A decorated fireproof building substrate includes a fireproof building substrate and a decorated multilayer. The fireproof building substrate includes a substrate and a fireproof layer, wherein the fireproof layer covers the surface of the substrate. The decorated multilayer includes an adhesive layer, a printed layer, a grain layer and a hard coating layer disposed on the fireproof building substrate subsequently. The hard coating layer is located at the outermost side of the decorated multilayer, wherein the grain layer also can has the function of the hard coating layer so as to omit the disposal of the hard coating layer.
DEPRECATED FIREPROOF BUILDING SUBSTRATE

CROSS-REFERENCE TO RELATED APPLICATION

[0001] This application claims the priority benefit of Taiwan application serial no. 103200221, filed on Jan. 6, 2014. The entirety of the above-mentioned patent application is hereby incorporated by reference herein and made a part of this specification.

BACKGROUND OF THE INVENTION

[0002] 1. Field of the Invention
[0003] The invention relates to a fireproof building substrate, and more particularly, to a decorated fireproof building substrate.
[0004] 2. Description of Related Art
[0005] With people's increasing attention on quality of residential security, a variety of fireproof building substrates which are used as materials to build the building have been introduced to the market. At the same time, in order to meet the needs of aesthetics, a common approach is to adhere a decoration film to the fireproof building substrate. However, for the fireproof building substrate with the adhered decoration film thereto, the decoration film may have a grain layer, a pattern layer, and a membrane thereon, which improves the flammability of the decorated fireproof building substrate. Accordingly, it is often for the decorated fireproof building substrate not passing a flame resistant test of the fireproof building substrate.

SUMMARY OF THE INVENTION

[0006] The invention provides a decorated fireproof building substrate, which has good decorative effects and fireproof effects simultaneously.
[0007] The decorated fireproof building substrate of the invention includes a fireproof building substrate and a decorated multilayer. The fireproof building substrate includes a substrate and a fireproof layer, wherein the fireproof layer covers a surface of the substrate. The decorated multilayer includes a printed layer, a grain layer, and a hard coating layer disposed on the fireproof building substrate subsequently, and the hard coating layer is located at the outermost side of the decorated multilayer.
[0008] In an embodiment of the invention, the decorated multilayer above-mentioned further comprises an adhesive layer, and the adhesive layer adheres between the fireproof layer and the printed layer.
[0009] In an embodiment of the invention, the surface of the substrate above-mentioned has a plurality of pores, and the fireproof layer at least fills the pores.
[0010] In an embodiment of the invention, the printed layer, the grain layer, or the hard coating layer above-mentioned are further added with a fireproof material.
[0011] In an embodiment of the invention, the grain layer above-mentioned has a planar surface relatively far from the fireproof layer and a patterned surface relatively close to the fireproof layer, and the patterned surface has a texture structure thereon.
[0012] In an embodiment of the invention, the printed layer above-mentioned has another patterned surface, and the patterned surface of the printed layer and the patterned surface of the grain layer are adhered to each other, such that the patterned surface of the printed layer has the texture structure thereon.
[0013] In an embodiment of the invention, an outer surface of the above-mentioned hard coating layer has a texture structure thereon.
[0014] According to the above, the decorated fireproof building substrate of the invention is disposed with the decorated multilayer and the fireproof layer, so as to provide the good decorative effects and the fireproof effects.
[0015] In order to make the aforementioned and other features and advantages of the invention comprehensible, embodiments accompanied with figures are described in detail below.

BRIEF DESCRIPTION OF THE DRAWINGS

[0016] FIG. 1 to FIG. 3 are schematic flow diagrams of manufacturing a decorated fireproof building substrate of an embodiment of the invention.
[0017] FIG. 4 to FIG. 5 are schematic flow diagrams of manufacturing a decorated fireproof building substrate of another embodiment of the invention.

DESCRIPTION OF EMBODIMENTS

[0018] The invention is described in detail with reference to the accompanying figures. However, the invention may be embodied in various forms and is not limited to the embodiments described herein. Orientation terms used in the following embodiments, such as "above," "below," and the like, are merely referring to the orientation illustrated in the figures. Therefore, the orientation terms are used to describe the invention in detail rather than to limit the invention. In addition, the size and relative size of each layer may be exaggerated in the figures for clarity.

[0019] FIG. 1 to FIG. 3 are schematic flow diagrams of manufacturing a decorated fireproof building substrate of an embodiment of the invention. Please first refer to FIG. 1. First, a fireproof building substrate 100 is provided. The fireproof building substrate 100 includes a substrate 110 and a fireproof layer 120, wherein the fireproof layer 120 covers a surface of the substrate 110. Material of the substrate 110 includes material of first-order flame resistance, material of second-order flame resistance, or material of third-order flame resistance. The substrate 110 is such as material which is used to build the buildings, for example, wood, marble, a cement board, a calcium silicate board, or other material which may have a function of flame resistance after being treated.

[0020] The fireproof layer 120 covers a surface of the substrate 110. In detail, material with the fireproof effects may be coated on the surface of the substrate 110 through coating methods. Then, after procedures such as drying, planarization, etc. the fireproof layer 120 with the fireproof effects may be formed. The fireproof layer 120 is a coating layer with the flame-resistant effects and the flame-retardant effects. For example, the substrate 110 is such as a material with a plurality of pores. When the material with the fireproof effects is coated on the surface of substrate 110, the fireproof material may penetrate into the pores of the substrate 110 to fill the pores. Preferably, besides filling the pores, the material with the fireproof effects may further cover the surface of the substrate 110 completely. In addition, after the procedures such as drying and planarization, the fireproof layer 120 may provide a planar surface, so as to facilitate a decoration film to
follow adhere to the surface of the fireproof layer 120 sequentially, and detachment due to poor adhesion is less likely to occur. In other words, the fireproof layer 120 not only can improve the fireproof properties of the substrate 110, but also can enhance the adhesion strength between the decoration film and the substrate 110.

[0021] Next, please first refer to FIG. 2. A decoration film 200 is adhered to the fireproof building substrate 100. The decoration film 200 includes an adhesive layer 210, a printed layer 220, a grain layer 230, a hard coating layer 240, a release layer 250, and a membrane 260 which are adhered together subsequently.

[0022] The membrane 260 is such as a flexible membrane, wherein the material thereof may be polycarbonate (PC), acrylonitrile butadiene styrene (ABS), polyethylene terephthalate (PET), polymethylmethacrylate (PMMA), polyoxygenethylene (POM), polybutylene terephthalate (PB), polypropylene (PP), methylmethylacrylate-styrene (MMASt, MS) copolymer, polystyrene (PS), polyethylene terephthalate (PET), or the combinations thereof, but the invention is not limited thereto.

[0023] The release layer 250 is disposed on the surface of the membrane 260, and the release layer 250 is interposed between the membrane 260 and the hard coating layer 240. The release layer 250 is mainly disposed to make the membrane 260 temporarily adhere to the other film layers (such as the adhesive layer 210, the printed layer 220, the grain layer 230, the hard coating layer 240, etc.), and to trip the other film layers from the membrane 260 after the transfer process. In addition, the release layer 250 is typically a film layer of low surface tension. The release layer 250 is composed of, for example, a matrix material (a thermo-curable resin or a photo-curable resin) selectively added with at least one of wax, paraffin, and silicone, or, the release layer 250 may also be composed of highly smooth and impermeable polymers.

[0024] The hard coating layer 240 may be a UV-curable resin which has high light transmittance and anti-reflective characteristics, for example, an acrylic resin, polyurethane (PU), an epoxy resin, etc. The hard coating layer 240 may have a quite hardness to provide scratch-resistant and wear-resistant effects.

[0025] The grain layer 230 is disposed on the hard coating layer 240. The grain layer 230 has a planar surface 230a and a patterned surface 230b. The planar surface 230a is relatively far from the fireproof layer 120 and contacts with the hard coating layer 240. The patterned surface 230b is relatively close to the fireproof layer 120 and contacts with the printed layer 220. The patterned surface 230b has a texture structure thereon. The texture structure is such as designed text or pattern which is wish to achieve the decorative effects, wherein the texture structure may be formed by texture stamping methods. The grain layer 230 may be the UV-curable resin which has the high light transmittance and the anti-reflective characteristics, for example, the acrylic resin, polyurethane (PU), the epoxy resin, etc. In other embodiments, the grain layer 230 may also be a layer of which both sides are planar surfaces and without the texture structure.

[0026] The printed layer 220 is disposed on the grain layer 230. The printed layer 220 may also have a patterned surface 220a, wherein the patterned surface 220a of the printed layer 220 and the patterned surface 230b of the grain layer 230 are adhered to each other such that the patterned surface 220a has another texture structure. In detail, the printed layer 220 is formed on the grain layer 230, so that a coating layer which contacts with the surface of the grain layer 230 is formed. Accordingly, on the surface of the printed layer 220 is also formed with the texture structure which is complementary to the texture structure of the grain layer 230, but the invention is not limited thereto. In other embodiments, the printed layer 220 may also be a layer of which both sides are planar surfaces and without the texture structure. The printed layer 220 may be composed of printing inks or printable material. For example, the pattern layer 220 may be an ink single layer, an ink multilayer, or a patterned ink layer, so as to show a single-color pattern, a multi-color pattern, or a desired pattern, respectively. By any suitable printing process (such as gravure printing process, screen printing process, flexographic printing process, offset printing process, reverse printing process, inkjet printing process, etc.), the ink is able to be transferred on the grain layer 230 to form the printed layer 220. Material of the pattern layer 220 includes polyurethane (PU) or polyacrylate, etc. which is mixed with inorganic material. Material of the printed layer 220 includes polyurethane (PU) or polyacrylate, etc. which is mixed with inorganic material.

[0027] Preferably, during the manufacturing process of the film layers such as the printed layer 220, the grain layer 230, or the hard coating layer 240, a fireproof material may also be added to the film layers such that the film layers have the fireproof effects simultaneously. Material of the above fireproof material is such as a mixture of organic and inorganic material which has a phosphorus-containing compound, a halogen compound, an azo compound, a carbonate compound, a hydroxide, a metal oxide, or any combination thereof. In detail, the carbonate compound includes calcium carbonate (CaCO₃). The hydroxide includes aluminum hydroxide (Al(OH)₃), magnesium hydroxide (Mg(OH)₂). The metal oxide includes antimony oxide, tin oxide, molybdenum oxide, or zirconium oxide, etc. In addition, the metal oxide may be used with the halogen compound. Specifically, the halogen compound may avoid the production of free radicals during a combustion process. Calcium carbonate or the azo compound may respectively produce flame-retardant gases (such as carbon dioxide or nitrogen) during combustion so as to dilute the oxygen concentration in the air. It is easy for the hydroxide to generate water molecules during combustion and thus having an extinguishing effect. The hydroxide together with the halogen-containing compound may dilute flammable gases and produce a flame-retardant layer during the combustion process.

[0028] The adhesive layer 210 adheres between the fireproof layer 120 and the printed layer 220. In other words, the decoration film 200 may adhere to the fireproof building substrate 110 through the adhesive layer 210. The adhesive layer 210 may be hot melt adhesive, UV-curable adhesive, photo-curable adhesive, or electron-curable adhesive. The adhesive layer 210 is selected from, for example, at least one material of polycrylate, polymethylacrylate, polystyrene, polycarbonate, polyurethane, polyester, poliamide, epoxy resin, ethylene vinylacetate copolymer (EVA), or thermo-plastic elastomer, or copolymers, mixtures, or composites thereof.

[0029] The decoration film 200 is transferred to the fireproof building substrate 100 through a high-pressure transfer molding process. First, a heating and softening procedure is performed to the decoration film 200. Next, the decoration film 200 is made to contact with the fireproof building substrate 100, and a pressurizing procedure is performed. Then,
a high-pressure vacuum molding process is performed to the decoration film 200 and the fireproof building substrate 100, such that the decoration film 200 is transferred to the fireproof building substrate 100.

[0030] Next, please refer to FIG. 3. A stripping procedure is performed such that the release layer 250 and the membrane 260 are released from the surface of the hard coating layer 240, and the hard coating layer 240 is located at the outermost side of the decorated multilayer 200a (including the printed layer 220, the grain layer 230, and the hard coating layer 240). Thus, the manufacturing of the decorated fireproof building substrate 10a is completed.

[0031] Please refer to FIG. 3 again. The decorated fireproof building substrate 10a includes the fireproof building substrate 100 and the decorated multilayer 200a. The fireproof building substrate 100 includes the substrate 110 and the fireproof layer 120, wherein the fireproof layer 120 covers the surface of the substrate 110. The decorated multilayer 200a includes the printed layer 220, the grain layer 230, and the hard coating layer 240 which are disposed on the fireproof building substrate 100 subsequently, wherein the hard coating layer 240 is located at the outermost side of the decorated multilayer 200a. In addition, the decorated multilayer 200a further includes the adhesive layer 210, wherein the adhesive layer 210 adheres between the fireproof layer 120 and the printed layer 220. The patterned surface 230b of the grain layer 230 faces the printed layer 220 so as to form a decorative effect of which the texture structure is toward the inside of the decorated fireproof building substrate 10a. Since no membrane 260 and no release layer 250 are disposed in the decorated fireproof building substrate 10a of the embodiment, and thus it is helpful to pass a fireproof test. In detail, the membrane 260 and the release layer 250 are substantially composed of material of lower ignition point (such as organic material). In the manufacturing process of the embodiment, the decorated multilayer 200a is kept on the fireproof building substrate 100, and the membrane 260 and the release layer 250 are removed instead of being kept on the fireproof building substrate 100. Accordingly, the decorated fireproof building substrate 10a may have the beautiful decorative effect and the good fireproof effects.

[0032] FIG. 4 to FIG. 5 are schematic flow diagrams of manufacturing a decorated fireproof building substrate of another embodiment of the invention. The manufacturing flow in the embodiment of FIG. 4 to FIG. 5 is similar to the manufacturing flow in the embodiment of FIG. 1 to FIG. 3, wherein the same or similar reference numerals are used for the same or similar components, and the same part of the description of the technical content is not reiterated. The differences between the two embodiments are described in the following. First, the procedures as shown in FIG. 1 are performed, by which the fireproof building substrate 100 is provided.

[0033] Next, please first refer to FIG. 4. A decoration film 200b is adhered to the fireproof building substrate 100. The decoration film 200b is transferred to the fireproof building substrate 100 through, for example, the high-pressure transfer molding process. The decoration film 200b includes the adhesive layer 210, a printed layer 220b, a hard coating layer 240b, a release layer 250b, and the membrane 260 which are subsequently adhered to each other. The structure of the decoration film 200b is similar to the structure of the decoration film 200 in FIG. 2, wherein the differences therebetween are that the release layer 250 of the decoration film 200b has a patterned surface 250b, and the patterned surface 250b has a texture structure thereon. In addition, the hard coating layer 240b which contacts with the patterned surface 250b of the release layer 250b also has another patterned surface 240b, wherein the patterned surface 240b also has the texture structure thereon. In detail, in the embodiment, the release layer 250 with the texture structure is formed on the membrane 260, and then the hard coating layer 240b is formed on the release layer 250b. Accordingly, the patterned surface 240b of the hard coating layer 240b and the patterned surface 250b of the release layer 250b are adhered to each other, and thus the patterned surface 240b has another texture structure.

[0034] Next, please refer to FIG. 5. The stripping procedure is performed such that the release layer 250b and the membrane 260 are released from the surface of the hard coating layer 240b, and the patterned surface 240b of the hard coating layer 240b is located at the outermost side of the decorated multilayer 200b (including the printed layer 220b and the hard coating layer 240b). Thus, the manufacturing of the decorated fireproof building substrate 10b is completed.

[0035] Please refer to FIG. 5 again. The decorated fireproof building substrate 10b includes the fireproof building substrate 100 and the decorated multilayer 200b. The fireproof building substrate 100 includes the substrate 110 and the fireproof layer 120, wherein the fireproof layer 120 covers the surface of the substrate 110. The decorated multilayer 200b includes the printed layer 220b and the hard coating layer 240b which are disposed on the fireproof building substrate 100 subsequently, wherein the patterned surface 240b of the hard coating layer 240b is located at the outermost side of the decorated multilayer 200b so as to form a decorative effect of which the texture structure is toward the outside of the decorated fireproof building substrate 10b. Furthermore, the decorated multilayer 200b further includes the adhesive layer 210, wherein the adhesive layer 210 adheres between the fireproof layer 120 and the printed layer 220b. Since no membrane 260 and no release layer 250b are disposed in the decorated fireproof building substrate 10b of the embodiment, and thus it is helpful to pass the fireproof test. In detail, the membrane 260 and the release layer 250b are substantially composed of material of lower ignition point (such as organic material). In the manufacturing process of the embodiment, the decorated multilayer 200b is kept on the fireproof building substrate 100, and the membrane 260 and the release layer 250b are removed instead of being kept on the fireproof building substrate 100. Accordingly, the decorated fireproof building substrate 10b may have the beautiful decorative effect and the good fireproof effects.

[0036] The Fireproof Test of the Decorated Fireproof Building Substrate

[0037] The substrate of the decorated fireproof building substrate of the invention is such as the calcium silicate board. Material of the fireproof layer is such as the resin containing inorganic material, for example, a coating material added with substances having the flame-resistant effect. The decorated multilayer is adhered to the fireproof layer, and the structure thereof is shown in FIG. 3. A CNS flame resistant test is performed on the above-mentioned decorated fireproof building substrate, wherein the heating temperature is 720°C to 750°C, and the heating time is 20 minutes.

[0038] According to the above, the decorated fireproof building substrate of the invention is disposed with the decorated multilayer so as to provide the good decorative effects. The decorated fireproof building substrate above is disposed
with the fireproof layer so as to provide the fireproof effects. Moreover, no release layer and no membrane are disposed on the decorated multilayer and thus it is difficult to burn due to high temperature. Accordingly, the fireproof effects of the decorated fireproof building substrate may be effectively enhanced.

[0039] It will be apparent to those skilled in the art that various modifications and variations can be made to the structure of the disclosed embodiments without departing from the scope or spirit of the invention. In view of the foregoing, it is intended that the disclosure cover modifications and variations of this specification provided they fall within the scope of the following claims and their equivalents.

What is claimed is:

1. A decorated fireproof building substrate, comprising:
   a fireproof building substrate, comprising a substrate and a fireproof layer, wherein the fireproof layer covers a surface of the substrate; and
   a decorated multilayer, comprising a printed layer, a grain layer, and a hard coating layer disposed on the fireproof building substrate subsequently, wherein the hard coating layer is located at the outermost side of the decorated multilayer.

2. The decorated fireproof building substrate as claimed in claim 1, wherein the decorated multilayer further comprises an adhesive layer, and the adhesive layer adheres between the fireproof layer and the printed layer.

3. The decorated fireproof building substrate as claimed in claim 1, wherein the surface of the substrate has a plurality of pores, and the fireproof layer at least fills the pores.

4. The decorated fireproof building substrate as claimed in claim 1, wherein the printed layer, the grain layer, or the hard coating layer are further added with a fireproof material.

5. The decorated fireproof building substrate as claimed in claim 1, wherein an outer surface of the hard coating layer has a texture structure thereon.

6. The decorated fireproof building substrate as claimed in claim 5, wherein the printed layer has another patterned surface, and the patterned surface of the printed layer and the patterned surface of the grain layer are adhered to each other, such that the patterned surface of the printed layer has the texture structure thereon.

7. The decorated fireproof building substrate as claimed in claim 1, wherein an outer surface of the hard coating layer has a texture structure thereon.

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