

PREFABRIC FIBER REINFORCED CEMENT (GRC)
WALLPANEL

DESCRIPTION OF THE INVENTION

5 The present invention relates to fiber reinforced cement (GRC) wallpanel heat isolated by foam concrete and a method for producing this.

 In terms of related field and present state of the art currently there are 4 types of prefabric wallpanel production methods:

10 a) Iron reinforced concrete panel: These panels have an sq/m weight of 400 kg, does not contain heat isolation and because of weight create problems while transportation and mounting.

 b) Heat isolated concrete panel: obtained by putting 5 cm thick hard polystyrene foam sheet among 10 cm thick two panels and
15 comprises same weight and mounting problems.

 c) Sandwich system panel: These panels are obtained by covering all sides of Styropor foam blocks with Fiber reinforced cement. It can provide heat isolation and lightness but it is not possible to mount to concrete tabliers and creates problems as times pass by.
20 For these reasons production is abandoned.

 d) Fiber reinforced cement (GRC) lining plates: They are steel carcassed plates that have 12 mm section thickness and used to cover general columns, present walls and to provide forms on surface. Heat isolation is done by placing isolation plates behind them after
25 mounting.

e) Since there is strict rigidity in all types of these panels they do not have any movement freedom against building straps and building movements.

In view of the above mentioned present state of the art, subject
5 of this application is the solution of the known problems.

Panels produced according to the present state of the art have a panel thickness of 20-25 cm in order to prevent cracks and breaking of iron mounting in the panel. In this case sq/m weight of the panel is about 400-450 kg. And this causes problems in transporting and
10 mounting of large scale panels, also brings huge loads over building stude frame concrete. In our invention panel thickness does not exceed 10-15 cm and panel weight is about 90-100 kg. This enables easy transportation and mounting of the panel, weight load to building concrete decreases to minimum and amount of iron used in building
15 stude frame concrete is decreased.

In the panels produced according to the present state of the art there is a need for further heat isolation and this requires various isolation materials and a further process, labor use and extra cost.

In our invention since cellular structure and air spaces in foam
20 concrete function as an isolation material there is no need for further heat isolation process. Second advantage of heat isolation with foamconcrete is that since it is possible to produce concrete with requested densities while forming foam concrete, depending on the heat values of the area that the panel is to be used, panels having
25 various isolation values of Lambda values 0.065 to 0.500 and K values 0.29 to 3.33.

Panels produced according to the present state of the art can not contain forms other than some basic shapes, because iron reinforced concrete technology itself does not allow it. In our invention since GRC is a material that can be molded in any form, every kind of architectural design form can be given to the panels.

Panels produced according to the present state of the art are heavy and rigid panels. They don't have the freedom of movement apart from building and the ability to accommodate to the movements such as building movements, ground movements and straps. Thus there are cracks and openings in joint gaps among the panel in the course of time. In our invention GRC shell which forms the outer side of panel is fixed to the panel steel stude frame with flexible anchorage rods and panel stude frame is fixed to the building tablier with anchorage plates. For this reason when transition of movements of the building to the panel body, flexible anchorage rods bend and the panel is not effected by movements of the building.

In practice GRC panels can vary depending on the architectural plan and subject of the application is described in more detail by the enclosed drawings which are presented just to explain the invention and have no intention to limit the scope of the invention. They have the following characteristics which form the invention.

Figure 1) An outside view of a finished window spaced monoblock panel. On the front view there is shown (A-A) plan section and (B-B) plan section which are going to be shown in next figures.

Figure 2) Inner detail view of panel in vertical (A-A) section.

a - building tabliers

- b - GRC shell
- c - Omega sectioned steel stude frame
- d - Flexible anchorage rods
- e - Pets connecting flexible anchorage rods to GRC shell inner
- 5 surface
- f - Foam concrete filling
- g - foam concrete equipment straw steel
- h - anchorage plates in four corners of panel from which panel is going to be welded
- 10 i - brace clamp welded to anchorage plate
- j - steel band screwed to building tablier
- k - Joint gap isolation material (Polysulphit)
- m - brace clamp on which the above panel is going to be placed.

Figure 3) Inner detail view of panel in (B-B) vertical section:

- 15 a - building tabliers
- b - GRC shell
- c - Omega sectioned steel stude frame
- d - Flexible anchorage rods
- e - Pets connecting flexible anchorage rods to GRC shell inner
- 20 surface
- f - Foam concrete filling
- g - foam concrete equipment straw steel
- h - anchorage plates in four corners of panel from which panel is going to be welded
- 25 i - brace clamp welded to anchorage plate
- j - steel band screwed to building tablier

k - Joint gap isolation material (Polysulphit)

m - brace clamp on which the above panel is going to be placed

Figure 4) Section of panels connection section to building tablier.

a - building tabliers

5 b - GRC shell

c - Omega sectioned steel stude frame

d - Flexible anchorage rods

e - Pets connecting flexible anchorage rods to GRC shell inner surface

10 f - Foam concrete filling

g - foam concrete equipment straw steel

h - anchorage plates in four corners of panel from which panel is going to be welded

i - brace clamp welded to anchorage plate

15 j - steel band screwed to building tablier

k - Joint gap isolation material (Polysulphit)

m - brace clamp on which the above panel is going to be placed

Figure 5) Flexible anchorage detail

a - Steel stude frame

20 b - Flexible rod

d - GRC pet

e - GRC shell

c - the part which is going to provide flexibility by inclinations

Figure 6) View of steel stude frame on which there is flexible

25 anchorage rods and anchorage plates on 4 corners:

c - Omega sectioned steel stude frame

d - Flexible anchorage rods

h - steel plates by which stude frame is going to be connected to building tablier.

5 The subject of this application is explained below.

In GRC panel of the invention obtained by providing a composite product by joining two different elements which have different characteristics and use, advantages are obtained which are formed by joining characteristics of two elements and thus there is
10 obtained novel self heat isolated, light, monoblock prefabric GRC wallpanel.

In known state of the art Fiber reinforced cement is a type of cement which is formed by alkali resistant glass fiber and has the strength of reinforced cement-sand mortar, can be molded and can be
15 casted in section thickness of 10-12 mm. On the other hand, foam concrete is a type of air foamed concrete that is obtained by foaming a foamer liquid chemical by an air generator and mixing this foam with cement mortar. Because of the air bubbles contained it provides perfect heat isolation, moreover it is light.

20 The present invention relates to a self heating isolated light, monoblock GRC prefabric wallpanel obtained by joining these two material in a form of a panel and a method for producing this.

10-12 mm thick GRC shell is formed (Figure 2,3-b) by spraying GRC mortar inside steel or glass fiber reinforced plastic (CTP) panel
25 mold prepared according to the requested architectural form. Spraying

of GRC mortar is done by concrete pump and spray guns built for this purpose.

Steel stude frame (Figure 2,3-c) (Figure 6) designed to provide wind load, essential weight etc. mechanic characteristics is going to be placed inside the formed GRC shell. On this stude frame there is placed flexible anchorage rods with 50 cm distance from each other. Also there is provided steel anchorage plates (Figure 2,3-h)(Figure 6-h) on four corners of steel stude frame which are going to be fixed to steel straps on the building. Thus, it is displaced inside steel stude frame GRC shell (b) which both carries the GRC and also the panel by fixing to building tablier. After this process flexible anchorage rods are padded to steel stude frame by GRC mortar (Figure 2,3,4-e)(Figure 5-e). One end of these 6-10 mm section thick , 1-15 long flexible anchorage rods are fixed to steel stude frame and the other end is fixed to GRC shell. There is a 6-8 cm free section in between (Figure 5-c). This free section on the rod provides the flexibility. When there is a movement in the building and panel these flexible rods bend and prevent the movement from transmitting to the rigid section. As a result this causes the ground movements, building movements and tasman from being transmitted to the panel.

After placing flexible anchorage rods (Figure 6-d) and steel stude frame (Figure 6) containing mounting plates (Figure 6-h) into GRC shell and after each flexible anchorage rod is padded to GRC shell (Figure 2,3,4-e), a layer of straw steel is placed in order to function as a filling to the foam which will be poured into shell and prevent cracks and openings that may happen there, and is fixed from a

few points to the steel stude frame (c). After this stage, panel is formed by putting foam concrete into GRC shell (Figure 2,3,5-f).

Panel is sent to curing chamber together with its mold, is taken out of the mold after the curing period and sent to construction area
5 where it is going to be mounted.

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CLAIMS

1. The subject of the present invention is self heat isolated, light,
5 monoblock and prefabric wallpanel obtained by using glass fiber reinforced concrete with foam concrete which have different characteristics.

2. GRC panel according to claim 1, characterized in that heat
isolation is proved by cellular structure and air spaces in foam concrete
10 and said panel does not require an additional heat isolation material and process.

3. Self heat isolated GRC panel according to claim 1 or 2, characterized in that it is possible to prepare a foam concrete with requested concrete density, it can be produced with requested various
15 isolation values such as Lambda values between 0.065 and 0.500 and K value between 0.029 and 3.33, depending on the region where said GRC panel is going to be used.

4. Self heat isolated GRC panel according to the preceding claims, characterized in that it comprises the following: GRC shell (b),
20 omega sectioned steel stude frame (c), flexible anchorage rods (d), pads that connect flexible anchorage rods to shell inner face, foam concrete filling (f), foam concrete mounting straw steel (g), anchorage plates (h) by which panel will be welded to four corners of the panel, diagonal profile (i) which is welded to anchorage plate.

25 5. Self heat isolated GRC panel according to the preceding claims, characterized in that GRC shell is filled with foam concrete (f) in order to provide heat isolation.



6. Self heat isolated GRC panel according to the preceding claims, characterized in that GRC shell (b) which is obtained by spraying GRC mortar inside steel or glass reinforced plastic panel mold which is prepared in architectural form, design and detail, has a
5 thickness of 10-12 mm.

7. Self heat isolated GRC panel according to the preceding claims, characterized in that GRC shell (b) can be produced with requested form, design and shape and such that it can include every kind of detail such as window spaces, strip windows, blind frames,
10 fringe, surface texture etc.

8. Self heat isolated GRC panel according to the preceding claims, characterized in that steel stude frame (c) (Figure 6) which is placed inside GRC shell (b), carries GRC shell (b) by means of flexible anchorage rods (d) and also provides panel to be fixed to building
15 tablier (a) by means of diagonal profile (m) which is placed on anchorage plate (h).

9. Self heat isolated GRC panel according to the preceding claims, characterized in that flexible anchorage rods (d) are placed on steel stude frame (c) with about 50 cm space.

20 10. Self heat isolated GRC panel according to the preceding claims, characterized in that flexible anchorage rods (d) are welded to steel stude frame (c) from one end and fixed to GRC shell from the other end and there is provided flexibility by means of the free 6-8 cm section (Figure 5-c) and as a result of this panel is not effected by
25 ground and building movements.

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11. Self heat isolated GRC panel according to the preceding claims, characterized in that mounting of said panel to building tablier (a) is provided by fixing the diagonal profile (Figure 2,3,4-L) which is fixed to anchorage plates (Figure 6) on the corners of the panel, to steel strap on the building tablier (Figure 2,3,4-J).

12. Self heat isolated GRC panel according to the preceding claims, characterized in that it functions as mounting to foam concrete filing (f) and there is a layer of steel wire mesh (g) placed in steel stude frame (c) in order to prevent the possible cracks and openings on foam concrete.

13. Self heat isolated GRC panel according to the preceding claims, characterized in that finished panel thickness is about 10-15 cm.

14. Self heat isolated GRC panel according to the preceding claims, characterized in that finished panel weight is 80-10 kg for each meter square.

15. A method for producing self heat isolated GRC panel according to the preceding claims, it comprises the steps of:

a) first panel mold made of steel or glass reinforced plastic is prepared with desired architectural form, design and detail;

b) 10-12 mm thick GRC shell (b) is formed by spraying GRC mortar into said panel;

c) steel stude frame (c) (Figure 6) which is constructed so that it can receive wind load, particular weight and mechanic characteristics, is placed;

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d) 50 cm spaced flexible anchorage rods (d) and anchorage plates (h) (Figure 6-n) which have 4 steel corners are provided over steel stude frame;

e) flexible anchorage rods (d) are padded to GRC shell by means
5 of GRC mortar;

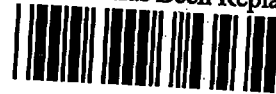
f) a layer of steel wire mesh (g) which functions as mounting to foam concrete filing (f) is placed on steel stude frame (c);

g) a panel is formed by filling foam concrete into GRC shell (b);

h) panel is sent to treatment chamber inside the mold;

10 i) after treating period panel is removed from the mold and becomes ready to transport to the construction area where it is going to be mounted.

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**AMENDED CLAIMS**

[received by the International Bureau on 8 June 1998 (08.06.98);
original claims 1-15 replaced by amended claims 1-13 (3 pages)]

1. The subject of the present invention is self heat isolated composite light wallpanel comprising FTB/GRC (glass fiber reinforced concrete), foamed concrete, special designed carrier steel stude frame (c) and steel wire mesh (g) having different characteristics, characterized in that the carrier steel stude frame (c) and the steel wire mesh (g) placed inside the heat isolated light wallpanel is totally covered with foam concrete and therefore does not constitute a heat bridge whereby the saturation on outer surfaces of panels caused by temperature differences is prevented.

2. Self heat isolated GRC panel according to the preceding claims, characterized in that it comprises the following: GRC shell (b), omega sectioned steel stude frame (c), flexible anchorage rods (d), pads that connect flexible anchorage rods to shell inner face, foam concrete filling (f), foam concrete mounting steel wire mesh (g), anchorage plates (h) by which panel will be welded to four corners of the panel, diagonal profile (i) which is welded to anchorage plate.

3. Self heat isolated GRC panel according to claim 1 and claim 2, characterized in that the GRC shell (b) for the aim of providing heat isolation is filled with foam concrete before said GRC shell has set and during the same manufacturing process so that the light wallpanel is produced in one and same process.

4. Self heat isolated GRC panel according to the preceding claims, characterized in that GRC shell (b) can be produced with requested form, design and shape and such that it can include every kind of detail such as window spaces, strip windows, blind frames, fringe, surface texture etc.

AMENDED SHEET (ARTICLE 19)

REPLACEMENT SHEET

08 JUN 1998



5. Self heat isolated GRC panel according to the preceding claims, characterized in that steel stude frame (c) (Figure 6) which is placed inside GRC shell (b), carries GRC shell (b) by means of flexible anchorage rods (d) and also provides panel to be fixed to building tablier (a) by means of diagonal profile (m) which is placed on anchorage plate (h).

6. Self heat isolated GRC panel according to the preceding claims, characterized in that flexible anchorage rods (d) are placed on steel stude frame (c) with sufficient space.

7. Self heat isolated GRC panel according to the preceding claims, characterized in that the steel stude frame is narrower to reduce the thermal transfer and that sufficiently thick foam concrete has been placed on both sides of the steel stude frame.

8. Self heat isolated GRC panel according to the preceding claims, characterized in that flexible anchorage rods (d) are welded to steel stude frame (c) from one end and fixed to GRC shell from the other end and there is provided flexibility by means of the free 6-8 cm section (Figure 5-c) and as a result of this panel is not effected by ground and building movements.

9. Self heat isolated GRC panel according to the preceding claims, characterized in that mounting of said panel to building tablier (a) is provided by fixing the diagonal profile (Figure 2,3,4-L) which is fixed to anchorage plates (Figure 6) on the corners of the panel, to steel strap on the building tablier (Figure 2,3,4-J).

10. Self heat isolated GRC panel according to the preceding claims, characterized in that it functions as mounting to foam concrete filing (f) and there is a layer of steel wire mesh (g) placed in steel stude

AMENDED SHEET (ARTICLE 19)

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frame (c) in order to prevent the possible cracks and openings on foam concrete.

11. Self heat isolated GRC panel according to the preceding claims, characterized in that finished panel thickness is about 10-15 cm.

12. Self heat isolated GRC panel according to the preceding claims, characterized in that finished panel weight is 80-100 kg for each meter square.

13. A method for producing self heat isolated GRC panel according to the preceding claims, it comprises the steps of:

a) first panel mold made of steel or glass reinforced plastic is prepared with desired architectural form, design and detail;

b) 10-12 mm thick GRC shell (b) is formed by spraying GRC mortar into said panel;

c) steel stude frame (c) (Figure 6) which is constructed so that it can receive wind load, particular weight and mechanic characteristics, is placed;

d) sufficiently spaced flexible anchorage rods (d) and anchorage plates (h) Figure 6-n) which have 4 steel corners are provided over steel stude frame;

e) flexible anchorage rods (d) are padded to GRC shell by means of GRC mortar;

f) a layer of steel wire mesh (g) which functions as mounting to foam concrete filing (f) is placed on steel stude frame (c);

g) a panel is formed by filling foam concrete into GRC shell (b);

h) panel is sent to treatment chamber inside the mold;

i) after treating period panel is removed from the mold and becomes ready to transport to the construction area where it is going to be mounted.

AMENDED SHEET (ARTICLE 19)

REPLACEMENT SHEET

08 JUN 1998

STATEMENT UNDER ARTICLE 19

We respectfully submit in the enclosure the set of claims 1 to 13 amended in consideration of the International Search Report dated February 19, 1998 citing the following documents:

- EP 0 183 526 A1 (PERMANENT FORMWORK LIMITED)
 - in category (Y) against claims 1-3, 5, 6
 - in category (A) in respect of claims 7, 12, 15
- WO 93/12 303 A1 (HARDIE)
 - in category (Y) against claims 1-3, 5, 6
 - in category (X) against claims 1-3, 5
 - in category (A) in respect of claims 4, 7, 8, 9

With a view to better differentiate the above application from the cited documents the claims have been amended as follows:

- In WO 93/12 303 A1 of HARDIE, the steel profiles are emptied in order to reduce the heat bridge thereof, whereas in the present invention no heat bridge occurs as the wallpanel described herein is heat isolated (the system in EP 0183 526 A1 of PERMANENT is not characterized with heat isolation). In order to emphasise these differences of the present invention, we have deleted original filed claim 1 and replace same with new claim 1 as submitted as replacement. Also original claims 2 and 3 are deleted.
- Originally filed claim 5 has been amended and renumbered as new claim 3 in view of WO 93/12 303 A1 of HARDIE to emphasise that the GRC shell is produced in one and same process effected for the production of the

wallpanel, whereas in said document the outer and inner shell are made before the production process.

- Originally filed claim 4 (renumbered as claim 2) has been amended in that the term "straw steel" (g) has been replaced with the technical term "steel wire mesh". This term has also been used in new claim 1.
- In originally filed claim 14 (renumbered as claim 12), the indication as to the finished panel weight has been corrected as "80 - 100 kg".
- The claim 7 has been newly added to differentiate the present invention from both HARDIE and PERMANENT documents. New claims 7 claims a steel stude frame (which is not claimed or explained in PERMANENT) which is narrower and aims the reduction of thermal expansion (whereas there is no feature in HARDIE in regard to thermal expansion).
- Original claim 9 (new claim 6) and original claim 15 (new claim 13) have been amended in that in original claim 9 the term "with about 50 cm space" has been amended to read "with sufficient space" and in original claim 15 under point (d) the term "50 cm spaced" has been amended to read "sufficiently spaced".
- The remaining originally filed claims 7,8,10,11,12,13 are unchanged.
- The following originally filed claims against which no anticipating documents are cited are maintained as such and renumbered as :

- original claim 4 renumbered as claim 2
- original claim 7 renumbered as claim 4
- original claim 8 renumbered as claim 5
- original claim 9 renumbered as claim 6
- original claim 10 renumbered as claim 8
- original claim 11 renumbered as claim 9
- original claim 12 renumbered as claim 10
- original claim 13 renumbered as claim 11
- original claim 14 renumbered as claim 12
- original claim 15 renumbered as claim 13

It is respectfully submitted that the Substantive Examination be conducted as of the enclosed set of amended claims and of the explanations provided in this present submission.