadmium Orange: an intermediate between cadmium red and
- 10 cadmium yellow: cadmium sulfoselenide;
- chromium pigments including Chrome Orange: a naturally occurring pigment mixture composed of lead(II) chromate and lead(II) oxide. ($\text{PbCrO}_4 + \text{PbO}$)
- Red inorganic pigments
- cadmium pigments including Cadmium Red: cadmium selenide (CdSe);
- 15 ○ iron oxide pigments including Sanguine, Caput Mortuum, Oxide Red, Red Ochre: anhydrous Fe_2O_3 , Burnt Sienna: a pigment produced by heating Raw Sienna, Venetian Red;
- lead pigments (toxic) including Red Lead: lead tetroxide, Pb_3O_4 ;
- mercury pigments (toxic) including Vermilion: Synthetic and natural pigment: Occurs naturally in mineral cinnabar; Mercuric sulfide (HgS);
- 20 - Brown inorganic pigments
- clay earth pigments (naturally formed iron oxides) including Raw Umber: A natural clay pigment consisting of iron oxide, manganese oxide and aluminum oxide: $\text{Fe}_2\text{O}_3 + \text{MnO}_2 + \text{nH}_2\text{O} + \text{Si} + \text{AlO}_3$; Raw Sienna: a naturally occurring yellow-brown pigment from limonite clay;
- Black inorganic pigments
- 25 ○ Carbon pigments including Carbon Black, Ivory Black, Vine Black, Lamp Black;
- Iron Pigments including Fe_3O_4 ;
- Titanium pigments: Titanium Black;
- Gray inorganic pigments
- Payne's gray: a mixture of Ultramarine and black or of Ultramarine and Sienna;

30

The term "organic pigment" as used herein refers to synthetic organic coloring compounds, which are carbon based molecules manufactured from petroleum compounds, acids, and other chemicals, usually under intense heat or pressure.

Organic pigments include for instance but are not limited to:

35

- Yellow organic pigments:

WO 2018/178079

PCT/EP2018/057774

13

Yellow Lakes, which are transparent pigments used as a yellow to cover other inks but not hide them, Tartrazine Yellow Lake (also called FD&C Yellow No. 5 and used as a dyestuff in foods), Hansa Yellows, and Diarylide Yellows, which are the most common yellow pigments used in printing inks. Fluorescent Yellow is also used in some specialty applications. Organic Yellows are commonly used to replace Chrome Yellows;

- Orange organic pigments:

The most common orange pigment is Diarylide Orange, a transparent yet not very fast-to-light pigment. Other assorted orange materials tend to be used where orange pigments are necessary, and include DNA Orange, Pyrazolone Orange, Fast Orange F2G, Benzimidazolone Orange HL, and Ethyl Lake Red C;

- Red organic pigments:

Reds include Para Reds, Toluidine Red, ["Permanent Red "R"], Carmine F.B., Naphthol Reds and Rubines, Permanent Red FRC, Bordeaux FRR, Rubine Reds, Lithol Reds, BON Red, Lithol Rubine 4B, BON Maroon, Rhodamine 6G, Lake Red C, BON Arylamide Red, Quinacrinone Magentas, Copper Ferrocyanide Pink, Benzimidazolone Carmines and Reds, Azo Magenta G, Anthraquinone Scarlet, and Madder Lakes;

- Blue organic pigments:

'Blues'. Blues include Phthalocyanine Blues (the most commonly used group of organic blue pigments), PMTA Victoria Blue, Victoria Blue CFA, Ultramarine Blue, Indanthrene Blue, Alkali Blues, and Peacock Blue;

- Violet organic pigments:

Violets overlap slightly with some of the bluer reds (such as *Benzimidazolone Bordeaux HF 3R* (see Benzimidazolone Carmines and Reds), and also include such pigments as PMTA Rhodamine, PMTA Violet (also known as Methyl Violet), Dioxazine Violet (RL) Carbazole Violet, Crystal Violet, Dioxazine Violet B, and Thioindigoid Red;

- Green organic pigments:

A common series of greens are the Phthalocyanine Greens as well as the PMTA Greens;

- Brown organic pigments:

Brown pigments include Diazo Brown and Benzimidazolone Brown HFR;

The terms "extender pigment" or "filler pigment" as used herein refers to any pigment (as defined herein) having a low refractive index or opacity and therefore not providing color or hiding power to a substance. Extender or filler pigments appear transparent in a paint or ink. Extender pigments have significant positive effects on various properties of the paint for example, as described further below, mica can improve the water resistance of a film due to its "platy" particle shape and tendency to orient

WO 2018/178079

PCT/EP2018/057774

14

itself in overlapping layers horizontal to the surface. Extender pigments or filler pigments for instance include but are not limited to Barium Sulphate, Calcium Carbonate, Magnesium Silicate, Mica, Kaolin (China Clay), Asbestine, Talc, Silica / Quartz, Alumina Hydrate, Kalunite, Pumice, Bentonite, Vermiculite, and Glass Beads.

5

The term "UV-curable" refers to a composition that can polymerize upon application of UV irradiation. Typically, this at least implies the presence of photo-polymerizable monomers or oligomers, together with photoinitiators and/or photosensitizers.

10 A "clear coat" or a "clear coating composition" as referred to herein is used to indicate a coating formulation or composition having the property of transmitting rays of light through its substance so that surfaces or objects, which are situated beyond or behind the coating, such as surfaces or objects coated by such transparent coating, are distinctly visible.

15 The term "transparent" or "transparency" when referring to a coating composition or a coating layer refers to the physical characteristic of allowing light to pass through the coating without being scattered. Transparency can be measured with any method known in the art. For instance, a haze meter measures the transparency, haze, see-through quality, and total transmittance of a coating, based on how much visible light is diffused or scattered when passing through the coating. Haze is
20 measured with a wide angle scattering test in which light is diffused in all directions which results in a loss of contrast. That percentage of light that when passing through deviates from the incident beam greater than 2.5 degrees on average is defined as haze. See through quality is measured with a narrow angle scattering test in which light is diffused in a small range with high concentration. This test measures the clarity with which finer details can be seen through the coating being tested. The haze
25 meter also measures total transmittance. Total transmittance is the measure of the total incident light compared to the light that is actually transmitted (e.g. total transmittance). So the incident light may be 100%, but because of absorption and reflection the total transmittance may only be 94%. The data gained from the haze meter can be transferred to a PC for further data processing to ensure a consistent product.

30

The term "(staple) length of fiber(s)" as used herein refers to the average length of a group of (staple) fibers of any composition. For cut synthetic fibers, such as polypropylene fibers, the (staple) length refers to the discrete length to which these fibers have been cut, and is thus the same for every fiber present in the group. For broken or torn synthetic fibers, such as polypropylene fibers, the (staple)
35 length refers to the average length to which these fibers have been broken or torn.

15

In the context of the present invention, the term “polypropylene” is intended to include any polymeric composition comprising propylene monomers, either as a homopolymer or copolymer with other polyolefins, dienes, or other monomers (such as ethylene, butylene, and the like). The term is also intended to encompass any different configuration and arrangement of the constituent monomers (such as syndiotactic, isotactic, and the like). Thus, the term as applied to filaments, monofilaments, multifilaments or fibers herein, is intended to encompass endless stretches, actual long strands, threads, and the like, of polypropylene homopolymer or copolymer.

The invention will now be further explained in detail with reference to various embodiments. It will be understood that each embodiment is provided by way of example and is in no way limiting to the scope of the invention. In this respect, it will be clear to those skilled in the art that various modifications and variations can be made to the present invention without departing from the scope ~~or spirit~~ of the invention. For instance, features illustrated or described as part of one embodiment, can be used in another embodiment to yield a still further embodiment. Thus, it is intended that the present invention covers such modifications and variations as encompassed within the scope of the appended claims and equivalents thereof.

The present invention provides novel pale-colored fiber cement products, which are mechanically strong and highly resistant to cracks and wearing, even under harsh and adverse weather conditions. In addition, the fiber cement products as provided by the present invention have an attractive appearance because of their specific esthetic features, whereby the natural texture of both the cement (which is white-colored or pale-colored) and the synthetic fibers (which are dark-colored) is exposed, creating an appealing contrast between both components. This provides the products with a natural yet modern look and additionally provides for the advantage that any defects or damages occurring during the life-time of the products will be less visible compared to coated products, which typically have a surface color which is different from the inner mass color.

Accordingly, in view of the above, it is clear that the present invention provides fiber cement products, which are both technically (good mechanical strength and impact resistance and highly wearproof) and esthetically (intense though natural appearing colour and no colour change upon damage) improved.

In a first aspect, the present invention provides pale-colored fiber cement products at least comprising white cement and synthetic fibers, wherein the synthetic fibers are pigmented with at least one dark

WO 2018/178079

PCT/EP2018/057774

16

pigment chosen from the group consisting of a black pigment, a brown pigment, a red pigment, a blue pigment, a green pigment and a gray pigment.

In the context of the present invention, fiber cement products are to be understood as cementitious products comprising cement and synthetic (and optionally natural) fibers. The fiber cement products are made out of fiber cement slurry, which is formed in a so-called "green" fiber cement product, and then cured.

Dependent to some extent on the curing process used, the fiber cement slurry typically comprises water, process or reinforcing fibers which are synthetic organic fibers (and optionally also natural organic fibers, such as cellulose), cement (e.g. Portland cement), limestone, chalk, quick lime, slaked or hydrated lime, ground sand, silica sand flour, quartz flour, amorphous silica, condensed silica fume, microsilica, kaolin, metakaolin, wollastonite, mica, perlite, vermiculite, aluminum hydroxide (ATH), pigments, anti-foaming agents, flocculants, and/or other additives.

The fiber cement products according to the present invention are "pale-colored" or "white-colored" (as defined herein). The pale color of the products of the invention is obtained by using white cement as the cementitious matrix. White cement, such as for example white ordinary Portland cement (WOPC) is similar to ordinary, gray Portland cement in all aspects except for its high degree of whiteness. Obtaining this color requires substantial modification to the method of manufacture, and because of this, it is more expensive than the gray product. White Portland cement differs physically from gray cement only in terms of its color. Its setting behavior and strength development are essentially the same as that expected in gray cement, and it meets standard specifications such as ASTM C 150 and EN 197. In practice, because much white cement is used in pre-cast concrete products, it is commonly made to a high-early strength specification such as ASTM C 150 Type III. The whiteness of the product is typically expressed in terms of a reflectance measurement, such as L^*a^*b L-value, or tristimulus.

The pale-colored fiber cement products of the present invention comprise 20 to 95 weight % of white cement as hydraulic binder. In particular embodiments, white cement in the products of the invention is white Portland cement.

In particular embodiments, the pale-colored fiber cement products of the present invention further comprise in their cementitious matrix a white pigment. In further particular embodiments, the white pigment is present in an amount of between about 3 weight % and about 6 weight %, such as more particularly in an amount of between about 3 weight % and about 5 weight %, such as most particularly in an amount of about 4.6 weight % of white pigment (compared to the total dry weight of the fiber cement composition). In yet further particular embodiments, the white pigment is chosen from the

WO 2018/178079

PCT/EP2018/057774

17

group consisting of titanium oxide, a barium oxide, a barium sulphate and a barium containing mixture. In yet further particular embodiments, the white pigment is titanium oxide (TiO₂). In yet further particular embodiments, the white pigment is titanium oxide (TiO₂) and is present in an amount of about 4.6 weight % (compared to the total dry weight of the fiber cement composition).

5

The pale-colored fiber cement products of the present invention at least further comprise pigmented synthetic fibers.

In particular embodiments, the fiber cement products of the present invention comprise from about 0.1 to about 5 weight %, such as particularly from about 0.5 to about 4 weight % of pigmented synthetic
10 fibers, such as more particularly between about 1 to 3 weight % of pigmented synthetic fibers, such as most particularly about 2 weight % of pigmented synthetic fibers with respect to the total weight of the fiber cement product.

In further particular embodiments, the pigmented synthetic fibers in the pale-colored fiber cement
15 products of the present invention are selected from the group consisting of pigmented polypropylene fibers, pigmented polyvinylalcohol fibers, pigmented polyacrylonitrile fibers, polyethyelene, pigmented polyamide fibers, pigmented polyester fibers, pigmented aramide fibers and pigmented carbon fibers. In yet further particular embodiments, the pigmented synthetic fibers in the pale-colored fiber cement products of the present invention are pigmented polypropylene fibers.

20 In particular embodiments, the pigmented synthetic fibers are polypropylene fibers having a thickness of about 70 dtex.

In particular embodiments, the pigmented synthetic fibers are milled pigmented polypropylene fibers. In particular embodiments, the synthetic fibers are milled polypropylene fibers having an average length of about 1 mm to about 2 mm.

25

The pigmented synthetic fibers in the pale-colored fiber cement products of the present invention are pigmented with at least one dark pigment chosen from the group consisting of a black pigment, a brown pigment, a red pigment, a blue pigment, a green pigment and a gray pigment. In particular
30 embodiments, the pigmented synthetic fibers are pigmented with a gray iron oxide, a black iron oxide, a brown iron oxide, or carbon black.

In particular embodiments of the present invention, the pigments suitable for pigmenting the synthetic fibers for use in the pale-colored fiber cement products of the present invention are essentially alkali-resistant, i.e. resistant to a pH of about 8 or higher, such as resistant to a pH of about 9 or higher, such as resistant to a pH of about 10 or higher, such as resistant to a pH of about 11 or higher, more
35 particularly resistant to a pH of higher than about 12 or higher than about 13.

WO 2018/178079

PCT/EP2018/057774

18

In particular embodiments, the fiber cement products according to the invention are characterized in that they additionally comprise non-pigmented or pigment-free synthetic fibers in a weight % of about 0.1 to about 5, such as particularly from about 0.5 to about 4, such as more particularly between about 1 to 3 with respect to the total weight of the fiber cement product. Most particularly, pigment-free synthetic fibers are present in the pale-colored fiber cement products of the present invention in a weight % of about 2 weight % with respect to the total weight of the fiber cement product.

In particular embodiments, these pigment-free synthetic fibers are selected from the group consisting of polypropylene fibers, polyvinylalcohol fibers, polyacrylonitrile fibers, polyethylene fibers, polyamide fibers, polyester fibers, aramide fibers and carbon fibers. In yet further particular embodiments, these pigment-free synthetic fibers are polyvinylalcohol (PVA) fibers, such as but not limited to pigment-free PVA fibers with a thickness of about 8 dtex.

In further particular embodiments, natural fibers, such as cellulose fibers may in addition be added to the fiber cement formulations of the present invention. In these particular embodiments, the fiber cement products of the present invention may comprise from about 2 to about 5 weight %, such as particularly about 2 to about 4 weight % of cellulose fibers, such as more particularly about 3 weight % of cellulose fibers with respect to the total weight of the fiber cement product. These cellulose fibers may for example be Kraft softwood cellulose fibers, such as bleached Kraft softwood cellulose fibers.

In further particular embodiments, additional fibers may be added to the cement formulations and may be selected from the group consisting of glass fibers, rockwool fibers, slag wool fibers, wollastonite fibers, ceramic fibers and the like. In further particular embodiments, the fiber cement products of the present invention may additionally comprise fibrils fibrids, such as for example but not limited to, polyolefinic fibrils fibrids % in a weight % of about 0.1 to 3, such as "synthetic wood pulp".

In particular embodiments, the pale-colored fiber cement products of the present invention further comprise limestone (CaCO_3) in an amount of between about 5 weight % and about 15 weight %, such as between about 7 weight % and about 13 weight %, such as more particularly between about 9 weight % and about 11 weight %, such as most particularly about 10 weight % of CaCO_3 (compared to the total dry weight of the fiber cement composition of said fiber cement product). In particular, the present inventors have found that CaCO_3 improves the water channeling properties of the fiber cement products of the present invention. Without being bound to any hypothesis or theory, the inventors believe that this is because white cement has a relatively low specific surface area compared to ordinary gray cement and therefore tends to enclose water in a higher degree. However, entrapped

WO 2018/178079

PCT/EP2018/057774

19

amounts of water are undesirable because these could be the cause of cracks and swelling of the fiber cement material upon exposure to rain and freeze-thaw conditions. The present inventors have managed to solve this issue by adding limestone. This ingredient ensures that a network of channels is created in between the cement particles of the fiber cement product, so as to ensure an optimal internal flow and channeling of water.

According to particular embodiments, the fiber cement products according to the invention optionally comprise further components. These further components in the fiber cement products of the present invention may be selected from the group consisting of water, sand, silica sand flour, condensed silica fume, microsilica, fly-ashes, ground quartz, the ground rock, clays, pigments, kaolin, metakaolin, blast furnace slag, carbonates, puzzolanas, aluminium hydroxide, wollastonite, mica, perlite, calcium carbonate, and other additives (e.g. colouring additives) etc. It will be understood that each of these components is present in suitable amounts, which depend on the type of the specific fiber cement product and can be determined by the person skilled in the art. In particular embodiments, the total quantity of such further components is preferably lower than 70 weight % compared to the total initial dry weight of the composition.

Further additives that may be present in the fiber cement products of the present invention may be selected from the group consisting of dispersants, plasticizers, antifoam agents and flocculants. The total quantity of additives is preferably between about 0.1 and about 2 weight % compared to the total initial dry weight of the composition.

In particular embodiments, the fiber cement products of the invention have a thickness of between about 5 mm and about 25 mm, in particular between about 5 mm and about 20 mm.

In particular embodiments, the fiber cement products of the invention have a length of between about 2 m and about 6 m, in particular between about 2 m and about 4 m, more in particular of about 2.40m or of about 3.50 m.

In particular embodiments, the fiber cement products of the invention have a width of between about 1 m and about 4 m, more in particular of about 1.20 m.

In particular embodiments, the pale-colored fiber cement products of the present invention are coated with a clear coating (as defined herein).

WO 2018/178079

PCT/EP2018/057774

20

In further particular embodiments, the clear coating is a conventional (i.e. not radiation-curable) clear coating. Suitable conventional clear coatings are those with binders obtained by aqueous free radical or ionic emulsion polymerization. Acrylic and/or methacrylic (co)polymers are particularly preferred as binders of the conventional clear coatings. These acrylic and/or methacrylic (co)polymers are usually prepared by aqueous radically initiated emulsion polymerization of esters of acrylic acid and/or methacrylic acid with C1-C12 alkanols as well as a minor amount of acrylic and/or methacrylic acid as monomers. Preference is given in particular to esters of acrylic and methacrylic acid with C1-C8 alkanols; ethyl acrylate, n-butyl acrylate, ethylhexyl acrylate and methylmethacrylate are particularly preferred. The emulsion polymerization requires the use of surfactants as stabilizers. Non-ionic surfactants are preferred. Alcohol ethoxylates are particularly preferred. Conventional coatings with a hydroxyl number (measured according to ISO 4629) of at least 1 are preferred. Hydroxyl numbers of at least 1,5 are particularly preferred. Preferably the minimum film forming temperature during the drying of the conventional coating is below 60°C.

The conventional clear coating composition generally comprises, besides the polymeric binders and pigments, also usual auxiliaries, e.g. fillers, wetting agents, viscosity modifiers, dispersants, defoamers, preservatives and hydrophobisizers, biocides, fibers and other usual constituents. Examples of suitable fillers are aluminosilicates, silicates, alkaline earth metal carbonates, preferably calcium carbonate in the form of calcite or lime, dolomite, and also aluminum silicates or magnesium silicates, e.g. talc. The solids content of suitable conventional clear coatings is generally in the range from 20 to 60% by weight. The conventional clear coating compositions comprise as liquid component essentially water and, if desired, an organic liquid miscible with water, for example an alcohol. The conventional coating compositions are applied at a wet coating weight in the range from 50 to 500 g/m², in particular from 70 to 300 g/m², in a known manner, for example by spraying, troweling, curtain coating, knife application, brushing, rolling or pouring onto the cement bonded board, or by a combination of one or more applications.

In alternative particular embodiments, the clear coating is a radiation-curable clear coating. Radiation-curable coatings are known in the art and comprise at least one polymer A having ethylenically unsaturated double bonds, which is radiation-curable. Possible polymers A for the radiation-curable compositions are in principle any polymers having ethylenically unsaturated double bonds which can undergo radical-initiated polymerization on exposure to UV radiation or electron beam radiation. Care should be taken here that the content of ethylenically unsaturated double bonds in the polymer is sufficient to ensure effective crosslinking. The content of ethylenically unsaturated double bonds in A is generally in the range from 0,01 to 1,0 mol/100 g of A, more preferably from 0,05 to 0,8 mol/100 g of A and most preferably from 0,1 to 0,6 mol/100 g of A.

WO 2018/178079

PCT/EP2018/057774

21

Suitable polymers A are polyurethane derivatives which contain ethylenically unsaturated double bonds, such as polyurethane acrylates.

The radiation-curable composition further comprises at least one chemically and radiation crosslinkable polymer B. Suitable polymers B are free isocyanate-bearing polyurethanes having ethylenically unsaturated double bonds. Polyurethane acrylates with free isocyanate groups are preferred. The reaction of the free isocyanate groups with moisture present in the air takes place at room temperature, in particular, in areas not exposed to radiation and hence not completely cured (back side, edges, cavities formed in the radiation-curable coating, ...). The free isocyanate content of B measured according to DIN EN ISO 11 909, ranges usually from 5 to 20% by weight. Preferably the free isocyanate content of B is between 8 and 20% by weight and more preferably between 10 and 18 % by weight. The weight ratio of B /A is preferably in the range of 0,03/0,2. A weight ratio of B/A in the range of 0,05/0,1 is particularly preferred. Besides the polymers A and B, the radiation-curable preparations may also contain a compound different from polymer A and polymer B and having a molecular weight of less than 800 g/mol and capable of polymerization by cationic or free-radical pathways. These compounds have generally at least one ethylenically unsaturated double bond and/or one epoxy group and a molecular weight being less than 800 g/mol. Such compounds generally serve to adjust to the desired working consistency of the radiation-curable preparations. This is particularly important if the preparation contains no other diluents, such as water and/or inert organic solvents, or contains these only to a subordinate extent. Such compounds are therefore also termed reactive diluents. The proportion of reactive diluents, based on the total amount of (A+B) and the reactive diluent in the radiation-curable preparation, is preferably in the range of 0 to 90% by weight, and most preferably in the range of from 5 to 50 % by weight. Preferred reactive diluents are the esterification products of di- or polyhydric alcohols with acrylic and/or methacrylic acid. Such compounds are generally termed polyacrylates or polyether acrylates. Hexanediol diacrylate, tripropylene glycol diacrylate and trimethylolpropane triacrylate are particularly preferred. The radiation-curable compositions may also comprise polymers which have cationically polymerizable groups, in particular epoxy groups. These include copolymers of ethylenically unsaturated monomers, the copolymers containing, as comonomers, ethylenically unsaturated glycidyl ethers and/or glycidyl esters of ethylenically unsaturated carboxylic acids. They also include the glycidyl ethers of OH-group-containing polymers, such as OH-group-containing polyethers, polyesters, polyurethanes and novolacs. They include moreover the glycidyl esters of polymers containing carboxylic acid groups. If it is desired to have a cationically polymerizable component, the compositions may comprise, instead of or together with the cationically polymerizable polymers, a low-molecular-weight, cationically polymerizable compound, for example a di- or polyglycidyl ether of a low-molecular-weight di- or polyol or the di- or polyester of a low-molecular weight di- or polycarboxylic acid.

WO 2018/178079

PCT/EP2018/057774

22

The radiation-curable compositions comprise usual auxiliaries, such as thickeners, flow control agents, defoamers, UV stabilizers, emulsifiers, surface tension reducers and/or protective colloids. Suitable auxiliaries are well known to the person skilled in the coatings technology. Silicones, particularly polyether modified polydimethylsiloxane copolymers, may be used as surface additives to provide good substrate wetting and good anti-crater performance by reduction of surface tension of the coatings. Suitable stabilizers encompass typical UV absorbers, such as oxanilides, triazines, benzotriazoles (obtainable as Tinuvin™ grades from Ciba Geigy) and benzophenones. These may be used in combination with usual free-radical scavengers, for example sterically hindered amines, e.g. 2,2,6,6-tetramethylpiperidine and 2,6-di-tert-butylpiperidine (HALS compounds). Stabilizers are usually used in amounts of from 0,1 to 5,0% by weight and preferably from 0,3 to 2,5% by weight, based on the polymerizable components present in the preparation.

If curing of the radiation-curable coating is performed by UV radiation (step f), the preparations to be used comprise at least one photoinitiator. A distinction is to be made here between photoinitiators for free-radical curing mechanisms (polymerization of ethylenically unsaturated double bonds) and photoinitiators for cationic curing mechanisms (cationic polymerization of ethylenically unsaturated double bonds or polymerization of compounds containing epoxy groups). Photoinitiators are not needed for electron beam curable compositions.

Suitable photoinitiators for free-radical photopolymerization, i.e. polymerization of ethylenically unsaturated double bonds, are benzophenone and benzophenone derivatives, such as 4-phenylbenzophenone and 4-chlorobenzophenone, Michler's ketone, anthrone, acetophenone derivatives, such as 1-benzoylcyclohexan-1-ol, 2-hydroxy-2,2-dimethylacetophenone and 2,2-dimethoxy-2-phenylacetophenone, benzoin and benzoin ethers, such as methyl benzoin ether, ethyl benzoin ether and butyl benzoin ether, benzil ketals, such as benzil dimethyl ketal, 2-methyl-1-[4-(methylthio) phenyl]-2-morpholinopropan-1-one, anthraquinone and its derivatives, such as .beta.-methylanthraquinone and tertbutylanthraquinone, acylphosphine oxides, such as 2,4,6-trimethylbenzoyldiphenylphosphine oxide, ethyl-2,4,6-trimethylbenzoylphenylphosphinate and bisacylphosphine oxides. Suitable photoinitiators for cationic photopolymerization, i.e. the polymerization of vinyl compounds or compounds containing epoxy groups, are aryl diazonium salts, such as 4-methoxybenzenediazonium hexafluorophosphate, benzenediazonium tetrafluoroborate and toluenediazonium tetrafluoroarsenate, arylodonium salts, such as diphenyliodonium hexafluoroarsenate, arylsulfonium salts, such as triphenylsulfonium hexafluorophosphate, benzene- and toluenesulfonium hexafluorophosphate and bis[4-diphenylsulfoniophenyl] sulfide bishexafluorophosphate, disulfones, such as diphenyl disulfone and phenyl-4-tolyl disulfone, diazodisulfones, imidotriflates, benzoin tosylates, isoquinolinium salts, such as N-ethoxyisoquinolinium hexafluorophosphate, phenylpyridinium salts, such as N-ethoxy-4-

WO 2018/178079

23

PCT/EP2018/057774

phenylpyridinium hexafluorophosphate, picolinium salts, such as N-ethoxy-2-picolinium hexafluorophosphate, ferrocenium salts, titanocenes and titanocenium salts.

The abovementioned photoinitiators are used, in amounts from 0,05 to 20% by weight, preferably from 0,1 to 10% by weight and in particular from 0,1 to 5% by weight, based on the polymerizable components of the radiation-curable composition.

The radiation-curable compositions are applied in a known manner, e.g. by spraying, troweling, knife application, brushing, rolling or pouring onto the cement bonded board. It is also conceivable that the preparation may be applied to the cement board by hot-melt processes or by powder-coating processes. The radiation-curable composition is preferably applied by roller-coating. The radiation-curable composition is usually applied to obtain a dry thickness in the range from 10 to 100 Pm, preferably from 50 to 80 Pm. The application may take place either at room temperature or at elevated temperature, but preferably not above 100 °C. The liquid coated surface is roll-covered with a radiation permeable film before applying radiation. Care is taken to have an intimate contact between the liquid coated panels and the controlled surface layer of the film, in order to remove entrapped bubbles and air pockets between the overlying film and the panel by the roller. This film provides protection against the radical chain-breaking reaction of oxygen, and avoids the use of inert gas atmosphere in the case of electron beam curing. Moreover, this covering film has a controlled gloss surface with a predetermined surface finish on the side in contact with the liquid coated panel surface. Suitable radiation permeable films are thin plastic films of polyester or polyolefins. The controlled surface gloss on the radiation permeable film can be obtained in various ways, such as embossing, printing, coating, etching or by the use of matting additives. Moreover, the radiation permeable film with its regularly distributed surface micro-roughness can possibly be texturized, e.g. allowing labeling.

The radiation curable coating may be cured by exposure to UV radiation of wavelength generally from 200 to 600 nm. Suitable examples of UV sources are high and medium pressure mercury, iron, gallium or lead vapor lamps. Medium pressure mercury vapor lamps are particularly preferred, e.g. the CK or CK1 sources from the company IST (Institut für Strahlungstechnologie). The radiation dose usually sufficient for crosslinking is in the range from 80 to 3000 mJ/cm². Any solvent present, in particular water, is dried out before the curing in a separate drying step preceding curing, for example by heating to temperatures in the range from 40 to 80 °C, or by exposure to IR radiation.

In case of electron beam curing, irradiation is performed with high-energy electrons (usually from 100 to 350 keV, by applying a high voltage to tungsten filaments inside a vacuum chamber), and the actual curing step takes place in an inert, oxygen-free atmosphere. After irradiation, the covering film is removed by peeling it off.

WO 2018/178079

PCT/EP2018/057774

24

In other particular embodiments, the clear coating applied on the pale-colored fiber cement products of the invention is a combination of one or more layers of a conventional clear coating and one or more layers of a radiation curable clear coating.

5 In particular embodiments, at least one layer of the conventional clear coating composition and/or at least one layer of the radiation-curable clear coating of the products of the present invention comprises at least one white pigment. In further particular embodiments, at least one layer of the conventional clear coating and/or radiation curable clear coating composition comprises about 0.5 weight % to about 4 weight % (compared to the total dry weight of the coating composition) of a white
10 pigment. In further particular embodiments, at least one layer of the conventional clear coating and/or radiation curable clear coating comprises about 1% to about 2% (compared to the total dry weight of the fiber cement composition of said fiber cement product) of a white pigment. In yet further particular embodiments, at least one layer of conventional clear coating and/or radiation curable clear coating composition comprises about 1 weight % to about 2 weight % (compared to the total dry weight of the
15 coating composition) of TiO_2 .

In particular embodiments of the present invention, the white pigments, suitable for pigmenting the clear coating for application onto the pale-colored fiber cement products of the present invention, are essentially alkali-resistant pigments, i.e. resistant to a pH of about 8 or higher, such as resistant to a pH of about 9 or higher, such as resistant to a pH of about 10 or higher, such as resistant to a pH of
20 about 11 or higher, more particularly resistant to a pH of higher than about 12 or higher than about 13.

In a second aspect, the present invention provides methods for the manufacture of pale-colored fiber cement products according to the invention, which methods at least comprise the steps of:

- 25 a) Providing a fiber cement slurry at least comprising white cement and synthetic fibers, which synthetic fibers are pigmented with at least one dark pigment chosen from the group consisting of a black pigment, a brown pigment and a gray pigment;
- b) Manufacturing a fiber cement product by means of a fiber cement production process;
- c) Curing the fiber cement product, so as to obtain the pale-colored fiber cement product.

30

In the first step a) of the methods of the present invention, a fiber cement slurry can be prepared by using one or more sources of at least white cement, water and pigmented synthetic fibers in the amounts as previously disclosed herein. In certain specific embodiments, these one or more sources of at least white cement, water and pigmented synthetic fibers are operatively connected to a
35 continuous mixing device constructed so as to form a cementitious fiber cement slurry.

WO 2018/178079

25

PCT/EP2018/057774

In particular embodiments, the present invention provides methods for the manufacture of pale-colored fiber cement products, wherein at least one white pigment is added in the fiber cement slurry during step a) of providing a fiber cement slurry. In further particular embodiments, the white pigment is added in an amount of between about 3 weight % and about 6 weight % (compared to the total dry weight of the fiber cement composition) of the fiber cement product. In further particular
5 embodiments, the at least one white pigment is TiO_2 .

Once a fiber cement slurry is obtained, the manufacture of the fiber cement products can be executed according to any known procedure. Indeed, in the methods of the invention, the step b) of providing a fiber cement product, can be performed according to any method known in the art for preparing
10 fiber cement products, which products at least comprise white cement, water and pigmented synthetic fibers.

The process most widely used for manufacturing fiber cement products is the Hatschek process, which is performed using a modified sieve cylinder paper making machine. Other manufacturing processes that can be used include the Magnani process, injection, flow-on, extrusion and others. In particular
15 embodiments, the fiber cement products of the present invention are provided by using the Hatschek process. The "green" or uncured fiber cement product is optionally post-compressed usually at pressures in the range from about 22 to about 30 MPa to obtain the desired density.

The processes according to the present invention may further comprise the step of cutting the fiber cement products to a predetermined length to form a fiber cement product. Cutting the fiber cement
20 products to a predetermined length can be done by any technique known in the art, such as but not limited to water jet cutting, air jet cutting or the like. The fiber cement products can be cut to any desirable length and width but preferably to the dimensions as disclosed previously herein for the products of the present invention. Thus, in particular embodiments, the pale-colored fiber cement
25 products of the present invention can be cut into specific dimensions so as to form fiber cement boards, panels, plates, sidings, planks, tiles etc.

It will be understood by the skilled person that the processes of the present invention may further comprise additional steps of processing the produced fiber cement products.

For instance, in certain particular embodiments, during the processes of the present invention, the fiber
30 cement slurry and/or the fiber cement products may undergo various intermediate treatments, such as but not limited to treatment with one or more hydrophobic agents, treatment with one or more flocculants, additional or intermediate pressing steps, etc.

As soon as the fiber cement products are formed, these are trimmed at the lateral edges. The border strips can optionally be recycled through immediate mixing with the recycled water and directing the mixture to
35 the mixing system again.

WO 2018/178079

PCT/EP2018/057774

26

In step c) of the methods of the present invention, the obtained fiber cement products are cured. Indeed, after production, fiber cement products can be allowed to cure over a time in the environment in which they are formed, or alternatively can be subjected to a thermal cure (e.g. by autoclaving or the like).

In particular embodiments, the fiber cement products of the present invention are air-cured. This air-curing step involves curing the green fiber cement products under ambient conditions for about 2 to 4 weeks, such as for about 3 weeks.

It has been found by the present inventors that air-cured fiber cement products as produced according to the methods as disclosed herein perform particularly well, especially having regard to their mechanical characteristics, such as impact resistance and mechanical strength. This will become clear from the Examples as further described herein.

In yet further particular embodiments, the “green” fiber cement products may be first pre-cured to the air, after which the pre-cured product is further air-cured until it has its final strength to give the product its final properties.

In particular embodiments of the present invention, the processes may further comprise the step of thermally drying the obtained fiber cement products. After curing, the fiber cement product being a panel, sheet or plate, etc. may still comprise a significant weight of water, present as humidity. This may be up to 10 even 15 %w, expressed per weight of the dry product. The weight of dry product is defined as the weight of the product when the product is subjected to drying at 105°C in a ventilated furnace, until a constant weight is obtained.

In certain embodiments, the fiber cement product is dried. Such drying is done preferably by air drying and is terminated when the weight percentage of humidity of the fiber cement product is less than or equal to 8 weight %, even less than or equal to 6 weight %, expressed per weight of dry product, and most preferably between 4 weight % and 6 weight %, inclusive.

During step (a) of the methods of the present invention, one or more white pigments may be added to the fiber cement in order to increase the pale or white color intensity of the fiber cement product in production. Methods for coloring fiber cement products in the mass are known to the person skilled in the art.

This may for example (but not necessarily only) be achieved by adding one or more white pigments to the fiber cement slurry prior to the production of the fiber cement product.

WO 2018/178079

PCT/EP2018/057774

27

In particular embodiments of the methods of the present invention, the at least one white pigment for use in the fiber cement products of the present invention is white titanium oxide. In further particular embodiments, the at least one white pigment for use in the fiber cement products of the present invention is white titanium oxide in a total amount of about 3 to 6 weight % (weight % total pigment compared to the total dry weight of the fiber cement composition).

In particular embodiments of the present invention, the white pigments suitable for use in the fiber cement products of the present invention are essentially alkali-resistant, i.e. resistant to a pH of about 8 or higher, such as resistant to a pH of about 9 or higher, such as resistant to a pH of about 10 or higher, such as resistant to a pH of about 11 or higher, more particularly resistant to a pH of higher than about 12 or higher than about 13.

In particular embodiments of the present invention, the methods may further comprise the step of surface treating the produced uncoated pale-colored fiber cement products. Surface treatments may include, without limitation, abrasive blasting, engraving, embossing and the like, of a decorative pattern onto or into the fiber cement product surface.

In particular embodiments of the present invention, the methods may further comprise the step of coating the produced pale-colored fiber cement products with a clear conventional coating and/or with a clear radiation-curable coating as described in detail herein.

In a third aspect, the present invention provides pale-colored fiber cement products obtainable by any of the methods according to the present invention.

In a fourth aspect, the present invention provides uses of the pale-colored fiber cement products according to the present invention as building materials.

In particular embodiments, the present invention provides uses of the pale-colored fiber cement products according to the present invention as an outer surface to walls, applied internally or externally, e.g. as façade plate, siding, etc. In other particular embodiments, the pale-colored fiber cement products according to the present invention can be used for decking or flooring applications, fencing applications and/or covering applications.

The invention will now be further illustrated in detail with reference to the following Examples.

WO 2018/178079

PCT/EP2018/057774

28

EXAMPLES

It will be appreciated that the following examples, given for purposes of illustration, are not to be construed as limiting the scope of this invention. Although only a few exemplary embodiments of this invention have been described in detail above, those skilled in the art will readily appreciate that many modifications are possible in the exemplary embodiments without materially departing from the novel teachings and advantages of this invention. Accordingly, all such modifications are intended to be included within the scope of this invention that is defined in the following claims and all equivalents thereto. Further, it is recognized that many embodiments may be conceived that do not achieve all of the advantages of some embodiments, yet the absence of a particular advantage shall not be construed to necessarily mean that such an embodiment is outside the scope of the present invention.

It will become clear from the experimental results as described below that the fiber cement products of the present invention are characterized by an attractive esthetic appearance because of their pale-colored aspect and their original surface pattern as achieved through the presence of the dark-pigmented synthetic fibers (as shown in Figures 1 to 6).

Example 1: Manufacture of pale-colored fiber cement products according to the present invention

Fiber cement products were produced with the methods of the present invention as described herein according to the following specific embodiments.

1.1 Materials & Methods**1.1.1 Production of fiber cement slurry samples**

Formulations of an aqueous fiber cement slurry were prepared as shown in Table 1. Other additives may have been added to these formulations, without being essential to the findings of the present invention.

1.1.2 Manufacture of fiber cement product on mini-Hatschek machine

Cementitious products were manufactured by the Hatschek technique according to a pilot process reproducing the main characteristics of the products obtained by the industrial process.

The green sheets were pressed at 230 kg/cm² and air-cured by subjecting them to a curing at 60°C for 8 hours, and thereafter curing at ambient conditions. After two weeks, half of the formed fiber cement products were left uncoated and half of the formed fiber cement products were coated with a conventional clear coating comprising 1-2% of TiO₂ in the top layer. All the resulting products were

observed and photographed and reflectance measurements were done to determine the whiteness of the products.

Ingredient	Dry weight (kg)	Weight %
White cement	769	76.9
*Cellulose fibers	28	2.8
PVA fibers 8 dtex	19	1.9
White pigment	46	4.6
**Gray pigmented PP fibers 70 dtex	19	1.9
Limestone	100	10
Additives	19	1.9

Table 1. Fiber cement formulation of a pale-colored fiber cement product according to the present invention (PVA: polyvinyl alcohol; PP: polypropylene; Weight % refers to the mass of the component over the total mass of all components except free water, i.e. the dry matter.

**Kraft softwood bleached cellulose*

***PP synthetic fibers were pigmented with a gray pigment during production and milled afterwards. Milling of the PP fibers provided a length distribution of between about 0.2 mm and about 3 mm, with an average fiber length of between about 1 mm and about 2 mm. RGB color of the fibers was Red: 178; Green: 176; Blue: 170 (HEX code: B2 B0 AA).*

1.2 Results

The whiteness of the produced uncoated pale-colored fiber cement product according to the invention, expressed as L^*a^*b L-value, was $L^*=87.98$, $a^*=0.23$, $b^*=4.48$ (Cie-Lab).

The whiteness of the produced coated pale-colored fiber cement product according to the invention, expressed as L^*a^*b L-value, was $L^*=87.18$, $a^*=0.05$, $b^*=4.21$ (Cie-Lab).

Figures 1 to 6 show that the surface of the fiber cement products of the present invention displays the texture and color of the core materials, which provides the products with a natural yet modern look.

In particular, the pale-colored fiber cement products of the present invention expose the natural texture of both the cement (which is white-colored or pale-colored) and the synthetic fibers (which are dark-colored), creating an appealing contrast between both components.

Claims

1. A pale-colored fiber cement product at least comprising white cement and synthetic fibers, wherein the synthetic fibers are pigmented with at least one dark pigment chosen from the group consisting of a black pigment, a brown pigment, a blue pigment, a red pigment, a green pigment and a gray pigment.
2. The pale-colored fiber cement product according to claim 1, wherein said synthetic fibers are polypropylene fibers.
3. The pale-colored fiber cement product according to claims 1 or 2, wherein said synthetic fibers are polypropylene fibers having a thickness of ~~about~~ 70 dtex.
4. The pale-colored fiber cement product according to any of claims 1 to 3, wherein said synthetic fibers are milled polypropylene fibers having an average length of ~~about~~ 1 mm to ~~about~~ 2 mm.
5. The pale-colored fiber cement product according to any of claims 1 to 4, wherein said synthetic fibers are pigmented with at least one dark pigment, which is a gray iron oxide, a black iron oxide, a brown iron oxide, or carbon black.
6. The pale-colored fiber cement product according to any of claims 1 to 5, which further comprises a white pigment.
7. The pale-colored fiber cement product according to claim 6, wherein said white pigment is titanium oxide (TiO₂).
8. The pale-colored fiber cement product according to claim 6 or 7, wherein said white pigment is present in an amount of between ~~about~~ 3 weight % and ~~about~~ 6 weight % (compared to the total dry weight of the fiber cement composition) of said fiber cement product.
9. The pale-colored fiber cement product according to any of claims 1 to 8, which further comprises limestone (CaCO₃) in an amount of between ~~about~~ 5 weight % and ~~about~~ 15 weight % (compared to the total dry weight of the fiber cement composition of said fiber cement product).
10. The pale-colored fiber cement product according to any of claims 1 to 9, which is coated with a clear coating.

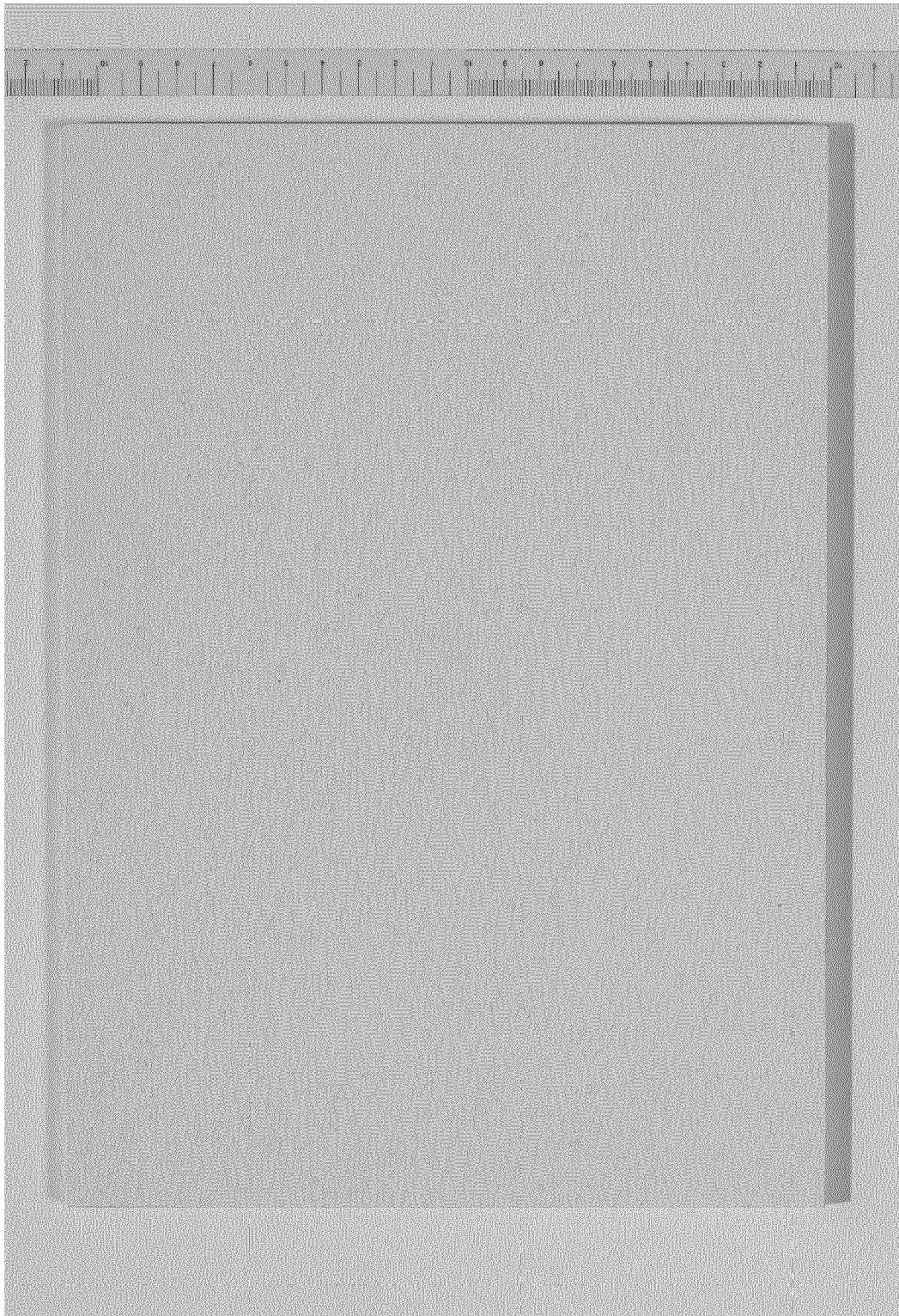
31

11. The pale-colored fiber cement product according to claim 10, wherein said clear coating comprises between ~~about~~ 0.5 weight % to ~~about~~ 4 weight % (compared to the total dry weight of the fiber cement composition of said fiber cement product) of a white pigment.
12. The pale-colored fiber cement product according to claim 11, wherein said white pigment is titanium oxide (TiO₂).
13. A method for the manufacture of a pale-colored fiber cement product according to any of claims 1 to 12, comprising at least the steps of:
- d) Providing a fiber cement slurry at least comprising white cement and synthetic fibers, which synthetic fibers are pigmented with at least one dark pigment chosen from the group consisting of a black pigment, a brown pigment and a gray pigment;
 - e) Manufacturing a fiber cement product by means of a fiber cement production process;
 - f) Curing the fiber cement product, so as to obtain said pale-colored fiber cement product.
14. The method according to claim 13, wherein said step c) of curing the fiber cement product comprises air-curing the fiber cement product.
15. Use of a pale-colored fiber cement product according to any of claims 1 to 12 as a building material.

WO 2018/178079

PCT/EP2018/057774

1/4

FIGURES**Figure 1**

WO 2018/178079

PCT/EP2018/057774

2/4

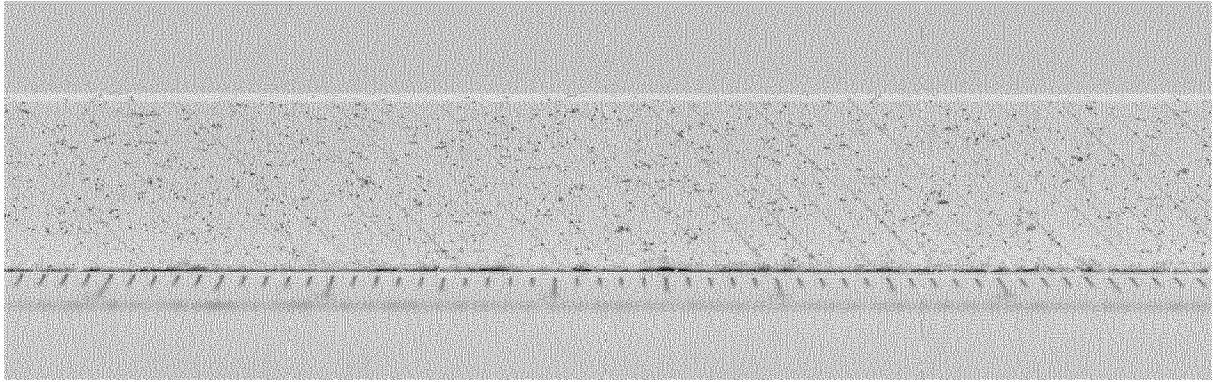
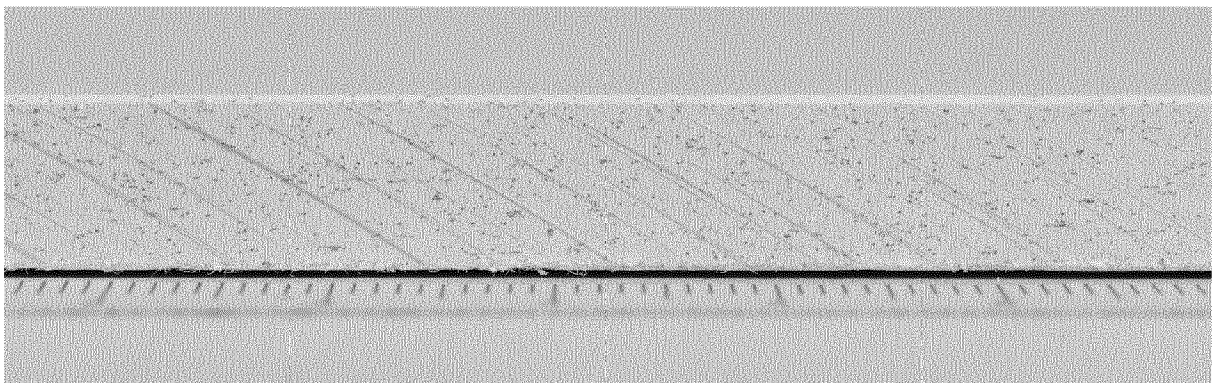
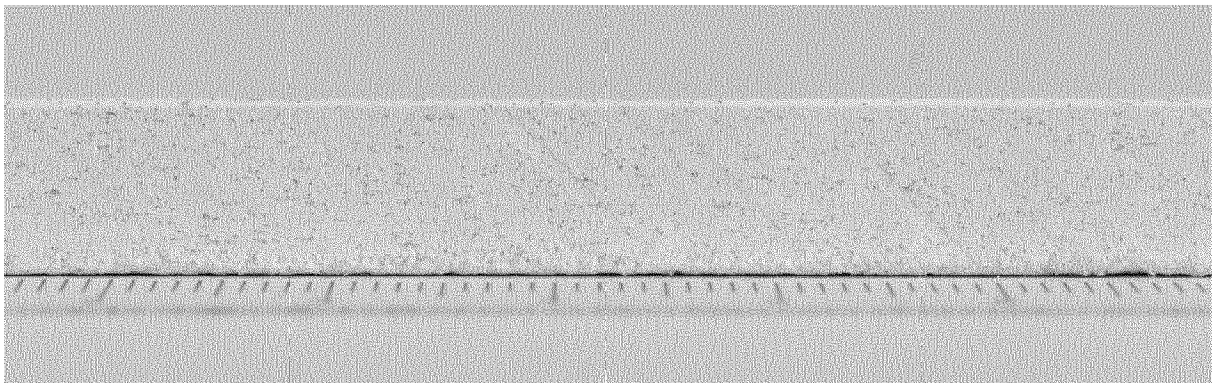


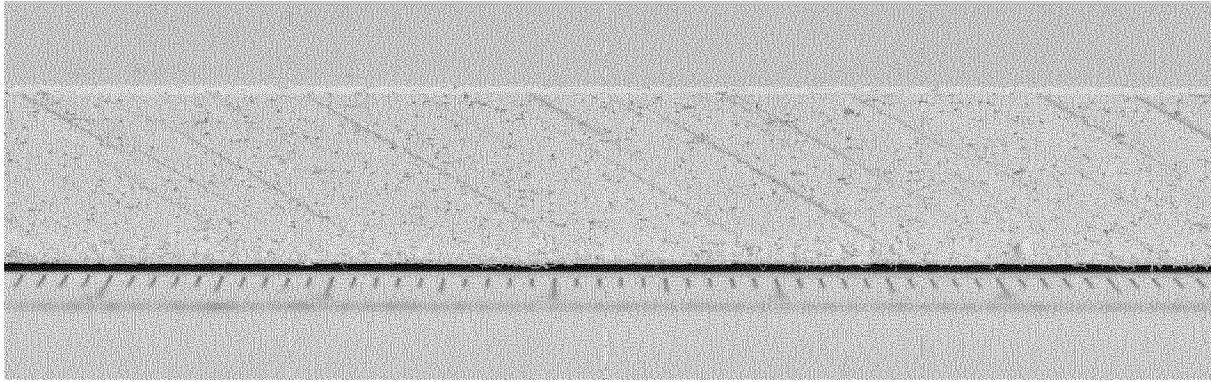
Figure 2

WO 2018/178079

3/4

PCT/EP2018/057774

**Figure 3****Figure 4****Figure 5**

WO 2018/178079**PCT/EP2018/057774****4/4****Figure 6**



Etex Services NV - Etex IPSC
Kuiermansstraat 1
1880 Kapelle-op-den-Bos
BELGIQUE

Formalities Officer
Name: Foglianisi, F
Tel: +49 89 2399 - 4097
or call
+31 (0)70 340 45 00

Application No. 18 712 252.8 - 1106	Ref. FC1710EPw	Date 17.08.2020
Applicant Etex Services NV, et al		

Communication under Rule 71(3) EPC

1. Intention to grant

You are informed that the examining division intends to grant a European patent on the basis of the above application, with the text and drawings and the related bibliographic data as indicated below.

A copy of the relevant documents is enclosed.

1.1 In the text for the Contracting States:

AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT
RO RS SE SI SK SM TR

Description, Pages

1-29 as published

Claims, Numbers

1-15 as published

Drawings, Sheets

1/4-4/4 as published

With the following amendments to the above-mentioned documents proposed by the division

Description, Pages 15
Claims, Numbers 3, 4, 8, 9, 11

Comments

DESCRIPTION

Page 1: Mention of relevant prior art in the description (Rule 42(1) EPC)

Page 15: Doubtful extent of protection (Guidelines F-IV, 4.4)

CLAIMS

Pages 30, 31, CLAIMS 3, 4, 8, 9, 11: Scope of claim unclear - clarified (Art. 84 EPC)

1.2 Bibliographic data

The title of the invention in the three official languages of the European Patent Office, the international patent classification, the designated contracting states, the registered name(s) of the applicant(s) and the other bibliographic data are shown on **EPO Form 2056** (enclosed).

2. Invitation

You are invited, **within a non-extendable period of four months** of notification of this communication,

2.1 to EITHER approve the text communicated above and verify the bibliographic data (Rule 71(5) EPC)

(1) by filing a translation of the claim(s) in the other two official languages of the EPO

	Fee code	EUR
--	-----------------	------------

(2a) by paying the fee for grant including the fee for publication: minus any amount already paid (Rule 71a(5) EPC):	007	960.00 0.00
---	------------	----------------

Total amount:	960.00
---------------	--------

(3) by paying additional claims fees under Rule 71(4) EPC; number of claims fees payable: 0 minus any amount already paid (Rule 71a(5) EPC):	016	0.00 0.00
--	------------	--------------

Total amount:	0.00
---------------	------

Important: If the translations of the claims and fees have already been filed and paid respectively in reply to a previous communication under Rule 71(3) EPC, e.g. in the case of resumption of examination after approval (see Guidelines C-V, 6), **agreement as to the text to be granted** (Rule 71a(1) EPC) must be expressed within the same time limit (e.g. by approving the text and verifying the bibliographic data, by confirming that grant proceedings can go ahead with the documents on file and/or by stating which translations of the claims already on file are to be used).

Note 1: See "Notes concerning fee payments" below.

Note 2: Any overpaid "minus" amounts will be refunded when the decision to grant (EPO Form 2006A) has been issued.

Note 3: For the calculation of the grant fee under Article 2(2), No. 7, RFees (old fee structure), the number of pages is determined on the basis of a clean copy of the application documents, in which text deleted as a result of any amendments by the examining division is not shown. Such clean copy is made available via on-line file inspection only.

2.2 OR, in the case of disapproval, to request reasoned amendments or corrections to the text communicated above or keep to the latest text submitted by you (Rule 71(6) EPC).

In this case the translations of the claims and fee payments mentioned under point 2.1 above are NOT due.

The terms "amendment(s)" and "correction(s)" refer only to amendments or corrections of the application documents and not of other documents (e.g. bibliographic data, the designation of the inventor, etc.).

If filing amendments, you must identify them and indicate the basis for them in the application as filed. Failure to meet either requirement may lead to a communication from the examining division requesting that you correct this deficiency (Rule 137(4) EPC).

2.3 Bibliographic data

Where you request a change or correction of bibliographic data in response to the Rule 71(3) communication, this will **not** cause the sending of a further communication under Rule 71(3) EPC. You will still have to pay the fees and file translations in reply to the Rule 71(3) communication in the case of 2.1 above, unless you also file a reasoned request for amendments or corrections in response to the Rule 71(3) communication (see case 2.2 above).

3. Loss of rights

If neither of the two possible actions above (see points 2.1 or 2.2) is performed in due time, the European patent application will be deemed to be withdrawn (Rule 71(7) EPC).

4. Further procedure

4.1 In the case of point 2.1 above

- 4.1.1 The decision to grant the European patent will be issued, and the **mention of the grant** of the patent will be published in the European Patent Bulletin, if the requirements concerning the translation of the claims and the payment of all fees are fulfilled and there is agreement as to the text to be granted (Rule 71a(1) EPC).

Note on payment of the renewal fee:

If a renewal fee becomes due before the next possible date for publication of the mention of the grant of the European patent, publication will be effected only after the renewal fee and any additional fee have been paid (Rule 71a(4) EPC).

Under Article 86(2) EPC, the obligation to pay renewal fees to the European Patent Office terminates with the payment of the renewal fee due in respect of the year in which the mention of the grant of the European patent is published.

Note on payment of the designation fee(s):

If the designation fee(s) become(s) due after the communication under Rule 71(3) EPC, the mention of the grant of the European patent will not be published until these fees have been paid (Rule 71a(3) EPC).

- 4.1.2 After publication, the **European patent specification** can be downloaded free of charge from the EPO publication server <https://data.epo.org/publication-server>.

4.1.3 Filing of translations in the contracting states

As regards translation requirements prescribed by the contracting states under Article 65(1) EPC, please consult the website of the European Patent Office

www.epo.org → Law & practice → Legal texts, National law relating to the EPC

www.epo.org → Law & practice → All Legal texts → London Agreement

In the case of a valid extension or validation

As regards translation requirements prescribed by the extension or validation states, please consult the website of the European Patent Office

www.epo.org → Law & practice → Legal texts, National law relating to the EPC

Failure to supply a prescribed translation in a contracting state, or in an extension or validation state may result in the patent being deemed to be void *ab initio* in the state concerned (Art. 65(3) EPC).

4.2 In the case of 2.2 above

If the present communication under Rule 71(3) EPC is based on an auxiliary request and, within the time limit, you maintain the main request or a higher ranking request which is not allowable, the application will be refused (Art. 97(2) EPC).

If the examining division gives its consent to the requested amendments or corrections, it will issue a new communication under Rule 71(3) EPC; otherwise, it shall resume the examination proceedings (Rule 71(6) EPC).

5. Filing of a divisional application

Any divisional application relating to this European patent application must be filed directly with the European Patent Office in Munich, The Hague or Berlin and will be in the language of the proceedings for the present application, or if the latter was not in an official language of the EPO, the divisional application may be filed in the language of the present application as filed (see Article 76(1) and Rule 36(2) EPC). Any such divisional application must be filed while the present application is still pending (Rule 36(1) EPC; Guidelines A-IV, 1.1.1).

6. Notes concerning fee payments

6.1 Making payments

For payments made via deposit account, please note that as from 1 December 2017 debit orders will only be carried out if filed in an electronically processable format (xml), using an accepted means of filing as laid down in the Arrangements for deposit accounts (ADA), published in the Supplementary publication in the Official Journal.

All relevant information related to the modes of payment of fees to the EPO can be retrieved from the EPO website at "**Making Payments**".

6.2 Information concerning fee amounts

Procedural fees are usually adjusted every two years, on even years, with effect from 1 April. Therefore, before making a payment, parties should verify the amounts actually due on the date of payment using the applicable version of the Schedule of fees and expenses, published as a Supplement to the Official Journal of the EPO, available on the EPO website (www.epo.org) at www.epo.org/schedule-of-fees. The "Schedule of fees" table allows the viewing, downloading and searching of individual fee amounts, both current and previous.

6.3 Note to users of the automatic debiting procedure

The fee for grant, including the fee for publication, and any additional claims fees due under Rule 71(4) EPC will be debited automatically on the date of filing of the translations of the claims, or on the last day of the period of this communication. However, if the designation fee(s) become(s) due as set out in Rule 71a(3) EPC and/or a renewal fee becomes due as set out in Rule 71a(4) EPC, these should be paid separately by another permitted way of payment in order not to delay the publication of the mention of the grant. The same applies in these circumstances to the payment of extension and validation fees. The same applies in these circumstances to the payment of extension and validation fees.

Examining Division:

Chairman:	Munro, Brian
2nd Examiner:	Gattinger, Irene
1st Examiner:	Philippart, Anahí



Foglianisi, F
For the Examining Division
Tel. No.: +49 89 2399 - 4097

Enclosures: Text intended for grant

 EPO Form 2056



European Patent Office
Postbus 5818
2280 HV Rijswijk
NETHERLANDS
Tel: +31 70 340 2040
Fax: +31 70 340 3016

Application No.:

EP18712252

Intention to grant a European patent

Electronically authenticated

07.08.2020

Date

Brian Munro

Chairman



Anahí Philippart

1st examiner

Irene Gattinger

2nd examiner

Solicitud No.:

EP18712252

**Intención de otorgar una patente europea
Autenticado Electrónicamente**

07.08.2020

Fecha

Brian Munro

Presidente



Anahf Philippart

1º examinador

Irene Gattinger

2º examinador

CÓDIGO DE BARRAS

Etex Services NV - Etex IPSC
Kuiermansstraat 1
1880 Kapelle - op - den - Bos
BÉLGICA

Solicitud No. 18 712 252.8 -	Ref. FC1710EPw	Fecha 17.08.2020
Solicitante Etex Services NV, et al		

Comunicación bajo Regla 71(3) EPC

1. Intención de otorgar

Se le informa que la división de evaluación tiene la intención de otorgar una patente europea sobre la base de la solicitud mencionada, con el texto y dibujos y la información bibliográfica relacionada que se indican más abajo.

Se adjunta una copia de los documentos relevantes.

1.1 En el texto para los Estados Contratantes:

AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT
RO RS SE SI SK SM TR

Descripción, Páginas

1 - 29 como fue publicado

Reivindicaciones, Números

1 - 15 como fue publicado

Dibujos, Hojas

1/4 - 4/4 como fue publicado

Con las siguientes modificaciones a los anterior documentos propuestas por la división

Descripción, Páginas 15

Reivindicaciones, Números 3, 4, 8, 9, 11

Comentarios

DESCRIPCIÓN

Página 1: Mención del arte previo relevante en la descripción (Regla 42(1) EPC)

Página 15: Medida dudosa de la protección (Lineamientos F - IV, 4.4)

REIVINDICACIONES

Páginas 30, 31, REIVINDICACIONES 3, 4, 8, 9, 11: Alcance de la reivindicación no es claro - aclarado (Art. 84 EPC)

1.2 Información Bibliográfica

El título de la invención en los tres idiomas oficiales de la Oficina Europea de Patentes, la clasificación internacional de patentes, los Estados Contratantes designados, el (los) nombre (s) registrado (s) del (de los) solicitante(s) y el resto de Información Bibliográfica se muestran en **EPO Formato 2056** (adjunto).

2. Invitación

Se le invita, **dentro de un período improrrogable de cuatro meses** desde la notificación de esta comunicación,

2.1 a O BIEN aprobar el texto comunicado arriba y verificar la Información Bibliográfica (Regla 71(5) EPC)

(1) radicando una traducción de la (s) reivindicación (es) en las otras dos lenguas oficiales de la EPO

	Cód. Tarifa	EUR
(2a) pagando la tarifa de otorgamiento incluyendo la tarifa de publicación: menos valores ya pagados (Regla 71a (5) EPC):	007	960.00 0.00
Monto Total:		960.00
(3) pagando tarifas de reivindicaciones adicionales bajo Regla 71(4) EPC; número de tarifas de reivindicaciones por pagar: 0 menos valores ya pagados (Regla 71a (5) EPC):	016	0.00 0.00
Monto Total:		0.00

Importante: Si las traducciones y las tarifas de las reivindicaciones ya han sido radicadas y pagadas respectivamente en respuesta de una comunicación previa bajo la Regla 71(3) EPC, v.g. en el caso de reinicio de la evaluación después de la aprobación (ver Lineamientos C - V, 6), se debe expresar **acuerdo al texto a ser aprobado** (Regla 71a(1) EPC) dentro del mismo plazo (v.g. aprobando el texto y verificando la Información Bibliográfica, confirmando que los trámites de otorgamiento pueden proseguir con los documentos radicados y/o diciendo qué traducción de las reivindicaciones ya radicadas se debe usar).

Nota 1: Ver "Notas respecto del pago de tarifas" más abajo.

Nota 2: Cualquier monto sobre - pagado "menos" será reintegrado cuando se tome la decisión de otorgar (EPO Formato 2006A).

Nota 3: Para el cálculo de la tarifa de otorgamiento bajo el Artículo 2(2), No. 7, R Tarifas (antigua estructura de tarifas), el número de páginas se determina sobre la base de una copia limpia de los documentos de solicitud, en donde el texto borrado como resultado de cualquier modificación de la división de evaluación no sea mostrado

Tal copia limpia sólo estará disponible vía inspección de archivo on - line.

2.2 O, en el caso de no aprobar, pedir modificaciones o correcciones justificadas al texto comunicado más arriba o mantener el más reciente texto presentado por ustedes (Regla 71(6) EPC).

En este caso las traducciones de las reivindicaciones y pagos de tarifas mencionados bajo el punto 2.1 anterior NO son exigibles.

Los vocablos "modificación (es)" y "corrección (es)" sólo se refieren a modificaciones o correcciones de los documentos de la solicitud y no de otros documentos (v.g. Información Bibliográfica, la designación del inventor, etc.).

Si se radican modificaciones, ustedes deben identificarlas e indicar las bases de las mismas en la solicitud como fue radicada. El no cumplir con cualquier requerimiento puede llevar a una comunicación de la división de evaluación solicitando que ustedes corrijan tal deficiencia (Regla 137(4) EPC).

2.3 Información Bibliográfica

Si ustedes solicitan un cambio o corrección de Información Bibliográfica en respuesta a la comunicación de la Regla 71(3), esto **no** causará el envío de una comunicación adicional bajo la Regla 71(3) EPC. Ustedes de todas formas tendrán que pagar las tarifas y radicar traducciones en respuesta a la comunicación de la Regla 71(3) en el caso de 2.1 más arriba, a no ser que ustedes también radiquen una solicitud justificada de modificaciones o correcciones en respuesta a la comunicación de la Regla 71(3) (ver caso 2.2 más arriba).

3. Pérdida de Derechos

Si ninguna de las dos acciones posibles mencionadas (ver puntos 2.1 o 2.2) se relaza a tiempo, se considerará que la Solicitud de patente europea ha sido retirada (Regla 71(7) EPC).

4. Procedimiento Adicional

4.1 En el caso del punto 2.1 anterior

- 4.1.1 La decisión de otorgar la Patente Europea será expedida, y la **mención del otorgamiento** de la patente será publicada en el Boletín Europeo de Patentes, si se han cumplido los requerimientos relativos a la traducción de las reivindicaciones y al pago de todas las tarifas y hay acuerdo respecto del texto a ser otorgado (Regla 71a (1) EPC).

Nota sobre el pago de la tarifa de renovación:

Si se causa una tarifa de renovación antes de la próxima fecha posible de publicación de la mención del otorgamiento de la Patente Europea, la publicación será efectuada sólo después de que la tarifa de renovación y cualquier tarifa adicional hayan sido pagadas (Regla 71a (4) EPC).

Bajo el Artículo 86(2) EPC, la obligación de pagar tarifas de renovación a la Oficina Europea de Patentes termina con el pago de la tarifa de renovación adeudada respecto del año en el cual se publica la mención del otorgamiento de la Patente Europea.

Nota sobre el pago de la (s) tarifa (s) de designación:

Si la (s) tarifa (s) de designación se causan después de la comunicación bajo la Regla 71(3) EPC, la mención del otorgamiento de la Patente Europea no será publicada sino después de que estas tarifas hayan sido pagadas (Regla 71a (3) EPC).

- 4.1.2 Tras la publicación, la **especificación de Patente Europea** puede ser descargada sin costo del servidor de publicaciones de la EPO <https://data.epo.org/publication-server>.

4.1.3 Radicación de traducciones en los Estados Contratantes

Respecto de los requerimientos de traducción prescritos por los Estados Contratantes bajo el Artículo 65(1) EPC, por favor consulte la página web de la Oficina Europea de Patentes

www.epo.org -->Ley & práctica --> Textos Legales, ley nacional respecto de la EPC

www.epo.org -->Ley & práctica --> todos los Textos Legales --> Acuerdo de Londres

En el caso de una extensión o validación válida

Respecto de los requerimientos de traducción prescritos por los estados de extensión o validación, por favor consulte la página web de la Oficina Europea de Patentes

www.epo.org -->Ley & práctica --> Textos Legales, ley nacional respecto de la EPC

El no presentar una traducción prescrita en un estado contratante, o en un estado de extensión o validación puede resultar en que se considere que la patente es nula *ab initio* en el correspondiente estado (Art. 65(3) EPC).

4.2 En el caso de 2.2 más arriba

Si la presente comunicación bajo la Regla 71(3) EPC se basa en una solicitud auxiliar y, dentro del plazo, ustedes mantienen la solicitud principal o una solicitud de un rango mayor que no se permite, la solicitud será negada (Art. 97(2) EPC).

Si la división de evaluación da su consentimiento a las modificaciones o correcciones solicitadas, emitirá una nueva comunicación bajo la Regla 71(3) EPC; de lo contrario, retomará los trámites de la evaluación (Regla 71(6) EPC).

5. Radicación de una solicitud divisional

Cualquier solicitud divisional respecto de a presente Solicitud de patente europea debe ser radicada directamente ante la Oficina Europea de Patentes en Munich, La Haya o Berlín y será en el idioma de los trámites de la presente solicitud, o si el anterior no estaba en un idioma oficial de la EPO, la solicitud divisional puede ser radicada en el idioma de la presente solicitud como ha sido radicada (ver Artículo 76(1) y Regla 36(2) EPC). Toda solicitud divisional debe ser radicada mientras que la presente solicitud siga pendiente (Regla 36(1) EPC; Lineamientos A - IV, 1.1.1).

6. Notas respecto del pago de tarifas

6.1 Hacer pagos

Para pagos hechos vía cuenta de depósitos, por favor notar que a partir del 1 de diciembre de 2017 las órdenes de débito sólo serán llevadas a cabo si se radican en un formato procesable electrónicamente (xml), usando los medios de presentación aceptados de la manera establecida en los arreglos para cuentas de depósito (ADA), publicado en la publicación Suplementaria en el Diario Oficial.

Toda la información relevante relativa a los modos de pago de tarifas a la EPO puede ser consultada en la página web de la EPO en "**Hacer Pagos**".

6.2 Información respecto de montos de tarifa

Las tarifas procedimentales por lo general se ajustan cada dos años, en los años impares a partir del 1 de abril. Por lo tanto, antes de hacer un pago, las partes deben verificar los montos realmente adeudados en la fecha de pago usando la versión aplicable del Anexo de tarifas y gastos, publicado como Suplemento al Diario Oficial de la EPO, disponible en la página web de la EPO (www.epo.org) en www.epo.org/schedule-of-fees. La tabla del "Anexo de Tarifas" permite ver, descargar y buscar montos individuales de tarifas, tanto en vigor como anteriores.

6.3 Nota a los usuarios del procedimiento de débito automático

La tarifa de otorgamiento, incluyendo la tarifa de publicación, y cualquier tarifa por reivindicaciones adicionales debidas bajo la Regla 71(4) EPC serán debitadas automáticamente en la fecha de radicación de las traducciones de las reivindicaciones, o en el último día del período de esta comunicación. Sin embargo, si las tarifa(s) de designación se hacen exigibles de la forma establecida en la Regla 71a (3) EPC y/o una tarifa de renovación se vuelve exigible de la forma establecida en la Regla 71a (4) EPC, las mismas deben ser pagadas separadamente por otra manera de pago permitida para no demorar la publicación de la mención del otorgamiento. Lo mismo es aplicable en estas circunstancias al pago de tarifas de extensión y validación. Lo mismo aplica en estas circunstancias al pago de tarifas de extensión y validación. (sic)

División de evaluación:

Presidente: Munro, Brian
2º Examinador: Gattinger, Irene
1º Examinador: Philippart, Anahf



Foglianisi, F
Por la División de evaluación
Tel. No.: +49 89 2399 - 4097

Anexos: Texto de intención de otorgar

EPO Formato 2056