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(54) **STRUCTURALLY REINFORCED PANELS**

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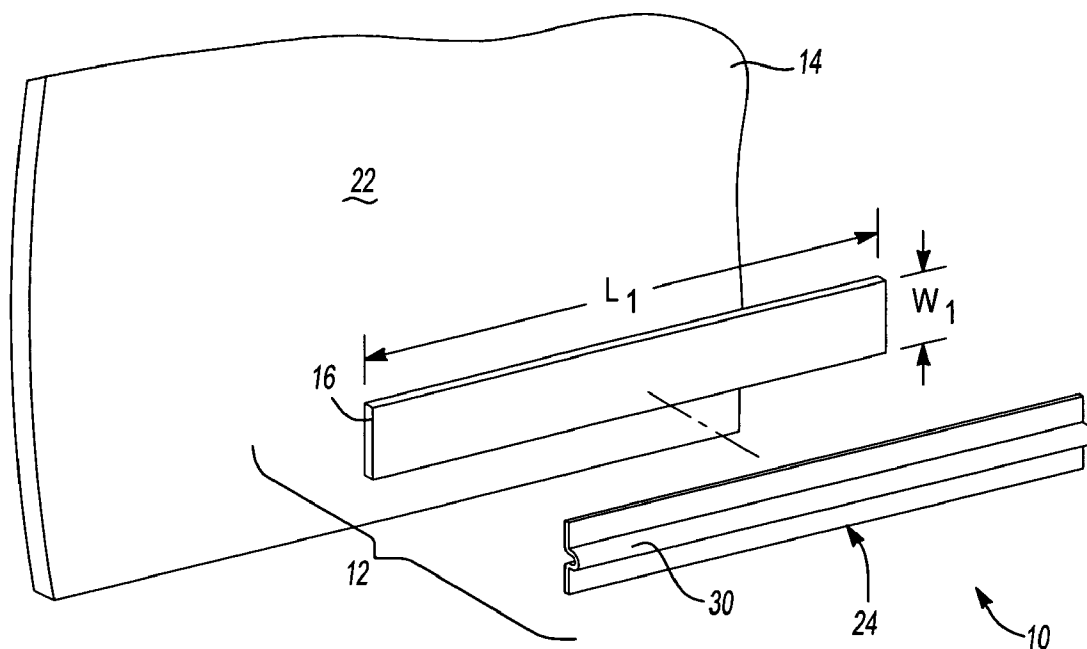
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(57) **ABSTRACT**

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A structurally reinforced panel and a method of forming the panel are disclosed. The reinforced panel includes a panel portion, a reinforcement material and a backing material disposed thereon.

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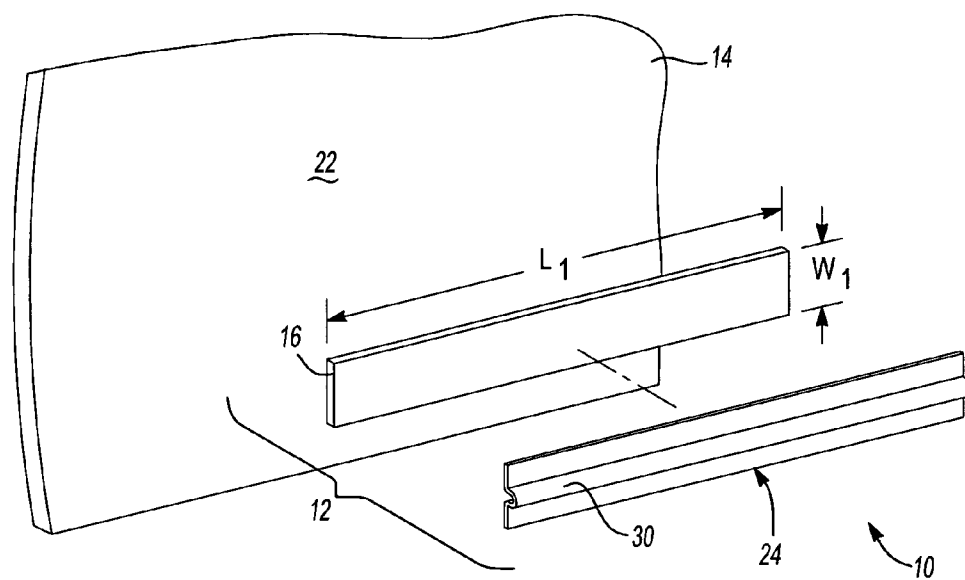


Fig-1

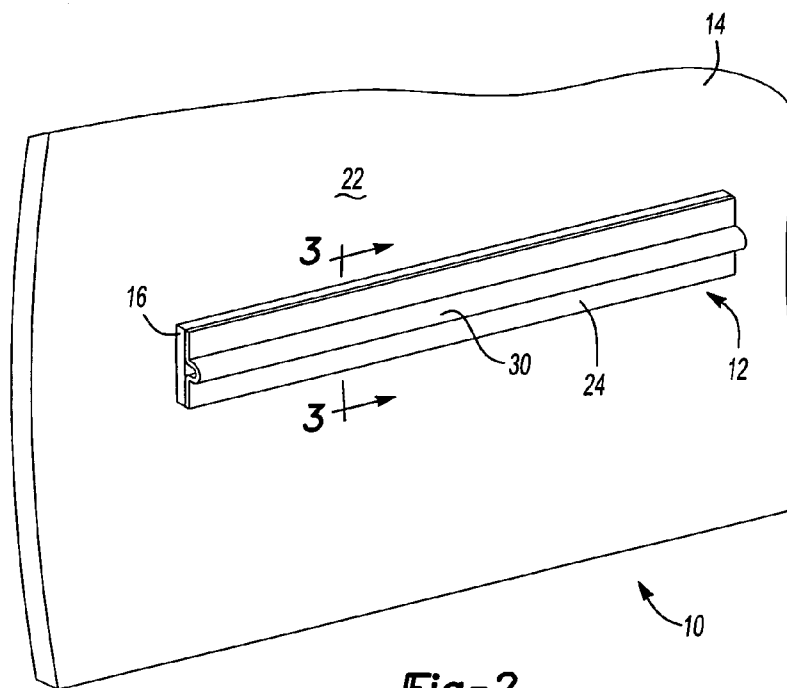


Fig-2

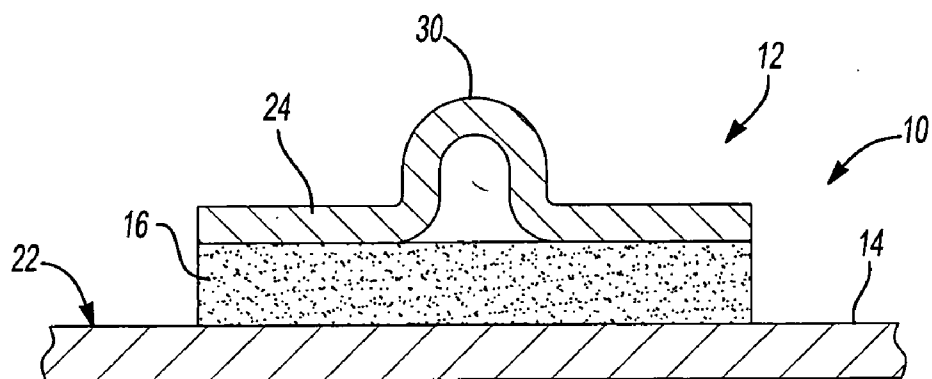


Fig-3

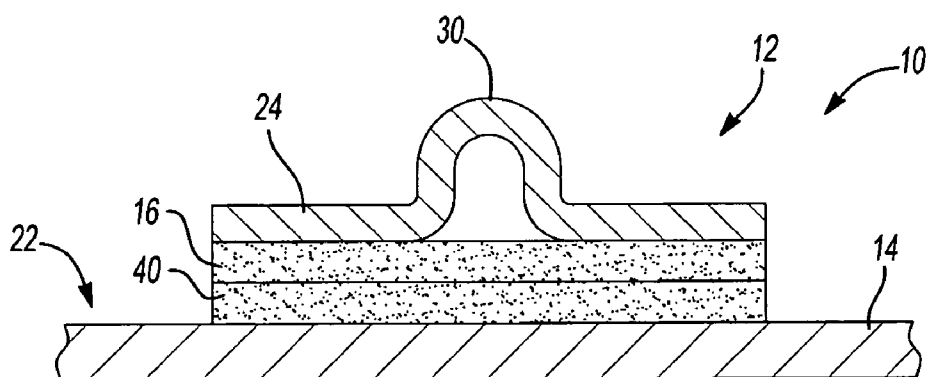


Fig-4

STRUCTURALLY REINFORCED PANELS

FIELD OF THE INVENTION

[0001] The present invention relates generally to a structurally reinforced panel of an automotive vehicle or other article of manufacture, and more particularly to a panel structurally reinforced with a member formed of a reinforcement material and a backing material.

BACKGROUND OF THE INVENTION

[0002] For many years the transportation industry has been concerned with designing structural members that do not add significantly to the weight of a vehicle. At the same time, automotive applications require structural members capable of providing reinforcement to targeted portions of the vehicle such as vehicle panels. It is known to apply a layer of heat activated matrix material along with a fibrous reinforcement material to panels of automotive vehicles for structurally reinforcing the panels. However, the fibrous materials that are used to achieve reinforcement of the panels can be expensive. Additionally, desired levels of reinforcement may not be achieved with the presently used fibrous materials. Thus, there is a need to replace the presently used fibrous material with a lower cost material that can be applied to vehicle panels along with a reinforcement material wherein the replacement material provides sufficient reinforcement to the panels, the reinforcement material or both.

SUMMARY OF THE INVENTION

[0003] The present invention satisfies one or more of these needs by providing a structurally reinforced panel and a method of manufacturing the same.

[0004] Accordingly, the present invention provides a structurally reinforced panel that includes a reinforcement material, a panel portion and a backing material disposed thereon. The backing material is typically a layer of material that includes at least one rib. In one preferred embodiment, the backing material is a metal layer with a roll formed rib.

BRIEF DESCRIPTION OF THE DRAWINGS

[0005] The features and inventive aspects of the present invention will become more apparent upon reading the following detailed description, claims and drawings, of which the following is a brief description:

[0006] **FIG. 1** is an exploded perspective view of a structurally reinforced panel of an automotive vehicle according to an exemplary aspect of the present invention.

[0007] **FIG. 2** is a perspective view of the structurally reinforced panel of **FIG. 1** after formation thereof.

[0008] **FIG. 3** is a sectional view of the structurally reinforced panel of **FIG. 2** taken along line 3-3.

[0009] **FIG. 4** is a sectional view of an alternative structurally reinforced panel according to an exemplary aspect of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

[0010] The invention relates to a structurally reinforced panel of an article, such as an automotive vehicle, a house-

hold or industrial appliance, furniture, storage containers or the like, and to a method of forming the panel. More particularly, the present invention relates to a reinforced panel of an automotive vehicle that includes a panel portion, a layer of reinforcement material applied (e.g., attached or otherwise bonded) to at least part of a surface of the panel portion and a layer of backing material positioned (e.g., applied or laminated) upon the reinforcement material, the panel portion or both. Preferably, the reinforcement material of the panel portion is a high strength to weight reinforcement material.

[0011] Referring to **FIGS. 1 and 2**, there is illustrated an exemplary embodiment of a structurally reinforced panel **10**. The panel **10** includes a reinforcement member **12** applied to a panel portion **14** (e.g., of a vehicle door). In the embodiment shown, the reinforcement member **12** is composed of a layer **16** of reinforcement material, which is applied to at least a part of a surface **22** of the panel portion **14**, and a layer **24** of backing material disposed upon the layer **16** of reinforcement material.

[0012] As used herein, the term "panel portion **14**" is broadly meant to encompass any component providing a surface **22** suitable for application of the layer **12** of composite material thereto. Preferably, the panel portion **14** is metal and includes a surface opposite the surface **22** to which the layer **12** of composite material is applied. For automotive applications, the panel portion **14** may be chosen from a variety of components of an automotive vehicle. Examples include components of a vehicle frame, components of a vehicle body or the like. In one highly preferred embodiment, the panel portion **14** is at least part of a body panel of an automotive vehicle wherein the body panel includes a surface that is visible from the outside of the vehicle and wherein that surface is opposite the surface **22** to which the reinforcement member **12** is applied. Examples of such panels include front and rear quarter panels, side panels, hood panels, trunk panels, door panels or the like.

Reinforcement Material

[0013] The layer **16** of reinforcement material may be configured in a variety of shapes, designs, or thicknesses corresponding to the dimensions of the selected panel portion **14** of the vehicle or otherwise configured as desired. The layer **16** of reinforcement material may be composed of one substantially homogeneous material or layer or multiple different materials or layers. Preferably, at least a portion of the reinforcement material is expandable, foamable, curable or a combination thereof.

[0014] The reinforcement material is preferably selected so as to be activatable under a desired condition to soften (e.g., melt), expand, foam or otherwise change states such that the reinforcement material can wet, and preferably bond to adjacent surfaces (e.g., the surfaces provided by the layer **24** of backing material, the panel portion **14** or a combination thereof). In one embodiment, the reinforcement material is also selected to cure during or after activation and, upon or after cure, form a relatively low density, low weight material with high strength characteristics such as high stiffness for imparting structural rigidity to a reinforced region of the panel portion **14**. In a preferred embodiment, the reinforcement material has a post-cure glass transition temperature that is greater than any temperatures to which

the reinforcement material may be exposed while in its intended environment of use (e.g., in an automotive vehicle). Exemplary glass transition temperatures may be greater than about 50 degrees Celsius and more preferably greater than about 70 degrees Celsius. Other desired characteristics of the reinforcement material might include good adhesion retention and degradation resistance particularly in the presence of corrosive or high humidity environments.

[0015] A number of reinforcement materials may be used to form the layer 16. The reinforcement material may be a thermoplastic, a thermoset or a blend thereof. According to one embodiment, the reinforcement material is provided as an epoxy-based material, an ethylene-based polymer, or a mixture thereof, which when compounded with appropriate ingredients (typically a blowing agent, a curing agent, and perhaps a filler), typically expands, cures or both in a reliable and predictable manner upon the application of heat or another activation stimulus.

[0016] Thus, according to one embodiment, the reinforcement material is a heat-activated, epoxy-based resin having foamable characteristics upon activation through the use of heat typically encountered in an e-coat or other paint oven operation. Preferably, the epoxy reinforcement material is such that upon being heated, it structurally bonds to adjacent surfaces. From a chemical standpoint for a thermally-activated material, such reinforcement material is usually initially processed as a thermoplastic material before curing. After curing, the reinforcement material typically becomes a thermoset material that is fixed and incapable of any substantial flowing. Examples of preferred formulations that are commercially available include those available from L&L Products, Inc. of Romeo, Mich., under the designations L-5204, L-5206, L-5207, L-5208, L-5209, L-5214, L-5222 and L-8000.

[0017] The layer 16 of reinforcement material may be formed using a variety of processing techniques, machines or the like. Possible processing techniques for the preferred materials include injection molding, blow molding, thermoforming, extrusion with a single or twin screw extruder or extrusion with a mini-applicator extruder. In a preferred embodiment, the layer 16 of reinforcement material is extruded using a twin-screw extruder and with the resulting layer 16 having a substantially continuous thickness or a variable thickness. Though preferred reinforcement materials are disclosed other suitable art disclosed reinforcement materials may be used in conjunction with the present invention. The choice of the reinforcement material used will be dictated by performance requirements and economics of the specific application and requirements. Examples of other possible reinforcement materials include, but are not limited to, polyolefin materials, copolymers and terpolymers with at one monomer type an alpha-olefin, phenol/formaldehyde materials, phenoxy material, polyurethane materials with high glass transition temperatures (including polyureas), and mixtures or composites (optionally including solid or porous metals). See also, U.S. Pat. Nos. 5,766,719; 5,755,486; 5,575,526; 5,932,680 (incorporated herein by reference).

[0018] Generally speaking, exemplary automotive vehicle applications may utilize technology and processes such as those disclosed in U.S. Pat. Nos. 4,922,596, 4,978,562, 5,124,186 and 5,884,960, commonly owned U.S. Pat. Nos.

6,467,834, 6,482,486, 6,620,501, 6,634,698, 6,419,305, 6,471,285, 6,561,571 and particularly co pending U.S. application Ser. No. 09/459,756 filed Dec. 10, 1999, all of which are expressly incorporated by reference.

[0019] In applications where the reinforcement material is a heat activated material, such as when a thermally melting, expanding, or foaming material is employed, an important consideration involved with the selection and formulation of the material can be the temperature at which the material activates, cures or both. In most applications, it is undesirable for the material to activate at room temperature or the ambient temperature in a production or assembly environment. For automotive applications, it may be desirable for the reinforcement material to activate at higher processing temperatures, such as those encountered in an automobile assembly plant, when the reinforcement material is processed along with the automobile components at elevated temperatures. Exemplary temperatures encountered in an automobile assembly body shop oven may be in the range of 148.89° C. to 204.44° C. (300° F. to 400° F.), and paint shop oven temps are commonly about 93.33° C. (215° F.) or higher. If needed, for foaming or expanding type reinforcement materials, various blowing agent activators can be incorporated into the composition to cause expansion at different temperatures outside the above ranges.

[0020] Although many reinforcement materials may be heat activated, other reinforcement materials that are activated by another stimuli and are capable of bonding also can be used. Without limitation, such reinforcement material may be activated by alternative stimuli such as, pressure, chemicals, or by other ambient conditions.

[0021] In one desirable embodiment, the reinforcement material is provided as a two component adhesive or reinforcement material as that term is used in the art. As a two component material, the reinforcement material would typically be formed by combining an A-side (i.e., a polymeric or resin component) with a B-side (i.e., an activating and or curing component). Typically, although not required, the A-side is maintained separate from the B-side until shortly before (e.g, within an hour or more, within 10 minutes or within 1 minute) application to the panel portion, the backing material or both. Examples of A-side materials can include epoxy-based materials, EVA based materials, polyurethane based materials, combinations thereof or the like. Examples of B-side materials can include amines, acid, isocyanates, combinations thereof or the like.

[0022] The two component material is typically designed to cure (e.g., partially or fully cure) upon addition of the A-side to the B-side. The material may be configured to cure within any amount of time after such addition. Typically, however, the material cures within one hour, more typically within 20 minutes and even more typically within 5 minutes of addition of the A-side to the B-side.

[0023] The reinforcement material may be provided in a variety of shapes and configurations. Thus, the layer of reinforcement material may be square, circular, round, elliptical, geometric, non-geometric, rectangular, combinations thereof or any other shape desired. In the particular embodiment illustrated, the layer 16 of reinforcement material is formed as a strip having a length (L_1) and a width (W_1). For that particular embodiment, the length (L_1) is typically at least twice the width (W_1), more typically at least 5 times the

width (W_1) and even more typically 10 times the width (W_1). As such, the length (L_1) is typically between about 10 cm or less and about 200 cm or more, more typically between about 30 cm and about 100 cm and even more typically between about 40 cm and about 70 cm. The width (W_1) is typically between about 0.5 cm and about 15 cm, more typically between about 1.0 cm and about 7 cm and even more typically between about 2 cm and about 4 cm. The layer 16 of reinforcement material also has a thickness (T_1) that is typically between about 5 mm or less and about 20 mm or greater, more typically between about 3 mm and about 10 mm and even more typically between about 4 mm and about 8 mm.

Backing Material

[0024] The backing material may be chosen from a variety of materials. For example, and without limitation, the backing material may be formed of metal foils, metal sheets, metal screens or the like. As alternative examples, the backing material may be formed of polymeric (e.g., thermoplastic) films, sheets or mesh. In still other alternative embodiments, the backing material may be formed of cellulose fiber material such as impregnated or non-impregnated paper, wood or the like. The backing material may also be formed of filament, fibrous or fabric material, for example, woven or unwoven strands, fibers, filaments or the like of cotton, fiberglass, nylon, carbon, aramid or other materials. It is also contemplated that combinations of each of these materials may be employed as the backing material or multiple separate backing materials may be employed and may be the same or different.

[0025] According to a preferred embodiment, the backing material is a metal layer. The metal layer may be partially or substantially entirely formed of metals such as aluminum, steel (e.g., galvanized or galvanized steel), iron, titanium, magnesium, zinc, molybdenum, brass, cobalt, nickel, copper, vanadium, chromium, manganese, platinum, gold, silver, combinations thereof or the like combinations thereof or the like.

[0026] It is typically preferable for backing material to include at least one rib and potentially a plurality (e.g., 2, 3, 4, 5 or more) of ribs. Such rib or ribs may be integrally formed with the backing material or may be separately formed and attached thereto. For example, the rib or ribs may be integrally molded or extruded as part of the backing material, particularly when the backing material and the rib are formed of metal or polymeric materials. As another example, metal forming techniques such as stamping or other techniques may be employed.

[0027] In the embodiment of FIGS. 1 and 2, the layer 24 of backing material is a layer of metal with a rib 30 roll formed into the layer. As such, the rib 30 is an arched portion of the layer 24 that, as shown, is generally U-shaped, but may be V-shaped or otherwise shaped as desired. The layer 24 typically has a thickness between about 0.5 mm or less and about 10 mm or greater, more typically between about 1 mm and about 5 mm and even more typically between about 2 mm and about 4 mm.

[0028] The layer 24 of backing material is also shown as a strip having a length (L_2) and a width (W_2). The length (L_2) and width (W_2) of the layer 24 typically correspond to (i.e., are within about 2 centimeters of) the length (L_1) and

width (W_1) of the layer 24 of reinforcement material, although not required. Such correspondence is seen in the member 12 of FIGS. 1 and 2. Thus, the preferred length (L_2) and width (W_2) of the layer 24 of backing material and a preferred length (L) and width (W) of the member 12 and the ratios of length to width are typically the same as those recited for the length (L_1) and width (W_1) of the layer 16 of reinforcement material. Preferably, although not required, the one or more ribs extend substantially the entire length of the layer 24 of backing material.

Manufacture

[0029] Generally speaking, the member 12 is applied to the panel portion 14 by applying (e.g., contacting) the layer 16 of reinforcement material to a surface of the panel portion 14 and applying (e.g., contacting) the layer 24 of backing material to the reinforcement material. This may be done in any order. According to one preferred protocol, however, the layer 16 of reinforcement material is applied to the layer 24 of backing material to form the member 12 and then the member 12 is applied to the panel portion 14. According to another preferred embodiment, the layer 16 of reinforcement material is applied to the surface 22 of the panel portion 14 and the layer 24 of backing material is applied to the layer 16 of reinforcement material.

[0030] In one preferred embodiment, the layer 24 of backing material is positioned (e.g., laminated) as desired upon a first side of the layer 16 of the reinforcement material and a second side of the layer 16 of reinforcement material is positioned (e.g., laminated) upon the surface 22 of the panel portion 14. Preferably, the reinforcement material is sufficiently tacky such that the layer 16 of reinforcement material can adhere to the layer 24 of backing material, the surface 22 of the panel portion 14 or both. In that instance, a pressure or force is typically applied to the layer 24 of backing material, the layer 16 of reinforcement material, the panel portion 14, or a combination thereof, urging the layer 16 of backing material and/or the surface 22 of the panel portion 14 into intimate contact with the layer 16 of reinforcement material. In alternative embodiments, particularly when the reinforcement material is not tacky, it is contemplated that mechanical fasteners, additional adhesive or other fastening mechanisms may be employed to at least temporarily attach the reinforcement material to the backing material the panel portion or both.

[0031] Release paper may be applied (e.g., laminated) upon the layer 16 of reinforcement material preferably while the layer 16 of reinforcement material is still in a tacky potentially pre-activated state. Preferably, a side of the layer 16 of reinforcement material covered by the release paper remains protected and at least partially tacky such that the release paper may be removed and the layer 16 of reinforcement material together with the layer 24 of backing material may be applied (e.g., adhered and/or laminated) to the panel portion 14 as the member 12.

[0032] The member may be applied generally as desired to the panel portion 14. Preferably, however, the member is applied to panel portions to reduce deformation in selected areas. For targeting certain areas or for properly fitting the member upon a panel portion, the member may be contoured (e.g., curved or otherwise shaped) to correspond any contours of the panel portion 14. For example, a door panel or

other panel of an automotive vehicle may be curved (e.g., outwardly curved) and the member may be correspondingly curved to allow the member to be more easily attached (e.g., adhered) to the panel.

[0033] The layer 16 of reinforcement material may be applied to the panel portion 14, to the backing material or both, in a solid or semi-solid state. However, the layer 16 may also be applied to the surface 22 of the panel portion 14 to the backing material or both in a fluid state using commonly known manufacturing techniques. Moreover, the reinforcement material may be heated to a temperature that permits it to flow slightly to aid in wetting the surface 22 of the panel portion 14. Alternatively, the layer 16 may also be applied by heat bonding/thermoforming or by co-extrusion.

[0034] For forming the reinforced panel 10 of FIGS. 2 and 3, the reinforcement material may each be activated to flow, expand, foam, cure or a combination thereof. Activation may be induced by a variety of stimuli such as moisture, chemicals, heat or the like and curing may also be induced by a variety of stimuli such as time, cooling or the like.

[0035] The layer 16 of reinforcement material hardens upon curing such that the layer 16 can provide added structural integrity to the panel portion 14. Preferably, the layer 16 of reinforcement material adheres, and/or reactively bonds to both the surface 22 of the panel portion 14 and to the layer 24 of backing material upon curing.

[0036] In one embodiment, the layer 16 of reinforcement material, is activated during an automotive bake cycle. In such an instance, it is preferable that the layer 16 of reinforcement material maintains a substantially high viscosity during the bake cycle such that the layer 16 substantially maintains its location between the layer 24 of backing material and the panel portion 14. In another embodiment, particularly when a two component material is employed, the layer 24 of reinforcement material cures upon application to the layer 24 of backing material, the surface 22 of the panel portion 14 or both (e.g., upon addition of the A-side to the B-side).

Additional or Alternative Embodiments

[0037] It is contemplated that the, a buffer layer may be applied between the reinforcement member and the panel portion. An example of this is illustrated in FIG. 4. As can be seen, a layer 40 of buffer material is interposed between the reinforcement member 12 and the panel portion 14.

[0038] The layer 40 of buffer material is preferably a material that has elastomeric or compliant properties. The buffer material may include one or any combination of the following components: one or more polymer components (e.g., elastomers, plastomers, rubbers, plastics or the like), one or more fillers or additives and one or more curing agents or adhesives. Other components may be included in the buffer material as well such as component for imparting surface tack, magnetism or the like to the material. Moreover, the buffer material may be water-based, solvent-based, substantially solid or otherwise. Preferably, the components of the buffer material are chosen such that the buffer material is capable of viscoelastic recovery during and after installation of the member 12 to the panel portion 14.

[0039] Typically the polymer components will include at least one elastomer. Exemplary elastomers include natural

and synthetic isoprenes, propylenes, styrene butadiene copolymers, terpolymers of ethylene, isobutene isoprene polymers, butadiene copolymers, nitrile butadiene copolymers, chlorosulphonated polyethylenes, polysiloxanes, polyesters, polyisobutylenes fluorinated hydrocarbon or the like. In one preferred embodiment, the polymer component is at least partially composed of an acrylic elastomer such as an acrylonitrile butadiene terpolymer. In another preferred embodiment the polymer component is at least partially composed of a styrene butadiene rubber. In highly preferred embodiments, the elastomer of the buffer material is carboxylated for assisting the buffer material in adhering to adjacent materials, reacting with adjacent materials or both.

[0040] Advantageously, the buffer material is compliant with respect to the reinforcement material during activation, cure or both of the reinforcement material. Such compliance allows the reinforcement material to expand, contract or both while the buffer material absorbs stress that might otherwise be exerted upon the panel portion 14. In this manner, the buffer material assists in minimizing any deformation of the panel portion 14 that might otherwise be caused by the expansion or contraction of the reinforcement material. As an additional advantage, use of the buffer material disclosed herein only minimally lessens or does not lessen the reinforcement ability of the reinforcement material. For further explanation of the buffer layer 40 and methods of applying the layer, reference may be had to U.S. patent application Ser. No. 10/098,952, titled "Structurally Reinforced Panels", filed Mar. 15, 2002 and incorporated herein by referenced for all purposes. It is further contemplated within the present invention that the layer 24 of backing material may include a fiberglass woven roving, which is disclosed in commonly owned U.S. patent application Ser. No. 09/939,152, also titled "Structurally Reinforced Panels" and fully incorporated herein by reference for all purposes.

[0041] Additionally it is contemplated that multiple members may be applied to a single panel. In such an embodiment, the members would typically be spaced apart upon the panel portion to maximize the ability of the members to reinforce the panel portion.

[0042] Unless stated otherwise, dimensions and geometries of the various structures depicted herein are not intended to be restrictive of the invention, and other dimensions or geometries are possible. Plural structural components can be provided by a single integrated structure. Alternatively, a single integrated structure might be divided into separate plural components. In addition, while a feature of the present invention may have been described in the context of only one of the illustrated embodiments, such feature may be combined with one or more other features of other embodiments, for any given application. It will also be appreciated from the above that the fabrication of the unique structures herein and the operation thereof also constitute methods in accordance with the present invention.

[0043] The preferred embodiment of the present invention has been disclosed. A person of ordinary skill in the art would realize however, that certain modifications would come within the teachings of this invention. Therefore, the following claims should be studied to determine the true scope and content of the invention.

What is claimed is:

1. A structurally reinforced member for an automotive vehicle, comprising:

- (a) a panel portion of the automotive vehicle;
- (b) a reinforcement member having a length, the reinforcement member being a laminate that includes:
 - i) a reinforcement material layered upon the panel portion; and
 - ii) a backing material formed as layer and having a rib, the backing material layered upon a surface of the reinforcement material.

2. A structurally reinforced member as in claim 1 wherein the reinforcement material is a two-component material that activates to cure upon exposure of a first component to a second component.

3. A structurally reinforced member as in claim 1 wherein the reinforcement material is a heat activatable material that activates to foam and cure upon exposure to a temperature experienced in an e-coat or paint curing oven.

4. A structurally reinforced member as in claim 1 wherein the rib is roll formed to have an arc.

5. A structurally reinforced member as in claim 1 wherein the backing material is formed of metal.

6. A structurally reinforced member as in claim 5 wherein the backing material is at least partially formed of aluminum or steel.

7. A structurally reinforced member as in claim 1 wherein the panel portion is part of a automotive vehicle panel selected from a quarter panel, a side panel, a hood panel, a trunk panel or a door panel.

8. A structurally reinforced member as in claim 1 wherein the length is between about 30 cm and about 100 cm.

9. A structurally reinforced member as in claim 1 wherein the layer of reinforcement material has a thickness between about 3 mm and about 10 mm.

10. A structurally reinforced member as in claim 1 wherein the reinforcement material is activatable to foam and cure, but is also sufficiently tacky to adhere the layer of backing material to the panel portion prior to activation.

11. A structurally reinforced member as in claim 1 wherein the reinforcement material and the backing material are substantially coextensive along the length of the reinforcement member.

12. A structurally reinforced member as in claim 1 wherein the reinforcement member is contoured to correspond to a surface of the panel portion.

13. A structurally reinforced panel for an automotive vehicle, comprising:

- (a) a metal panel portion;
- (b) a reinforcement member having a length and a width, the reinforcement member being a laminate that includes:
 - i) a reinforcement material selected from an epoxy-based material, an ethylene-based polymer, or a mixture thereof, the reinforcement material being layered upon panel portion; and
 - ii) a backing material formed of layer of metal having a metal rib extending along the length of the reinforcement member, the backing material layered upon a surface of the reinforcement material

wherein the length is at least twice the width and wherein the panel portion is an exterior panel of the automotive vehicle.

14. A structurally reinforced member as in claim 13 wherein the reinforcement material is a two-component material that activates to cure upon exposure of a first component to a second component.

15. A structurally reinforced member as in claim 13 wherein the reinforcement material is a heat activatable material that activates to foam and cure upon exposure to a temperature experience in an e-coat or paint curing oven.

16. A structurally reinforced member as in claim 13 wherein the rib is roll formed to have an arc and wherein the backing material is at least partially formed of aluminum or steel and wherein the panel portion is part of a automotive vehicle panel selected from a quarter panel, a side panel, a hood panel, a trunk panel or a door panel.

17. A structurally reinforced member as in claim 13 wherein the length is between about 30 cm and about 100 cm and wherein the layer of reinforcement material has a thickness between about 3 mm and about 10 mm and wherein the reinforcement material and the backing material are substantially coextensive along the length of the reinforcement member.

18. A structurally reinforced member as in claim 13 wherein the reinforcement material is activatable to foam and cure, but is also sufficiently tacky to adhere the layer of backing material to the panel portion prior to activation.

19. A structurally reinforced member as in claim 13 wherein the reinforcement member is contoured to correspond to a surface of the panel portion.

20. A structurally reinforced panel for an automotive vehicle, comprising:

- (a) a metal panel portion;
- (b) a reinforcement member having a length and a width, the reinforcement member being a laminate that includes:
 - i) a reinforcement material selected from an epoxy-based material, an ethylene-based polymer, or a mixture thereof, the reinforcement material being layered upon panel portion; and
 - ii) a backing material formed of layer of metal having a roll formed metal rib extending along the length of the reinforcement member, the backing material being shaped as an elongate panel that is layered upon a surface of the reinforcement material.

wherein the length is at least 10 times the width;

wherein the panel portion is an exterior panel of a door of the automotive vehicle;

wherein the reinforcement material is a two component material that activates to cure upon exposure of a first component to a second component, the first component including an epoxy resin and the second component including an amine.

21. A structurally reinforced member as in claim 20 wherein the rib is roll formed to have an arc and wherein the backing material is at least partially formed of aluminum or steel and wherein the length is between about 30 cm and about 100 cm and the layer of reinforcement material has a thickness between about 3 mm and about 10 mm and wherein the reinforcement material and the backing material are substantially coextensive along the length of the reinforcement member and wherein the reinforcement member is contoured to correspond to a surface of the panel portion.