(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 0 593 716 B1

(12) EUROPEAN PATENT SPECIFICATION

(45) Date of publication and mention of the grant of the patent:
14.10.1998 Bulletin 1998/42

(21) Application number: **93909472.8**

(22) Date of filing: **31.03.1993**

(51) Int Cl.6: **D04H 1/00**, D04H 1/54

(86) International application number:
PCT/US93/03135

(87) International publication number:
WO 93/23596 (25.11.1993 Gazette 1993/28)

(54) NONWOVEN MOLDABLE COMPOSITE AND METHOD OF MANUFACTURE

VERFORMBARER VERBUNDVLIESSTOFF UND HERSTELLVERFAHREN HIERFÜR

MATERIAU COMPOSITE MOULABLE NON TISSE ET PROCEDE DE FABRICATION

(84) Designated Contracting States:
DE ES FR GB IT

(30) Priority: **08.05.1992 US 880624**

(43) Date of publication of application:
27.04.1994 Bulletin 1994/17

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Description

BACKGROUND OF THE INVENTION

Field of the Invention

The present invention relates generally to nonwoven composite materials and their methods of manufacture and, more particularly, to nonwoven fibrous panels adapted for thermoforming. Specifically, the present invention relates to nonwoven moldable composite materials having enhanced stiffen/weight ratios and enhanced resistance to shrinkage during thermoforming and their methods of manufacture.

Description of the Prior Art

Nonwoven needlepunch fiber technology has been utilized in the past in a variety of manners to form a diverse number of nonwoven flexible fabric materials and products. Examples of such technology for producing flexible nonwoven materials include U.S. Patents No. 4,420,167, No. 4,258,094, No. 4,581,272, No. 4,668,562, No. 4,195,112, No. 4,342,813, No. 4,324,752, No. 4,315,965, No. 4,780,359, and No. 5,077,874.

In certain applications, however, flexible nonwoven materials having fabric-like surfaces are not the most desired product. In fact, there are certain instances where a more rigid nonwoven material is desirable, for example for use as a trunkliner to protect electronic components located in the trunk area. In certain past situations, plastics have been utilized for such applications. Historically, plastic composite panels have been manufactured using any number of different techniques. In the case of panels or materials suitable for low pressure thermoforming, which is desirable for trunkliner applications and other similar type of applications requiring molding, several processes have been utilized.

One typical process of the prior art is based on paper making technology. In this instance, short staple fiber reinforcement materials, having fiber lengths typically less than one inch, are mixed with a desired resin system, disbursed in a slurry, applied onto a porous belt, dried, and then consolidated using heat and pressure. In this instance, the desired resin system has been either a resin emulsion or additional fibrous materials of a lower melting point.

Other prior art processes rely on extrusion techniques to form a melt of the desired resin, which may or may not contain short staple fiber reinforcement materials and/or fillers. Panels are then formed by directing the molten resin through a slot die. One variation of this process uses a resin sheet which is combined with premanufactured reinforcement webs shortly after the extrusion die. These materials may be made in a sandwiched construction of resin-reinforcement-resin, and then consolidated through a compression operation consisting of high pressure rollers or presses.

In yet another prior art process, which has been used extensively for light weight textile type products such as diaper linings, interlinings, and the like, includes forming a nonwoven structure through a textile process such as carding or airlay technology of primarily reinforcement fibers. These reinforcement fibers can contain lower melting binder fibers. This nonwoven structure is then exposed to heat and pressure to form a fibrous nonwoven structure containing bond points in the structure. This is not unlike flexible textile manufacturing processes described in some of the aforementioned patents. Alternatively, the nonwoven structure may be exposed to resin systems via a spray or dip application of resin emulsions, which are then dried by way of heat and/or pressure.

Some of the drawbacks of the textile based technology discussed above, however, include the fact that if additional decorative or reinforcement materials such as carpeting or the like needs to be adhered or connected to the composite substrate material, such additional material has traditionally been needlepunched to attach it to the composite materials already formed. Such needlepunching has been shown to change the appearance of the decorative material or weaken the reinforcement materials. In the alternative, such carpeting or other decorative layer can be separately adhered to the composite substrate by use of separate adhesive applications.

Moreover, such composite materials of the past have exhibited a certain amount of shrinkage when subsequently exposed to additional heat during thermoforming processes to mold the composite into a desired shape for application as a trunkliner, dash panel or any other type of part. Such shrinkage during thermoforming can cause missizing of the desired component part. Alternatively, it requires precise prediction with respect to the amount of shrinkage in order to incorporate such shrinkage into the original panel size prior to thermoforming. Yet another alternative includes oversizing the panel so as to insure that shrinkage occurring through thermoforming would not affect the desired end product size. However, excess material must be trimmed off, and this is unnecessary waste. Therefore, there remains a need for a stiff, less flexible nonwoven composite material which is capable of being thermoformed and molded without shrinkage as well as providing alternative attachment mechanisms for decorative or reinforcement materials.

In EP-A-0174813, a molded fibrous surfaced article for automobile trunk compartments is disclosed which is manufactured by heating a blend of relatively high melting fibers and relatively low melting fibers, so that the latter fuse to bond the former, and forming the article in a mold under pressure. Articles manufactured in this matter suffer from the disadvantage that they possess substantial air voids, and are not very stiff, and after manufacture they shrink and tend to curl. The present invention overcomes these disadvantages, and has the further advantage that one or two decorative surface layers can be combined with the product during its manufacture, without the need for a separate combining step.

European Patent No. 0116845 discloses consolidated polyethylene fibrous networks by applying pressure to a network of high performance polyethylene fibers having a molecular weight average of at least about 500,000 for a time sufficient to cause adjacent fibers to adhere, and substantially eliminate voids, to form a translucent or transparent article substantially free of voids.

Accordingly, it is one object of the present invention to provide an improved moldable composite material and method of manufacture.

It is another object of the present invention to provide a moldable nonwoven panel which is stiffer and lighter in weight than prior art products.

Yet another object of the present invention is to provide a moldable nonwoven composite material which is resistant to shrinkage when subjected to thermoforming.

Still another object of the present invention is to provide a nonwoven moldable composite material to which carpeting and other decorative materials can be attached without the use of needlepunching or additional adhesives, and a method of manufacture thereof.

To achieve the foregoing and other objects and in accordance with a purpose of the present invention, as embodied and broadly described herein, a moldable, nonwoven composite material and method of manufacture thereof is provided. The method of manufacture includes blending a mix of first fibers and second thermoplastic fibers. The second fibers have a melting point lower than that of the first fibers and comprise approximately 40-80 per cent of the blend. A batt is formed and then consolidated into a nonwoven structure with the first fibers being thoroughly intermixed with the second fibers. The nonwoven structure is then heated to a temperature below the melting point of the first fibers and above the melting point of the second thermoplastic fibers substantially to liquify the second fibers and form a thermoplastic resin. The heated batt is compressed by passing between juxtaposed pinch rollers to flow the liquified resin to displace air voids in the batt and encapsulate the first fibers. Finally, the batt is cooled to form a composite material having substantially reduced air voids therein with the first fibers encapsulated by the resin and with the composite material being resistant to and preferably substantially free from shrinkage when subject to thermoforming.

The material includes a batt of reinforced fibers admixed throughout and encapsulated by a resin formed from melted and compressed thermoplastic fibers having a melting point less than that of the reinforcement fibers. The reinforcement fibers are 60-20 per cent of the composite, and the composite preferably has an air void volume no greater than approximately 20 per cent.

A preferred embodiment of the present invention is now described by way of example with reference to the accompanying drawing, Figure 1, which shows schematically the process of the present invention used to form the material of the present invention.

In accordance with the process of the present invention, at least two different types of fibers are blended together in preparation for a batt formation process. The base or first fiber is a reinforcement fiber, while the second fiber is thermoplastic in nature and will provide the resin utilized to bond the first reinforcement fibers together as discussed below.

The first type of fiber or reinforcement fiber may be thermoplastic, thermoset, inorganic or organic in nature as long as its melting point exceeds that of the second or resin fibers. In the preferred embodiment, the first type of fiber is either a non-thermoplastic fiber or a thermoplastic fiber having a melting point as explained above. Suitable non-thermoplastic fibers available for use as a first type of fiber include, but are certainly not limited to, wool, cotton, acrylic, polybenzimidazole, aramid, rayon or other cellulosic materials, carbon, glass, and novoloid fibers. Due to their very high temperature stability, for purposes of the present invention, polybenzimidazole fibers have been characterized as non-thermoplastic. If the the first type of fibers in the preferred embodiment are thermoplastic, the thermoplastic material must have a higher melting point temperature than the melting point temperature of the second thermoplastic fibers so that the second thermoplastic fibers may be melted without melting the first fibers. If the first fibers are thermoplastic in nature, any of the thermoplastics described below as being available for use as the second fibers are also available for the first fibers so long as the consideration stated above with respect to melting point is met. If desired, the preferred nonwoven batt may have components in addition to the above-described first and second type of fibers.

The second resin fiber may be made from any type of thermoplastic material having appropriate melting points. In the preferred embodiment, such materials include, but are not limited to, polyethylene, polypropylene, polyester, nylon, polyphenylene sulfide, polyether sulfone, polyether-ether ketone, vinyon, as well as bicomponent thermoplastic fibers. In fact, bicomponent fibers may be utilized as both first and second fibers. Such bicomponent fibers include a higher melting point core material surrounded by a lower melting point sheath material. In this manner, as heat is applied and the temperature increased, the sheath material melts thereby exposing the higher melting point core material which remains as the reinforcement fiber. An example of a usable bicomponent thermoplastic fiber is one made of a polypropylene core and a polyethylene sheath. Chisso Corporation of Japan manufactures a suitable bicomponent polyolefin fiber sold as "Chisso ESC" fiber. In the most preferred embodiment, the first reinforcement fiber is a higher melting point polyester while the second thermoplastic resin fiber is a lower melting point polypropylene.

Referring now to Fig. 1, the first and second fibers described above are admixed together and formed into a batt 10 by way of any typical textile processes such as carding/crosslapping or an airlay process. Typically, the second thermoplastic fibers representing the resin component of the ultimate composite will be utilized in the amount of 40-80 percent by volume of the total blend. Likewise, the first fibers representing reinforcement fibers will typically represent 20-60 percent of the blend. In the most preferred embodiment, the mix is in the ratio of 65 percent of the second resin fiber and 35 percent of the first reinforcement fiber.

The fiber is then passed through a batt formation process in order to consolidate the fibers and form a nonwoven web 12. The preferred weight of the batt 10 thus formed is about 300 g/m^2 or higher. In the preferred embodiment, a needlepunching technique is utilized to consolidate the batt 10 to form the nonwoven structure 12. Referring to Fig. 1, a needle loom 14 is illustrated as being utilized to consolidate the batt 10 into the nonwoven structure 12. The needle loom 14 includes needles 16 that punch into and withdraw from the webbing at desired number of strokes per minute as more specifically described in U.S. Patent No. 4,424,250, the contents of which are specifically incorporated herein by reference.

It is important to note that the first reinforcement fibers of the batt 10 are preferably of a long but discrete length, that is of a length of 1-6 inches (2.54 cm - 15.24 cm). This differentiates the ultimate composite 20 of the present invention from prior art types of composites, which includes those utilizing short staple fibers produced by wet-laid techniques or the like, or those utilizing continuous fibers. By maintaining the reinforcement fibers within the length specified above, it was discovered that the fibers help distribute forces encountered during thermoform molding of the composite, thereby providing certain beneficial elongation characteristics to the composite 20 of the present invention not available with prior art composite materials. This is discussed in greater detail below.

Returning to Fig. 1, the nonwoven structure 12 is heated above the melting point of the second thermoplastic fibers in order to melt the second fibers and encapsulate the first reinforcement fibers with resin. This is immediately followed by a compression operation. It was discovered that if the nonwoven structure 12 is heated to melt the second thermoplastic fibers and then immediately compressed, the melted thermoplastic fibers, or resin, becomes essentially liquid under the temperature and pressure range developed and responds by flowing throughout the web and displacing a substantial amount of the air voids present in the initial material. In fact, whereas prior art composite materials include up to 85 percent air voids volume in the ultimate composite material, the process of the preferred embodiment of the present invention creates a composite 20 having encaptured air of 20 percent or less and, in the more preferred embodiment, air voids of only 10-15 percent and even less than 10 percent.

There are any number of ways known to the art of accomplishing heating of the nonwoven structure 12 to achieve densification, and these include hot calendaring, heated flat platten pressing, continuous belt fed heating stations such as used in lamination or transfer printing, and the like. A preferred method developed with the present invention involves feeding the nonwoven structure 12 through an impingement or through-air heating unit 18. In order to raise the nonwoven structure temperature above the melting point of the second thermoplastic fibers, hot air is preferably forced through the nonwoven structure by the unit 18 so as to thoroughly heat the entire nonwoven structure throughout. This is as opposed to a radiant heating unit which tends to heat the surface of the nonwoven structure to a much greater degree than the interior portion of the nonwoven structure. Since a thorough distribution of melted resin is desired with the present invention, it is important that the nonwoven structure be heated thoroughly throughout.

Immediately upon completion of the heating process by unit 18, the heated nonwoven structure with its melted thermoplastic resin is directed through a compression stage wherein, as described above, the resin flows throughout the nonwoven structure encapsulating the first reinforcement fibers and displacing the air voids therein.

The compression stage utilizes a pair of pinch rollers 22, 24 which are maintained preferably at a temperature below the melting point of the resin so as to assist in cooling of the resin. The rollers 22, 24 are spaced with an appropriate gap so as to develop sufficient closure pressure at the nip 28 to cause the mobile molten resin in the nonwoven structure to redistribute within the matrix of the reinforcement fibers therein. Upon compression caused by the rollers 22, 24, the nonwoven structure is cooled to form the composite material 20. As described above, the rollers 22, 24 may assist in the initial cooling by being maintained at an appropriate lower temperature.

It is frequently desirable to utilize the composite material 20 as a substrate and add to it decorative or reinforcement covering materials. Prior to the present invention, such materials were attached to a composite formed from textile processes either by a needlepunching process, which tends to change the decoration materials appearance or weaken the reinforcing material, or by adding an additional adhesive, which added weight and required an additional processing step. With the present invention, a covering material 26 may be attached to the composite 20 by introducing the material 26 on either one 25 or both sides 25, 27 of the heated nonwoven structure at the nip point 28 to yield a finished composite material 30 having the covering material 26 attached thereto. The covering material 26 is attached to the composite 20 by compressing the covering material 26 against the surface 25 of the heated nonwoven structure so that the resin from the heated nonwoven structure penetrates the covering material 26 and thereby binds the covering material 26 to the substrate 12. Thus, the resin within the nonwoven structure also acts as the adhesive to attach the cover material 26 to the nonwoven structure to provide the final composite product 30. In the case of a decorative material, virtually any chemical type may be utilized as the covering material 26 so long as its melting point is greater than or equal to the melting point of the second thermoplastic fibers. While Fig. 1 only illustrates the attachment of the cover material 26 to one side 25 of the nonwoven structure, it is to be understood that both sides 25, 27 of the nonwoven structure can be covered by a material 26 simultaneously by introducing another covering material at the nip point 28 from the other side 27 of the nonwoven structure. The covering material 26 can be of any type of material such as textile, ie., carpets, cloths and the like, or other types of materials such as films, foils, spunbonded reinforcement materials and the like.

Since the resin system of the composite material 20 has been repositioned during its mobile or heated phase by the compression process, the resulting composite 20 is essentially free of trapped air as described above. In addition, essentially 100 percent contact exists between the resin system of the composite 20 and the first reinforcement fibers therein. Moreover, the final composite product 30 having a covering layer attached thereto is a singular material wherein the covering material 26 is intimately bound to the composite 20 by utilizing the same resin system that binds the fibers of the composite 20 together to bind the covering material 26 to the composite 20. This results in a product with performance properties similar to the extruded resin with reinforcement fibers in terms of offering a very high stiffness to weight ratio, while maintaining sufficient ultimate elongation to allow reliable thermoforming into complex shapes as described below.

As a result of the aforementioned processing, the resulting composite material 20 is a moldable, nonwoven composite. Due to the heating and compressing which densifies the material 20, the resultant composite 20 is highly resistant to shrinkage during subsequent thermoforming processes. The composite 20 ends up being a nonwoven structure of the first reinforcement fibers which are thoroughly mixed throughout and encapsulated entirely by the resin formed from the second melted fibers, the composite having an air volume of 20 percent or less and preferably in the range of 10-15 percent. Thus, substantially all of the air voids in the initial batt 10 have been displaced and removed.

The composite material 20 with or without covering material 26 may be utilized in a wide variety of applications as previously mentioned. With respect to thermoforming, the composite 20 has achieved elongation at failure values in excess of 50 percent elongation under thermoforming conditions. In other words, the composite 20 of the present invention is able to achieve in excess of 50 percent elongation during thermoform molding without cracking or failing. This makes the composite material of the present invention highly suitable for any method of shaping parts requiring heating or thermoforming techniques.

The process and product of the present invention described above differ significantly from prior art processes and products in that exclusively dry laid nonwoven structure forming technology is utilized as opposed to wet laid technology of many of the prior art products. The resultant composite structure of the invention comprises a matrix of reinforcement fibers essentially surrounded by resin material and essentially free of air spaces, which provides a very dense, stiff, yet lighter weight material. Nonetheless, this material is highly elongatable for thermoforming capabilities. Moreover, the material of the present invention allows lamination of decorative or additional reinforcement materials without the use of additional adhesive and without the use of needlepunching or other similar type of techniques which tend to damage the reinforcement material or change the appearance of the decorative material. As a result, a stiff, light-weight composite material is achievable with the present invention without being brittle, and yet is very compliant under thermoforming processes. This produces a composite material that is capable of being utilized in a wide variety of applications with significant advantages over existing nonwoven composites.

The foregoing description and the illustrative embodiments of the present invention have been shown in the drawing and described in detail in varying modifications and alternate embodiments. It should be understood, however, that the foregoing description of the invention is exemplary only, and that the scope of the invention is to be limited only to the claims as interpreted in view of the prior art.

Claims

1. A method of manufacturing a nonwoven moldable composite material (20) including the steps of forming a batt (10) by blending a mix of first fibers and second thermoplastic fibers, said second fibers having a melting point lower than that of said first fibers, and consolidating (14) said batt into a nonwoven structure (12), in which said first fibers are thoroughly intermixed with said second fibers characterised in that said second fibers comprise approximately 40-80 per cent by volume of the blend of fibers within said batt (10), and in that said nonwoven structure is heated (18) to a temperature below the melting point of said first fibers and above the melting point of said second thermoplastic fibers substantially to liquify said second fibers and form

a thermoplastic resin therefrom, and in that said heated nonwoven structure is compressed by passing it between juxtaposed pinch rollers (22,24) to flow said liquified resin to displace a portion of the air voids in said nonwoven structure and encapsulate said first fibers, and in that said nonwoven structure is cooled to form a composite material (20) with said first fibers being encapsulated by said resin, said composite material (20) being resistant to shrinkage when subjected to thermoforming.

2. The method as claimed in claim 1, characterised in that said liquified resin displaces an effective amount of said air voids upon compression of said heated nonwoven structure (12) to create a composite material (20) having an air void volume no greater than approximately 20 per cent.

3. The method as claimed in claim 1 or 2, characterised in that covering material (26) is positioned against at least one surface (25) of said heated nonwoven structure (12) as said nonwoven structure is compressed between the pinch rollers (22,24) to laminate said covering material (25) to said nonwoven structure during compression, said resin acting as an adhesive to achieve said lamination.

4. The method as claimed in claim 1, 2 or 3, characterised in that said first fibers are selected from the group consisting of thermoplastic materials, thermoset materials, inorganic materials, and organic materials.

5. The method as claimed in any one of claims 1-4, characterised in that both said first and second fibers are bicomponent fibers comprising a higher melting point core material covered by a thermoplastic lower melting point sheath material.

6. The method as claimed in any of claims 1-5 characterised in that the pinch rollers (22,24) are maintained at a temperature below the melting point of said second fibers to assist in solidifying said resin.

7. The method as claimed in any of claims 1-6 characterised in that the moldable composite material (20) is thermoform molded into a shaped nonwoven molded composite material.

8. A heat stabilized, moldable, consolidated nonwoven material comprised of a nonwoven substrate structure (12) of reinforcement fibers admixed throughout with thermoplastic fibers having a melting point less than the melting point of said reinforcement fibers, characterised in that said consolidated nonwoven material is resistant to shrinkage when molded during a subsequent thermoforming operation, and in that said material is substantially stiff and comprised of a nonwoven substrate structure (12) of a blend of reinforcement fibers admixed throughout and encapsulated by a thermoplastic resin formed from the melting thermoplastic fibers, and in that said material has assumed a densified structure resulting from said thermoplastic resin having displaced, under compressive force of a pair of pinch rollers (22,24), a portion of the air voids present in the nonwoven substrate structure before having been subjected to such compressive force, and in that said thermoplastic fibers comprise approximately 40-80 per cent per volume of said blend, and in that said reinforcement fibers comprise 60-20 per cent per volume of said blend, and in that the structure of the material is such as to enable said material to achieve at least about 50 per cent elongation during thermoforming.

9. A moldable material as claimed in claim 8, characterised in that the void volume therein is not greater than approximately 20 per cent.

10. A moldable material as claimed in claim 8 or 9, characterised in that said reinforcement fibers comprise at least one type of non-thermoplastic fibers selected from the group consisting of fibers of wool, cotton, acrylics, polybenzimidazoles, aramids, rayon, carbon, glass and novoloids.

11. A moldable material as claimed in claim 8, 9 or 10, characterised in that said thermoplastic fibers forming said resin comprise at least one type of thermoplastic fiber selected from the group consisting of fibers of polyethylene, polypropylene, polyester, nylons, polyphenylene sulfides, polyether sulfones, polyether-ether ketones, vinyon, and bicomponent thermoplastic fibers.

12. A moldable material as claimed in claim 8 or 9, characterised in that said reinforcement fibers comprise polyester, and said resin forming thermoplastic fibers comprise polypropylene.

13. A moldable material as claimed in any one of claims 8-11, characterised in that said reinforcement fibers have a length of from 2.54 cm to 15.24 cm (1 to 6 inches).

14. A moldable material as claimed in any one of claims 8-13, characterised in that said material further includes a covering member attached (26) to at least one surface (25) thereof utilizing the resin of said material.

15. A moldable material as claimed in claim 14, characterised in that said covering member (26) attached to said material comprises carpeting.

16. A moldable panel formed from the moldable material as claimed in any one of claims 8-15.

Patentansprüche

1. Verfahren zum Herstellen eines verformbaren Vlies-Verbundmaterials (20), mit den Schritten des Bildens einer losen Faserlage (10) durch Herstellen einer Mischung aus ersten Fasern und zweiten, thermoplastischen Fasern, wobei die zweiten Fasern einen Schmelzpunkt unterhalb desjenigen der ersten Fasern haben, und Verfestigen (14) der losen Faserlage zu einer Vliesstruktur (12), in der die ersten Fasern durchgehend mit den zweiten Fasern gemischt sind,
dadurch gekennzeichnet, daß die zweiten Fasern ungefähr 40-80 Volumenprozent der Fasermischung in der losen Faserlage (10) bilden, daß die Vliesstruktur auf eine unterhalb des Schmelzpunktes der ersten Fasern und über dem Schmelzpunkt der zweiten thermoplastischen Fasern liegende Temperatur erwärmt wird (18), um die zweiten Fasern im wesentlichen zu verflüssigen und ein thermoplastisches Harz aus ihnen zu bilden, daß die erwärmte Vliesstruktur durch Hindurchbewegen zwischen einander gegenüberliegenden Druckrollen (22,24) derart verdichtet wird, daß durch das Fließen des verflüssigten Harzes ein Teil der Luftporen in der Vliesstruktur verdrängt wird und die ersten Fasern eingekapselt werden, und daß die Vliesstruktur abgekühlt wird, um ein Verbundmaterial (20) zu bilden, bei dem die ersten Fasern durch das Harz eingekapselt sind, wobei das Verbundmaterial (20) bei Einwirkung einer Wärmeumformung schrumpffest wird.

2. Verfahren nach Anspruch 1, dadurch gekennzeichnet, daß das verflüssigte Harz bei Verdichtung der erwärmten Vliesstruktur (12) die Luftporen in hinreichender Menge verdrängt, um ein Verbundmaterial (20) mit einem Luftporenvolumen von nicht mehr als ungefähr 20 Prozent zu schaffen.

3. Verfahren nach Anspruch 1 oder 2, dadurch gekennzeichnet, daß, während die Vliesstruktur zwischen den Druckrollen (22,24) verdichet wird, ein Deckmaterial (26) gegen mindestens eine Oberfläche (25) der erwärmten Vliesstruktur (12) positioniert wird, um das Deckmaterial (26) während des Verdichtens auf die Vliesstruktur zu laminieren, wobei das Harz als Kleber zur Herbeiführung der Laminierung wirkt.

4. Verfahren nach Anspruch 1, 2 oder 3, dadurch gekennzeichnet, daß die ersten Fasern aus der Gruppe thermoplastische Materialien, warmhärtbare Materialien, anorganische Materialien und organische Materialien gewählt werden.

5. Verfahren nach einem der Ansprüche 1-4, dadurch gekennzeichnet, daß sowohl die ersten als auch die zweiten Fasern Bikomponenten-Fasern sind, die ein Kernmaterial mit höherem Schmelzpunkt aufweisen, das von einem thermoplastischen Umhüllungsmaterial mit niedrigerem Schmelzpunkt bedeckt ist.

6. Verfahren nach einem der Ansprüche 1-5, dadurch gekennzeichnet, daß die Druckrollen (22,24) auf einer unterhalb des Schmelzpunktes der zweiten Fasern gelegenen Temperatur gehalten werden, um das Härten des Harzes zu unterstützen.

7. Verfahren nach einem der Ansprüche 1-6, dadurch gekennzeichnet, daß das verformbare Verbundmaterial (20) durch Wärmeumformung zu einem Vlies-Verbundstoff-Formkörper geformt wird.

8. Wärmestabilisiertes, verformbares verfestigtes Vliesmaterial, mit einer Vliessubstrat-Struktur (12) aus Verstärkungsfasern, die durchgehend mit thermoplastischen Fasern gemischt sind, deren Schmelzpunkt unterhalb des Schmelzpunktes der Verstärkungsfasern liegt,
dadurch gekennzeichnet, daß das verfestigte Vliesmaterial beim Verformen während einer nachfolgenden Wärmeumformungsoperation schrumpffest ist, daß das Material im wesentlichen steif ist und eine Vliessubstrat-Struktur (12) aus einer Mischung aus Verstärkungsfasern aufweist, die durchgehend mit einem aus den schmelzenden thermoplastischen Fasern gebildeten thermoplastischen Harz vermischt und von diesem eingekapselt sind, daß das Material eine verdichtete Struktur angenommen hat, die daraus resultiert, daß das thermoplastische Material unter der Kompressivkraft eines Paares von Druckrollen (22,24) einen Teil der Luftporen verdrängt hat, die in dem Vliessubstrat-Struktur vorhanden waren, bevor diese der Kompressivkraft ausgesetzt war, daß die thermoplastischen Fasern ungefähr 40-80 Volumenprozent der Mischung ausmachen und die Verstärkungsfasern 60-20 Volumenprozent der Mischung ausmachen, und daß die Struktur des Materials derart beschaffen ist, daß das Material während des Wärmeumformens eine mindestens 50prozentige Dehnung erreichen kann.

9. Verformbares Material nach Anspruch 8, dadurch gekennzeichnet, daß das darin befindliche Porenvolumen nicht größer als ungefähr 20 Prozent ist.

10. Verformbares Material nach Anspruch 8 oder 9, dadurch gekennzeichnet, daß die Verstärkungsfasern mindestens einen Typ nichtthermoplastischer Fasern aufweisen, die aus der Gruppe von Fasern aus Wolle, Baumwolle, Akrylen, Polybenzimidazolen, Aramiden, Rayon, Kohlenstoff, Glas und Novoloids gewählt sind.

11. Verformbares Material nach Anspruch 8, 9 oder 10, dadurch gekennzeichnet, daß die das Harz bildenden thermoplastischen Fasern mindestens einen Typ von thermoplastischer Faser aufweisen, der aus der Gruppe von Fasern aus Polyethylen, Polypropylen, Polyester, Nylons, Polyphenylsulfiden, Polyethersulfonenen, Polyetheretherketonen, Vinyon und zweikomponentigen thermoplastischen Fasern gewählt ist.

12. Verformbares Material nach Anspruch 8 oder 9, dadurch gekennzeichnet, daß die Verstärkungsfasern Polyester aufweisen und die harzbildenden thermoplastischen Fasern Polypropylen aufweisen.

13. Verformbares Material nach einem der Ansprüche 8-11, dadurch gekennzeichnet, daß die Verstärkungsfasern eine Länge von 2,54 cm bis 15,24 cm (1 bis 6 Inch) aufweisen.

14. Verformbares Material nach einem der Ansprüche 8-13, dadurch gekennzeichnet, daß das Material ferner ein Deckteil (26) aufweist, das mit Hilfe des Harzes des Materials an mindestens einer Oberfläche (25) des Materials befestigt ist.

15. Verformbares Material nach Anspruch 14, dadurch gekennzeichnet, daß das an dem Material befestigte Deckteil (26) Teppichstoff aufweist.

16. Verformbare Platte, gebildet aus dem verformbaren Material nach einem der Ansprüche 8-15.

Revendications

1. Procédé de fabrication d'un matériau composite non tissé apte au moulage (20) comprenant les étapes consistant à former une nappe (10) en mélangeant un mélange de premières fibres et de secondes fibres thermoplastiques, lesdites secondes fibres ayant un point de fusion inférieur à celui desdites premières fibres, et à consolider (14) ladite nappe en une structure non tissée (12) dans laquelle lesdites premières fibres sont soigneusement emmêlées avec lesdites secondes fibres, caractérisé en ce que lesdites secondes fibres constituent environ 40 à 80 % en volume du mélange de fibres dans ladite nappe (10) et en ce qu'on chauffe (18) ladite structure non tissée à une température située au-dessous du point de fusion desdites premières fibres et au-dessus du point de fusion desdites secondes fibres thermoplastiques quasiment pour liquéfier lesdites secondes fibres et former une résine thermoplastique à partir de celles-ci, et en ce qu'on comprime ladite structure non tissée chauffée en la faisant passer entre des rouleaux compresseurs juxtaposés (22, 24) pour faire s'écouler ladite résine liquéfiée de façon à déplacer une partie des vides d'air dans ladite structure non tissée et encapsuler lesdites premières fibres, et en ce qu'on refroidit ladite structure non tissée pour former un matériau composite (20) avec lesdites premières fibres encapsulées par ladite résine, ledit matériau composite (20) étant résistant au retrait quand on le soumet à un thermoformage.

2. Procédé selon la revendication 1, caractérisé en ce que ladite résine liquéfiée déplace une quantité efficace desdits vides d'air par compression de la structure non tissée chauffée (12) pour créer un matériau composite (20) ayant un volume de vides d'air ne dépassant pas environ 20 %.

3. Procédé selon la revendication 1 ou 2, caractérisé en ce qu'on place un matériau de recouvrement (26) contre au moins une surface (25) de ladite structure non tissée chauffée (12) pendant qu'on comprime ladite structure non tissée entre les rouleaux compresseurs (22, 24) pour stratifier ledit matériau de recouvrement (25) sur ladite structure non tissée pendant la compression, ladite résine agissant comme un adhésif pour l'obtention de ladite stratification.

4. Procédé selon la revendication 1, 2 ou 3, caractérisé en ce qu'on choisit lesdites premières fibres dans l'ensemble constitué par des matériaux thermoplastiques, des matériaux thermodurcissables, des matériaux inorganiques et des matériaux organiques.

5. Procédé selon l'une des revendications 1 à 4, caractérisé en ce qu'à la fois lesdites premières fibres et lesdites secondes fibres sont des fibres à deux composants comprenant un matériau central à point de fusion élevé recouvert par un matériau gaine thermoplastique à point de fusion bas.

6. Procédé selon l'une quelconque des revendications 1 à 5, caractérisé en ce qu'on maintient les rouleaux compresseurs (22, 24) à une température située au-dessous du point de fusion desdites secondes fibres pour faciliter la solidification de ladite résine.

7. Procédé selon l'une quelconque des revendications 1 à 6, caractérisé en ce qu'on moule le matériau composite (20) apte au moulage par thermoformage en un matériau composite non tissé façonné moulé.

8. Matériau non tissé consolidé, apte au moulage et stabilisé à la chaleur, comprenant une structure de substrat non tissé (12) formée de fibres de renfort, intimement mélangées avec des fibres thermoplastiques ayant un point de fusion inférieur au point de fusion desdites fibres de renfort, caractérisé en ce que ledit matériau non tissé consolidé est résistant au retrait quand on le moule pendant une opération ultérieure de thermoformage, et en ce que ledit matériau est essentiellement rigide et constitué d'une structure de substrat non tissé (12) formée d'un mélange de fibres de renfort, totalement mélangées et encapsulées au moyen d'une résine thermoplastique formée par fusion des fibres thermoplastiques, et en ce que ledit matériau adopte une structure densifiée résultant de ladite résine thermoplastique qui, sous l'effet d'une force de compression d'une paire de rouleaux compresseurs (22, 24), a déplacé une partie des vides d'air présents dans la structure du substrat non tissé avant d'avoir été soumise à une telle force de compression, et en ce que lesdites fibres thermoplastiques constituent environ 40 à 80 % en volume dudit mélange, et en ce que lesdites fibres de renfort constituent 60 à 20 % en volume dudit mélange, et en ce que la structure du matériau est telle qu'elle permet audit matériau d'atteindre un allongement d'au moins environ 50 % pendant le thermoformage.

9. Matériau apte au moulage selon la revendication 8, caractérisé en ce que le volume de vides dans celui-ci ne dépasse pas environ 20 %.

10. Matériau apte au moulage selon la revendication 8 ou 9, caractérisé en ce que lesdites fibres de renfort, comprennent au moins un type de fibres non thermoplastiques choisies dans l'ensemble constitué par des fibres de laine, de coton, de matières acryliques, de polybenzimidazoles, d'aramides, de rayonne, de carbone, de verre et de novoloïdes.

11. Matériau apte au moulage selon la revendication 8, 9 ou 10, caractérisé en ce que lesdites fibres thermoplastiques formant ladite résine comprennent au moins un type de fibres thermoplastiques choisies dans l'ensemble constitué par des fibres de polyéthylène, de polypropylène, de polyester, de Nylons, de sulfures de polyphénylène, de polyéther-sulfones, de polyéther-éther-cétones, de vinyon et de fibres thermoplastiques à deux composants.

12. Matériau apte au moulage selon la revendication 8 ou 9, caractérisé en ce que lesdites fibres de renfort sont constituées de polyester, et lesdites fibres thermoplastiques formant une résine sont constituées de polypropylène.

13. Matériau apte au moulage selon l'une quelconque des revendications 8 à 11, caractérisé en ce que lesdites fibres de renfort ont une longueur de 2,54 cm à 15,24 cm (1 à 6 pouces).

14. Matériau apte au moulage selon l'une quelconque des revendications 8 à 13, caractérisé en ce que ledit matériau comprend, en outre, un élément de recouvrement attaché (26) au moins à une surface (25) de celui-ci au moyen de la résine dudit matériau.

15. Matériau apte au moulage selon la revendication 14, caractérisé en ce que ledit élément de recouvrement (26) attaché audit matériau est constitué de moquette.

16. Panneau apte au moulage formé à partir du matériau apte au moulage selon l'une quelconque des revendications 8 à 15.

FIG. 1