



INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification ⁶ : C03C 13/06, 13/00, E04D 3/35, E04C 2/16, E04B 1/80	A1	(11) International Publication Number: WO 99/08971 (43) International Publication Date: 25 February 1999 (25.02.99)
(21) International Application Number: PCT/EP98/03978 (22) International Filing Date: 30 June 1998 (30.06.98) (30) Priority Data: 9717482.5 18 August 1997 (18.08.97) GB (71) Applicant (for all designated States except US): ROCK- WOOL INTERNATIONAL A/S [DK/DK]; Hovedgaden 584, DK-2640 Hedehusene (DK). (72) Inventors; and (75) Inventors/Applicants (for US only): GULDBERG, Marianne [DK/DK]; Niels Finsens Alle 55, DK-2860 Soborg (DK). JENSEN, Soren, Lund [DK/DK]; Rudesovej 11, DK-2840 Holte (DK). (74) Agent: GILL JENNINGS & EVERY; Broadgate House, 7 Eldon Street, London EC2M 7LH (GB).		(81) Designated States: AL, AM, AT, AT (Utility model), AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, CZ (Utility model), DE, DE (Utility model), DK, DK (Utility model), EE, EE (Utility model), ES, FI, FI (Utility model), GB, GE, GH, GM, GW, HU, ID, IL, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SK (Utility model), SL, TJ, TM, TR, TT, UA, UG, US, UZ, VN, YU, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG). Published <i>With international search report.</i>
(54) Title: ROOF AND WALL CLADDING (57) Abstract Pipe sections for external roof or wall cladding are formed of bonded man-made vitreous fibre batts wherein the fibres have a viscosity at 1400 °C of 10 to 170 poise and a dissolution rate at pH 4.5 of at least 20 nm per day.		

FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AL	Albania	ES	Spain	LS	Lesotho	SI	Slovenia
AM	Armenia	FI	Finland	LT	Lithuania	SK	Slovakia
AT	Austria	FR	France	LU	Luxembourg	SN	Senegal
AU	Australia	GA	Gabon	LV	Latvia	SZ	Swaziland
AZ	Azerbaijan	GB	United Kingdom	MC	Monaco	TD	Chad
BA	Bosnia and Herzegovina	GE	Georgia	MD	Republic of Moldova	TG	Togo
BB	Barbados	GH	Ghana	MG	Madagascar	TJ	Tajikistan
BE	Belgium	GN	Guinea	MK	The former Yugoslav Republic of Macedonia	TM	Turkmenistan
BF	Burkina Faso	GR	Greece			TR	Turkey
BG	Bulgaria	HU	Hungary	ML	Mali	TT	Trinidad and Tobago
BJ	Benin	IE	Ireland	MN	Mongolia	UA	Ukraine
BR	Brazil	IL	Israel	MR	Mauritania	UG	Uganda
BY	Belarus	IS	Iceland	MW	Malawi	US	United States of America
CA	Canada	IT	Italy	MX	Mexico	UZ	Uzbekistan
CF	Central African Republic	JP	Japan	NE	Niger	VN	Viet Nam
CG	Congo	KE	Kenya	NL	Netherlands	YU	Yugoslavia
CH	Switzerland	KG	Kyrgyzstan	NO	Norway	ZW	Zimbabwe
CI	Côte d'Ivoire	KP	Democratic People's Republic of Korea	NZ	New Zealand		
CM	Cameroon	KR	Republic of Korea	PL	Poland		
CN	China	KZ	Kazakstan	PT	Portugal		
CU	Cuba	LC	Saint Lucia	RO	Romania		
CZ	Czech Republic	LI	Liechtenstein	RU	Russian Federation		
DE	Germany	LK	Sri Lanka	SD	Sudan		
DK	Denmark	LR	Liberia	SE	Sweden		
EE	Estonia			SG	Singapore		

ROOF AND WALL CLADDING

This invention relates to bonded man-made vitreous fibre (MMVF) batts which are constructed for use as
5 external roof or wall cladding or as pipe sections, i.e., insulation for fitting around pipes which may be internal or external.

Batts for external use are much more exposed to adverse conditions such as moisture, sun, temperature and
10 wind than batts for internal use. The combination of moisture and heat can create an aggressive environment for the fibres, but conventional MMVF fibres, in conventional batt constructions, resist this. The exposure to wind can promote delamination, but sufficient structural strength
15 can be provided by known techniques such as bonding with a bonding agent and by constructing the batt with the fibre direction predominantly perpendicular, as lamellar boards, instead of the conventional orientation of being substantially parallel to the face of the batt.

20 Similarly batts for internal or external pipe sections insulation are more exposed to humid conditions than batts for regular internal uses, especially when enclosed in an aluminium membrane or plastics membrane or other impermeable sheath.

25 More recently, there has been a trend to develop MMV fibres which have some degree of solubility in physiological fluids. Most of the publications on this topic of solubility emphasise the desirability of the fibres having some degree of solubility in physiological
30 saline at pH around 7.5.

Fibres which, instead, have improved solubility at around pH 4.5 are described in WO96/14454 and WO96/14274.

A problem which arises with the use of MMVF batts made from fibres having appreciable solubility at near neutral
35 pH (approximately pH 7.5) in roof or wall cladding is that the fibres are liable to degrade when exposed to atmospheric humidity for prolonged periods or when exposed

to condensation or direct contact with water. Accordingly it can be unsatisfactory to use such fibres for external roof or wall cladding, unless special precautions are taken to minimise this problem.

5 It would be desirable to be able to provide pipe sections or external roof or wall cladding formed from MMVF fibres which are regarded as having good physiological solubility under relevant test conditions but which have less tendency to degrade when exposed to ambient humidity.

10 According to the present invention, we provide pipe sections or external roof or wall cladding which is a bonded MMVF batt wherein the fibres are formed of a composition which includes fibres formed from,

	SiO ₂	32 to 48%
15	Al ₂ O ₃	18 to 30%
	CaO	10 to 30%
	MgO	2 to 20%
	FeO	9 to 15%
	Na ₂ O + K ₂ O	0 to 10%
20	TiO ₂	0 to 6%
	Other Elements	0 to 15%

and the composition has a viscosity at 1400°C of 10 to 70 poise, and the fibres have a dissolution rate of at least 20nm per day when measured at a pH of 4.5 (by the methods described in WO96/14454. Preferably they are relatively insoluble at pH 7.5

25 The invention includes the MMVF cladding batts themselves, their use as external wall or roof cladding in buildings and building components which are to be on the exterior of a building, and the buildings or building components themselves which include the defined MMVF batts. The invention includes the use of pipe sections for insulating pipes.

30 The building or building component generally comprises a metal, wood or other frame work on to which the MMVF batts are secured in a position such that they will be on the exterior of the building in use. The building may be

an entire building, but the invention also includes building components, for instance a roof structure or wall structure. For instance the roof or wall structure may constitute an entire roof or wall for a building or several
5 such structures, each containing a plurality of batts, may be assembled on site to provide a roof or wall.

The cladding batt as initially manufactured (ie before leaving the plant where it is manufactured) or before installation in or on the building component or building is
10 often provided with a substantially overall or impermeable coating on its external surface. This protective coating may be of water-repellant materials such as roofing felt or it may be of a foil or a decorative material such as paint. Even if such a coating is not applied before assembly, the
15 external surface of the batt or batts in the building component or building are usually provided with a coating. For instance roof boards may be coated with roof felt, asphalt, wood plate, vlies, foil or solar heating units. The roof boards are preferably sufficiently stiff that one
20 can walk on them. Wall cladding may be coated with plaster (either inorganic or organic), cement, paint, polyurethane, roof felt, foil (for instance aluminium), glass or solar heating units.

One type of cladding batt according to the invention
25 is a very high density MMVF batt, typically having a density 500 to 2,000 Kg/m³, often 700 to 1,200 Kg/m³. This high density product usually carries a coating of paint or other substantially impermeable or overall surface covering. Other batts according to the invention may have
30 lower density than this and can be roof boards or wall boards of more conventional construction.

The cladding batts of the invention usually have a density of at least 50 Kg/m³ and often at least 70 Kg/m³, typically up to 500 Kg/m³. Batt's of differing densities
35 can be laid one upon the other in use, with the higher density batt usually on the outside.

Preferred cladding products of the invention have a multi-density construction, usually a dual density construction, with the MMVF layer which is on the outside of the building in use having a higher density than, and
5 formed substantially integral with, the remainder of the MMVF batt. For instance the outer layer usual has a density of at least 60 Kg/m^3 and preferably at least 70 or 80 Kg/m^3 , and often it has a density of at least 20 Kg/m^3 , and frequently at least 50 Kg/m^3 , above the density of the
10 layer beneath it. The high density outer layer is usually at least 5 mm thick, often 10 to 40 mm thick and typically constitutes 2 to 30%, often 3 to 15 or 20%, of the total thickness of the MMVF batt.

The cladding batts are usually square or rectangular
15 slabs but can have other, more complex, shapes, especially when they form parts of roofs. The batts generally have a thickness of 10 to 500 mm. The thicker batts are stiff and are provided as slabs but some of the thinner batts, for instance as facade or wall boards, may sometimes be
20 supplied as a roll of sheet material.

The cladding batts and pipe sections are usually bonded by incorporation of conventional phenolic or other binder, typically in amounts of 1 to 5%, often 2 to 4%, by weight of the batt.

25 Water-repellent material may additionally be included in the cladding batts and pipe sections during manufacture in conventional manner, for instance an oil may be included to improve water-repellency. The total ignition loss of the batts is generally in the range 2 or 3% up to 5 or 6%.

30 The batts can be made by any of the conventional techniques known for making batts of the desired construction for description of suitable methods of making and using external MMVF wall and roof cladding and pipe sections, reference should be made to any or all of EP
35 133,083, 277,500, 420,837, 435,942, 518,964, 521,058, 560,878, 590,098 and 654,100, GB 1,027,799 and 2,223,248, DK 155,163 and DK-U3-9200033, DE-U1-29616962, DE 4,143,387,

4,319,340 and 4,432,866, and WO94/16162, 94/16163, 94/16164 and 95/20708, and WO89/07731, WO89/07733, WO96/37728 and WO97/01060. All these are incorporated by reference.

5 The fibres may be substantially parallel to the external face of the batt or the fibres may be substantially perpendicular to the face of the batt, the product then being of the type conventionally known as a lamellar batt or slab.

10 External roof cladding can have any of the normal configurations of roof boards or other roof cladding and generally has a density in the range 100 to 400, preferably 100 to 200, Kg/m^3 and a thickness of 10 to 500, usually 10 to 300 mm.

15 Single layer roof boards often have a density of 100-300 kg/m^3 and a thickness of 10-300mm. Instead of using a single layer, several layers may be applied one on top of the other, for instance as a combination of lamellar and normal batts, but preferably with the outer layer having the highest density and/or being a lamellar batt.

20 Preferred roof cladding is formed of dual density batts. The density of the bottom may be 60-200 kg/m^3 and the density of the top is usually at least 50 kg/m^3 more and is usually 200-400 kg/m^3 . The thickness of the bottom may be at least 15mm and the thickness of the top may be 100-300mm. The maximum total thickness is usually 350mm.

25 Wall cladding can be of two types. The first type is what is commonly known as a facade board. The other type of wall cladding is often known as a lamella board. The wall cladding generally has a density in the range 50 to 400, often 50 to 200 Kg/m^3 , often around 50 to 150 Kg/m^3 . For instance facade boards may have a density of around 70 to 150 Kg/m^3 whilst lamellar boards may have a density of 50 to 100 or 150 Kg/m^3 . They may have a thickness typically of 10 to 300, often 10 to 200 mm.

35 Lamella boards can be made with lower densities compared to the normal single layer boards. Furthermore, lamella boards can resist the influence of the wind

(delamination strength), which can be a problem with normal single layer boards having the same density. Lamella boards normally have an impermeable surface coating, for instance of wood, foil, roofing felt or other substantially impermeable sheet material.

Typical facade boards have a width of 20cm or more, e.g., 60cm, and can typically have a length of 1-2 metres (e.g., 1.2m) but can be a roll (e.g., 10m). Roof boards usually have a width of above 50cm (e.g., 60cm or 120cm up to 150cm) and a length which is more (e.g., 90cm up to 300cm, e.g., 180 or 140cm).

Pipe sections are used for heating insulation, cooling insulation or condensing insulation around internal or external pipes and pipe fittings. Condensing insulation has a thickness or shape designed so that vapour condenses on the outer surface of the pipe section and/or so that condensed vapour is drained out of the pipe section in order to prevent corrosion of the pipes (see EP 739,470, WO94/05947; EP 528,936, WO97/16676).

The sections can be covered with impermeable aluminium foil or plates; paper coated with aluminium; metal plates, i.e., steel plates, preferably galvanised metal plates, with a corrosion-preventing plastic film or coating; roofing felt; or woven or non-woven glass fibre fleece or cloth. Also the pipe sections may be coated with: canvas, paint, plastic foil, i.e., PVC, cardboard or paper. The covering material can be impregnated with bitumen in order to be weather resistant.

The covering material can be fire resistant.

Usually pipe sections have a density from 40-400Kg/m³, preferably 60-300Kg/m³. The pipe sections may include support rings which are part of the insulation. Pipe sections may consist of two types of wool, one type for the pipes and another more dense type for the support rings. These support rings have the purpose for cold pipes to avoid condensation and for hot pipes to avoid thermal loss. Pipe section support rings usually have densities from 150-

400Kg/m³ preferably 250-350Kg/m³ and preferred around 300Kg/m³. Wool for the remainder of the pipe section typically has density of 40-200Kg/m³, preferably 60-180Kg/m³.

5 In the invention, the preferred amount of SiO₂, Al₂O₃, CaO, MgO, Alkali, TiO₂ and other elements, and the preferred viscosities and dissolution rates (at pH 4.5 and at pH 7.5) are all preferably as described in WO96/14454 and WO96/14274 and reference should be made to those.

10 The amount of FeO is preferably 9-11%. Preferably it is at least 9.5%.

The following are examples of suitable compositions.

	wt%	E	F	G
15	SiO ₂	44,1	43,1	42,2
	Al ₂ O ₃	21,5	23,0	23,4
	TiO ₂	1,5	1,7	1,6
	FeO	9,7	10,1	9,5
	CaO	17,9	15,1	14,5
20	MgO	2,9	4,9	7,2
	Na ₂ O	1,7	1,0	0,8
	K ₂ O	0,6	0,9	0,8
	SUM	100	100	100
25	Sinter temp °C	1100	1100	1100
	Viscosity poise 1400°C	39	40	34
30	Dissolution rate pH 4.5 nm/day	46	55	51

CLAIMS

1. A bonded MMVF batt suitable for use as external roof or wall cladding or as pipe sections wherein the fibres are formed of a composition which includes, by weight of
 - 5 oxides,
 - SiO₂ 32 to 48%
 - Al₂O₃ 18 to 30%
 - CaO 10 to 30%
 - MgO 2 to 20%
 - 10 FeO 9 to 15%
 - Na₂O + K₂O 0 to 10%
 - TiO₂ 0 to 6%
 - Other Elements 0 to 15%

and the composition has a viscosity at 1400°C of 10 to

 - 15 70 poise and the fibres have a dissolution rate of at least 20nm per day when measured at a pH of 4.5
2. A batt according to claim 1 having a protective coating on its outer surface.
 3. A batt according to claim 1 or claim 2 for external
 - 20 roof or wall cladding and having a density of 500 to 2,000 Kg/m³.
 4. A batt according to any preceding claim for external roof or wall cladding and having a dual density construction.
 - 25 5. A batt according to claim 1 or claim 2 which is a pipe section including a ring of insulation of increased density.
 6. Use of a bonded MMVF batt according to any of claims 1 to 4 as external roof or wall cladding.
 - 30 7. A building or building component including a batt according to any of claims 1 to 4.
 8. Use of a batt according to claims 1, 2 or 5 as internal or external pipe sections around pipes or pipe fittings.
 - 35 9. Pipes insulated by a pipe section batt according to claims 1, 2 or 5.

INTERNATIONAL SEARCH REPORT

In .ational Application No
PCT/EP 98/03978

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 C03C13/06 C03C13/00 E04D3/35 E04C2/16 E04B1/80

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)
IPC 6 C03C E04D E04C E04B

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 practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 96 14274 A (ROCKWOOL-INTERNATIONAL) 17 May 1996 cited in the application	1,7-9
Y	see page 3, line 31 - page 4, line 22 see page 12, line 16 - page 12, line 28 see page 15, line 1 - page 15, line 15 ---	2-6
Y	US 5 571 610 A (LOFTUS ET AL.) 5 November 1996 see column 4, line 13 - column 4, line 21 see column 5, line 8 - column 5, line 19 see column 6, line 52 - column 7, line 15 see figures 1-3,6-8 ---	2,3
Y	EP 0 408 428 A (ISOVER SAINT-GOBAIN) 16 January 1991 see column 3, line 39 - column 4, line 34 see figures 1,2 --- -/--	2,6



Further documents are listed in the continuation of box C.



Patent family members are listed in 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 document 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

1 December 1998

Date of mailing of the international search report

08/12/1998

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,
Fax: (+31-70) 340-3016

Authorized officer

Hendrickx, X

INTERNATIONAL SEARCH REPORT

Information on patent family members

In ternational Application No

PCT/EP 98/03978

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 9614274 A	17-05-1996	AT 169352 T	15-08-1998
		AU 3871595 A	31-05-1996
		AU 3871695 A	31-05-1996
		BE 1009073 A	05-11-1996
		BG 101449 A	30-12-1997
		BG 101450 A	30-12-1997
		CZ 9701366 A	14-10-1998
		CZ 9701404 A	16-09-1998
		DE 19581829 T	02-10-1997
		DE 19581831 T	02-10-1997
		DE 29515168 U	14-03-1996
		DE 29521680 U	14-05-1998
		DE 69503919 D	10-09-1998
		DE 790962 T	30-04-1998
		DE 791087 T	30-04-1998
		DE 792843 T	30-04-1998
		DE 792844 T	30-04-1998
		DE 792845 T	30-04-1998
		WO 9614454 A	17-05-1996
		EP 0790962 A	27-08-1997
		EP 0791087 A	27-08-1997
		EP 0792843 A	03-09-1997
		EP 0792844 A	03-09-1997
		EP 0792845 A	03-09-1997
		EP 0877004 A	11-11-1998
		ES 2111504 T	16-03-1998
		ES 2111505 T	16-03-1998
		ES 2111506 T	16-03-1998
		ES 2111507 T	16-03-1998
		ES 2111508 T	16-03-1998
		FI 972515 A	13-08-1997
		FI 972516 A	13-08-1997
		FR 2726548 A	10-05-1996
		GR 98300009 T	31-03-1998
		GR 98300010 T	31-03-1998
		GR 98300011 T	31-03-1998
		GR 98300012 T	31-03-1998
		GR 98300013 T	31-03-1998
		HU 77860 A	28-08-1998
		HU 77859 A	28-08-1998
		JP 10509774 T	22-09-1998
		NL 1001607 A	21-08-1996
		PL 320344 A	29-09-1997
		PL 320363 A	29-09-1997
		SK 55097 A	05-11-1997
		SK 55197 A	08-10-1997
US 5571610 A	05-11-1996	US 5614132 A	25-03-1997
		US 5490961 A	13-02-1996
		US 5458822 A	17-10-1995
		AU 1287397 A	28-07-1997
		WO 9724211 A	10-07-1997
		US 5736475 A	07-04-1998
		AU 677357 B	17-04-1997
		AU 7170594 A	17-01-1995
		CA 2164212 A	05-01-1995
		CN 1133031 A	09-10-1996
		DE 69408987 D	16-04-1998

INTERNATIONAL SEARCH REPORT

Information on patent family members

In International Application No

PCT/EP 98/03978

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 5571610 A		DE 69408987 T	12-11-1998
		EP 0705227 A	10-04-1996
		ES 2113113 T	16-04-1998
		JP 8506391 T	09-07-1996
		PL 311884 A	18-03-1996
		WO 9500454 A	05-01-1995
		AU 7170494 A	17-01-1995
		CA 2164213 A	05-01-1995
		CN 1133030 A	09-10-1996
		DE 69408142 D	26-02-1998
		DE 69408142 T	03-09-1998
		EP 0705226 A	10-04-1996
		ES 2111312 T	01-03-1998
		JP 8506390 T	09-07-1996
		PL 311883 A	18-03-1996
		WO 9500453 A	05-01-1997
EP 0408428 A	16-01-1991	CH 678709 A	31-10-1991
		CS 9003491 A	15-09-1991
		DD 296729 A	12-12-1991
		DE 69003613 D	04-11-1993
		DE 69003613 T	11-05-1994
		DK 408428 T	06-12-1993
		HU 212331 B	28-05-1996
		IE 64217 B	26-07-1995
		JP 3114826 A	16-05-1991
		PL 166494 B	31-05-1995
		SI 9011280 A	31-12-1994
US 4917750 A	17-04-1990	DE 3701592 A	04-08-1988
		AT 107370 T	15-07-1994
		DE 3850130 D	21-07-1994
		DK 22088 A	22-07-1988
		EP 0277500 A	10-08-1988
		FI 880240 A,B	22-07-1988
		US 4950355 A	21-08-1990
EP 0021781 A	07-01-1981	GB 2054000 A	11-02-1981
		JP 56022663 A	03-03-1981
		ZA 8003634 A	24-06-1981
WO 9636573 A	21-11-1996	AU 5896896 A	29-11-1996
		CA 2220421 A	21-11-1996
		EP 0825965 A	04-03-1998
		SK 153297 A	03-06-1998