

A FRP DECORATION PANEL USING DECORATION PREPREG, AND A MANUFACTURING METHOD THEREOF

Background of the Invention

Field of the Invention

The present invention relates to a FRP (Fiber Reinforced Plastics) panel having a decorative appearance, and a manufacturing method thereof. Particularly, the present invention relates to a FRP panel endowed with surface decoration effect by a decoration prepreg which is based on a decoration sheet having decorative shapes or patterns, laminated on a conventional FRP panel. In addition, the present invention relates to a method for manufacturing a FRP decoration panel, which can effectively provide a FRP decoration panel by molding integrally a decoration prepreg and a sheet molding compound (here-in-after, referred to as "SMC") at the time of molding.

Prior Arts

A FRP, which is a plastic composite material reinforced with fiber, has been widely used with building or functional materials by virtue of the excellent mechanical properties, corrosion resistance of plastics and excellent moldability. Accordingly, the decorative requirement of products, especially FRP panel which is widely used as interior or exterior materials in the field of constructions, has been increased greatly.

However, SMC, which is resin composition as a raw material for molding of FRP panel, is unstably flowable at the time of molding and hardly compatible with pigments, whereby there is a limitation of expression of colors or patterns with molding. Thus, painting or transcription printing has been used in order to express colors or

patterns up to the present. These methods, however, has a limitation in utility owing to low homogeneity of patterns and colors of the product as well as high cost for production owing to requirement of additional process. In order to provide a FRP decoration panel in which various colors and patterns have been desirably expressed, and a simple method for manufacturing a decoration panel without the problems mentioned above, the present inventor has disclosed an invention entitled "A FRP decoration panel using decoration prepreg, and a manufacturing method thereof" as Korean Patent Application No. 94-25797. The FRP panel according to the aforementioned invention has a structure in which a decoration prepreg based on a decoration sheet expressed with a certain patterns or colors has been laminated on a conventional FRP panel, and the method according to the same invention comprises steps of impregnating a decoration sheet expressed with colors or patterns with an unsaturated polyester (UPE) resin composition, to prepare a decoration prepreg; covering both sides of the obtained decoration prepreg with films and aging thereof; removing the films of both sides of the decoration prepreg; and integrally molding the decoration prepreg and SMC by introducing said decoration prepreg at the upper part of a mold at the time of molding.

However, in the aforementioned invention, the FRP panel has problems in that the surface of the FRP panel is exposed so that scratching may be readily occurred during the working, and that defects of the product such as deformation or rupture of the decoration sheet are frequently occurred in the molding step. Further, the method has problems in that the process comprises complicated steps for covering the decoration prepreg with films and removing said films, and thus requires much time to perform the process; molding condition must be strictly controlled in order to avoid the

defects of the product; and that inferior goods is frequently produced because the molding steps is repeated only with the decoration prepreg and the SMC in the molding device so that foreign substance may be readily incorporated.

Among these problems, problems of deformation and rupture of the decoration sheet have been analyzed by the present inventor. As a result, it has found that the problems of the product have been caused by the shear stress originated from molding pressure in the mold used for press molding. In other words, the main reason for deformation or rupture of the product has been that the shear stress could cause a random flow of liquid raw material and solid raw material in the SMC, so that the base material of the decoration prepreg such as paper, woven or nonwoven could not bear this flow originated from the shear stress. An alternative solvation is to increase the thickness of the base material of the decoration prepreg in order to overcome such shear stress of the SMC. However, this solvation is undesirable because it causes another problem of lowering print precision of the decoration sheet, whereby decreasing the decoration effect of the product.

Summary of the invention

The object of the present invention is to provide a FRP decoration panel in which desired colors and patterns can be variably expressed, in which inferior goods, caused by deformation, rupture or incorporated foreign materials during molding, does not exist, and to which scratching is hardly occurred at the time of transportation or working because the surface is protected.

Another object of the present invention is to provide a method for manufacturing a FRP decoration panel, which can avoid the occurrence of the inferior goods by properly dispersing or blocking the shear stress originated by molding pressure in the

mold used in press molding so that the base material of the decoration prepreg does not deform or rupture, and comprises simplified steps for preparing a decoration prepreg whereby lowering the overall cost for the production.

According to the present invention, to achieve the aforementioned object, a FRP decoration panel in which a decoration prepreg layer based on a decoration sheet shaped with colors or patterns is laminated on at least a part of a SMC layer, wherein a glass mat is insertionally laminated between the decoration prepreg layer and the SMC layer is provided.

In the FRP decoration panel according to the present invention, the shear stress originated from the SMC layer of the lower part during molding is properly dispersed or blocked by the glass mat layer, so that the decoration prepreg layer of the upper part is not deformed or ruptured. Thus, inferior goods is hardly generated.

In addition, a thermal resistant film layer, which can be easily removed after molding or working, can be laminated on the decoration prepreg layer, in order to properly protect the surface so as to avoid elongation or shrinkage of the decoration prepreg layer during the molding process and to inhibit the scratching during transportation or working.

According to the present invention, to achieve the another object, a method for manufacturing a FRP decoration panel which comprises steps of preparing a decoration prepreg layer by impregnating the decoration sheet as a base material with an unsaturated polyester (UPE) resin composition; forming a glass mat layer by laying a glass mat on at least a part of a SMC layer filled in the mold; and integrally molding the decoration prepreg layer and the SMC layer on which the glass mat layer is formed, is supplied.

Besides, after the step of preparing the decoration prepreg layer before the step of forming the glass mat layer , a additional step of forming a thermal resistant film layer by laminating a thermal resistant film on the surface of the decoration prepreg layer can be performed.

According to the present invention, the process is simplified by omitting complicated steps of covering the both sides of the decoration prepreg with films, aging thereof, and removing the films at the time of molding, which were essential to the former process by the present inventor. Further, the glass mat layer formed on the SMC molding layer during molding so as to prevent the deformation or rupture of the decoration sheet in the decoration prepreg layer. In addition, the thermal resistant film layer can prevent not only the elongation or shrinkage of the decoration prepreg layer owing to the heat and pressure applied during the molding, but also the incorporation of foreign materials generated from the repeated molding step, and further acts as a protective film for the surface of final product.

Brief Description of the Drawings

FIG. 1 is a sectional view of a decoration FRP (Fiber Reinforced Plastics) panel according to preferred embodiment of the present invention.

FIG. 2 is an outlined structural view of a device for manufacturing a decoration prepreg layer which is a part of the FRP decoration panel according to the present invention.

Detailed Description of the Preferred Embodiments

Hereinafter, the present invention will be described in detail referring to the accompanying drawings and examples.

FIG. 1 is a sectional view of a FRP decoration panel according to a preferred embodiment.

Referring to FIG.1, a glass mat layer (3) is insertionally laminated between a decoration prepreg layer (1) which expresses decoration effect and SMC layer (2) which constructs a main body of the panel, and a thermal resistant film layer (4) is laminated on the decoration prepreg layer (1).

In the above embodiment, the SMC layer (2) is almost the same as conventional FRP panel made by general molding process, and the decoration prepreg layer (1), expressed with desired colors or patterns, has a structure formed by impregnating a decoration sheet (1a) made of paper, nonwoven or woven cloth with UPE resin composition (1b) in accordance with general impregnation process.

Where the decoration sheet (1a) used as a base material of the decoration prepreg layer(1) is made of paper, the main component of the paper is cellulose, and the unit weight thereof is 30 - 500 g/m², preferably 80 - 120 g/m². Where the decoration sheet (1a) is made of nonwoven or woven cloth, the raw material thereof can be selected from a group consisting of polyester, polyethylene, polypropylene or nylon type, and the unit weight thereof is 50 - 500 g/m², preferably 100 - 300 g/m². Considering the easiness of preparing prepreg and the deformation by the generation of curing heat of SMC during the molding and by the flow of SMC, polyester is most preferred.

The glass mat forming the glass mat layer (3) mentioned above can be selected from a group consisting of chop strand mat, continuous mat, glass cloth and woven cloth, and the unit weight can be 50 -1000 g/m². If the unit weigh thereof weight is too high, bubbles may be generated, while it is too low, the deformation or rupture of the

decoration sheet may be caused. Thus, the unit weight of 100 - 450 g/m² is the most preferable.

As film forming the thermal resistant film layer (4) mentioned above, films having high thermal resistance such as polyester, nylon, polyamide, polyvinyl alcohol (PVA) may be used, and the thickness of the film layer(4) can be 12 - 200 μ m. If the film layer(4) is too thick, glaze is deteriorated owing to dispersion of molding pressure during molding, while it is too thin, the film is minutely torn after molding, whereby the removal of the film is difficult. Thus, the thickness of about 16-35 μ m is most preferable.

In the FRP decoration panel according to the present invention, the shear stress originated from the SMC layer(2) of the lower part during the molding process is properly dispersed or blocked by the glass mat layer(3), so that the decoration prepreg layer(1) of the upper part, particularly the decoration sheet(1a) is not deformed or ruptured, whereby inferior goods is hardly generated. Further, the glass mat layer(3) has an effect of reinforcing the strength of the product and adhesion of the decoration prepreg layer(1).

In addition, as the thermal resistant film layer(4) is laminated on the decoration prepreg layer(1), the surface can be properly protected so that elongation or shrinkage of the decoration prepreg layer(1) does not occur during the molding process, and scratching does not occurs during the transportation of the products or working. After working, the thermal film layer(4) can be simply removed from the panel.

A method for manufacturing a FRP decoration panel according to the present invention comprises the steps of preparing a decoration prepreg layer(1) by impregnating the decoration sheet(1a) as a base material with an unsaturated polyester

(UPE) resin composition(1b); forming a glass mat layer(3) by laying a glass mat on at least a part of a SMC layer(2) filled in the mold; and integrally molding the decoration prepreg layer(1) and the SMC layer(2) on which the glass mat layer(3) is formed.

Besides, after the step of preparing the decoration prepreg layer(1) before the step of forming the glass mat layer(3), an additional step of forming a thermal resistant film layer(4) by laminating a thermal resistant film on the surface of the decoration prepreg layer(1) can be performed.

In the step for preparing the decoration prepreg layer(1), the decoration sheet(1a) as base material of the decoration prepreg layer(1) is prepared by forming desired colors or patterns on paper, nonwoven or woven cloth.

And, the components and content of the UPE resin composition are shown in Table 1 (based on 100 parts by weight of UPE resin).

<Table 1> Components and content of UPE resin composition

Component	Content(part by weight)
UPE resin	100
Shrinkage inhibitor	0 - 100
Curing agent	0.3 - 5
Releasing agent	0 - 10
Thickening agent	0 - 5

As the UPE resin, not only orthophthalic, terephthalic, isophthalic, bisphenol type resins, but also phthalic type resins of other structure may be used. Terephthalic and isophthalic type resins are most preferably used.

As the shrinkage inhibitor, polystyrene, polyvinylacetate, polymethylmethacr-

ylate, polystyrene copolymer, or the like may be used. Most preferably, only polystyrene is used or no shrinkage inhibitor is added. It can be contained with an amount of 0 - 100 parts (based on 100 part of the resin), preferably 0 - 50 parts.

As the curing agent, conventional organic peroxides may be used. Considering general condition for molding the decoration prepreg layer(1) and the SMC layer(2) at high temperature, curing agents used at high temperature are preferable. Examples thereof include tert-butyl peroxybenzoate, tert-butyl peroxyisopropylcarbonate, tert-butylperoxy-2-ethyl hexanoate and 1,1-di-tert-butylperoxy-3,3,5-trimethylcyclohexane. Among these, tert-butyl peroxybenzoate is the most preferable. The content of the curing agent is 0.3 - 5 parts (based on 100 parts of resin), preferably 0.7 - 2 parts.

As the releasing agent, zinc stearate or calcium stearate may be used. Zinc stearate is more preferable. The content of the releasing agent is 0 - 10 parts (based on 100 parts of resin), preferably 4 - 6 parts.

As the thickening agent, magnesium oxide, calcium oxide, magnesium hydroxide, calcium hydroxide, or the like may be used. Among these, magnesium oxide is the most preferable. The content of the thickening agent is desirably determined by considering a volume of impregnating bath, impregnation rate and degree of transmission of the UPE resin composition through the decoration sheet. The content is generally 0 - 20 parts (based on 100 parts of resin), preferably 0.5 - 10 parts.

As a method for impregnating the decoration sheet(1a) with the UPE resin composition(1b), conventional coating techniques such as gravure coating, reverse coating, knife coating, comma coating, bar coating, or the like may be used. For example, the gravure coating which can control the impregnating amount in accordance with mesh size may be properly used. The impregnating amount of the UPE resin

composition(1b) may be 10 - 100 parts by weight with respect to 100 parts by weight of the decoration sheet(1a). If the content of the UPE resin composition(1b) is too high, the flow of the UPE resin composition(1b) occurs at the time of press molding, and the UPE resin composition(1b) clusters locally owing to a rib of the decoration panel. If the content is too low, surface layer of the UPE resin composition(1b) cannot be sufficiently formed so as to deteriorate the physical properties of the decoration panel such as scratch resistance, abrasion resistance or water resistance. Thus, the content of 30 - 80 parts by weight(based on 100 parts by weight of the decoration sheet) is preferable.

The step of forming the thermal resistant film layer(4) is the process of laminating the thermal resistant film on the surface of the decoration prepreg layer(1) prepared by impregnating the decoration sheet(1a) with the UPE resin composition(1b). By this step, complicated steps of covering both sides of the decoration prepreg with films and aging thereof, and removing films, which have been essential to the prior art by the present inventor, can be omitted, and the process becomes simple.

Also, the thermal resistant film layer(4) can prevent contamination or scratching of the surface during the working. And, though the thermal resistant film layer(4) is adhered to the UPE resin composition(1b) of the decoration prepreg layer(1) in the beginning, it can be easily removed once the UPE resin composition(1b) is cured after molding. Thus the thermal resistant film layer(4) is generally removed when there is no possibility of contamination or scratching after working. The thermal resistant film used in this step is the same as the description above.

In FIG. 2, a device for continuously performing the steps for preparing the decoration prepreg layer and forming the thermal resistant film layer is illustrated.

As can be shown in the Fig.1, to the decoration sheet (1'a) supplied from a decoration sheet supplying roll (11), the UPE resin composition (1'b) is supplied by a impregnating roll (12) from an impregnating bath (13), whereby the impregnation of the UPE resin composition (1'b) to the decoration sheet (1'a) is performed. The impregnated decoration prepreg (1') thus obtained is adhered in an adhesion roll (15) with a thermal resistant film (4') supplied from other roll (14) for supplying the thermal resistant film, whereby the decoration prepreg(1') laminated with the thermal resistant film (4') comes out in a roll type from a winding roll (16).

The step for forming the glass mat layer(3) is the process of laying the glass mat on at least a part of the SMC layer(2) filled in the mold. This step is performed in order to properly disperse or block the shear stress originated from the SMC layer(2) of the lower part during the molding step, so that a rupture or deformation of the decoration prepreg layer(1) should not occur. The glass mat used in this step is the same as described above.

Finally, the molding step comprises steps of cutting the decoration prepreg layer(1), on which have been laminated by the thermal resistant film layer(4), in a predetermined size; incorporating the cut decoration prepreg layer(1) to the upper part of a mold in which predetermined SMC layer(2), laminated by the glass mat layer(3), have been filled; and integrally molding the decoration prepreg layer(1) and the SMC layer according to a conventional method.

The molding condition is as follows: the temperature of the upper mold to which the surface of the thermal resistant film layer(4) is to be contacted is about 80 - 180°C, preferably 130 - 160°C; the temperature of the lower mold is about 80 - 165°C, preferably 125 - 160°C; the molding pressure is about 5 - 100 kg/cm², preferably 7 -

70 kg/cm². A 3-rate time from contacting of the upper mold to the raw materials filled in the lower mold to the completion of pressing, is about 0.5 - 9 sec/mm, preferably 1.5 - 3 sec/mm. The duration of pressing and other molding conditions are the same as those of molding process of general FRP panel in which only SMC is used as a raw material.

Here-in-after, the moldability of the panels manufactured by several examples according to the present invention is examined.

Example 1

A polyester film (thickness: 19 μ m) as a thermal resistant film, a chop strand mat No.225 (225 g/m²) as a glass mat, general SMC for construction material [G/F 1 inch 25%, tere-type UPE resin 26%, CaCO₃ 40%, others (curing agent, releasing agent, etc.) 9%] as a SMC were used. The molding conditions were as follows: molding pressure of 25 kg/cm², molding temperature (upper/lower) of 145/135° C, panel thickness of 2.5 mm, molding time of 210 sec, and 3-rate time of 10 sec/10mm.

Example 2

The procedure according to Example 1 was performed but a continuous mat No.300 (300 g/m²) was used as a glass mat.

Example 3

The procedure according to Example 1 was performed but a continuous mat No.450 (450 g/m²) was used as a glass mat.

Example 4

The procedure according to Example 1 was performed but no thermal resistant film was used.

Example 5

The procedure according to Example 1 was performed but no glass mat was used.

Comparative Example 1

This comparative example was performed in accordance with prior art (Korean Patent Application No. 94-25797) invented by the present inventor. The procedure according to Example 1 was performed but neither the thermal resistant film nor glass mat was used.

The moldings in accordance with each examples (comparative examples) were repeated by 100 times, and the moldability of the products was tested. The results are shown in Table 2 below.

<Table 2> Result of the test of moldability.

Moldability (Defects)	Ex.1	Ex.2	Ex.3	Ex.4	Ex.5	Comp. Ex.1
Deformation of decoration sheet	10%	none	none	5%	15%	40%
Rupture of decoration sheet	none	none	none	none	none	none
Incorporation of foreign ma- terials	none	none	none	5%	none	20%
Voids	none	none	10%	none	none	none
Total (%)	10%	none	10%	10%	15%	60%

As collectively considering the results of the test of moldability obtained above,

Example 2 in which polyester film (thickness: 19 μm) as a thermal resistant film and continuous mat No.300 (300 g/m^2) as a glass mat were used exhibits the highest moldability. Also, it has been shown that all the examples according to the present invention exhibits better moldability than the comparative examples according to the prior art (Korean Patent Application No. 94-25797) of the present inventor.

Effects of the Invention

As described above, according to the process of the present invention, complicated steps of covering both side of the decoration prepreg with film and aging thereof, and removing the film, which have been essential for the prior art by the present inventor, is omitted, and the process becomes simple. In addition, the elongation or shrinkage of the decoration prepreg owing to the heat and pressure applied during molding, and inferiority involved by incorporation of foreign materials during the repeated molding stage can be prevented by the laminated thermal resistant film. Further, the film has a role of protective film for the surface of the final product. Besides, shear stress originated from lower SMC layer during the molding stage is properly dispersed or blocked by the step of inserting glass mat so that the deformation or rupture of the decoration sheet can be prevented.



What is claimed is:

1. A FRP decoration panel in which a decoration prepreg layer based on a decoration sheet shaped with colors or patterns is laminated on at least a part of a SMC layer, wherein a glass mat layer is insertionally laminated between the decoration prepreg layer and the SMC layer
2. The FRP decoration panel according to claim 1, wherein a glass mat of the glass mat layer is selected from a group consisting of chop strand mat, continuous mat, glass cloth and woven cloth.
3. The FRP decoration panel according to claim 2, wherein a unit weight of the glass mat is 150 - 450 g/m².
4. A FRP decoration panel in which a decoration prepreg layer based on a decoration sheet shaped with colors or patterns is laminated on at least a part of a SMC layer, wherein a thermal resistant film layer is laminated on the decoration prepreg layer.
5. A FRP decoration panel according to claim 4, wherein a film of the thermal resistant film layer is selected from a group consisting of polyester film, nylon film, polyamide film and polyvinyl alcohol.
6. A FRP decoration panel according to claim 5, wherein the thermal resistant film is polyester film and have a thickness of 12 - 200 μm .



7. A method for manufacturing a FRP decoration panel which comprises the steps of preparing a decoration prepreg layer by impregnating the decoration sheet as a base material with an unsaturated polyester (UPE) resin composition; forming a glass mat layer by laying a glass mat on at least a part of a SMC layer filled in the mold; and integrally molding the decoration prepreg layer and the SMC layer on which the glass mat layer is formed.

8. A method for manufacturing a FRP decoration panel which comprises the steps of preparing a decoration prepreg layer by impregnating the decoration sheet as a base material with an unsaturated polyester (UPE) resin composition; forming a thermal resistant film layer by laminating a thermal resistant film on the surface of the decoration prepreg layer; and integrally molding the decoration prepreg layer, on which the thermal resistant film layer is formed, and the SMC layer.

9. A method for manufacturing a FRP decoration panel according to claim 7 or 8, wherein the impregnating method of the UPE resin composition in the preparation step of the decoration prepreg layer is selected from a group consisting of gravure coating, reverse coating, knife coating, comma coating and bar coating.

10. A process for preparation of FRP decoration panel according to claim 7 or 8, wherein the impregnated amount of the UPE resin in the preparation step of the decoration prepreg is 10 - 100 parts by weight with respect to 100 parts by weight of



the decoration sheet.



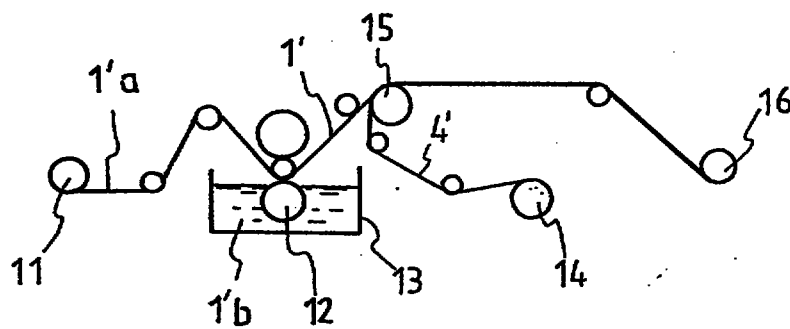
ABSTRACT

**A FRP DECORATION PANEL USING DECORATION PREPREG, AND A MANUFACTURING
METHOD THEREOF.**

The present invention relates to a FRP panel having decorative appearance and a manufacturing method thereof.

A method for manufacturing a FRP decoration panel which comprises the steps of preparing a decoration prepreg layer by impregnating the decoration sheet as a base material with an unsaturated polyester (UPE) resin composition; forming a thermal resistant film layer by laminating a thermal resistant film on the surface of the decoration prepreg layer; forming a glass mat layer by laying a glass mat on at least a part of a SMC layer filled in the mold; and integrally molding the decoration prepreg layer and the SMC layer on which the glass mat layer is formed, is disclosed . By the simplified process, a FRP decoration panel which does not have inferiority owing to a deformation or rupture of the panel surface, or incorporation of foreign materials can be obtained, and scratching does not occur during working with the product because the surface have been protected.

(Figure 1)



ABSTRACT

**A FRP DECORATION PANEL USING DECORATION PREPREG,
AND A MANUFACTURING METHOD THEREOF**

The present invention relates to a FRP panel having decorative appearance and a manufacturing method thereof.

A method for manufacturing a FRP decoration panel which comprises the steps of preparing a decoration prepreg layer (1) by impregnating the decoration sheet (1a) as a base material with an unsaturated polyester (UPE) resin composition (1b); forming a thermal resistant film layer (4) by laminating a thermal resistant film on the surface of the decoration prepreg layer; forming a glass mat layer (3) by laying a glass mat on at least a part of a SMC layer (2) filled in the mold; and integrally molding the decoration prepreg layer (1) and the SMC layer (2) on which the glass mat layer (3) is formed, is disclosed. By the simplified process, a FRP decoration panel which does not have inferiority owing to a deformation or rupture of the panel surface, or incorporation of foreign materials can be obtained, and scratching does not occur during working with the product because the surface has been protected.

Fig. 1