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(54) STRETCHABLE SHEETS COMPRISING A VARIETY OF LAYERS AND ZONES AND METHODS TO PRODUCE SUCH PRODUCTS

STRETCH SHEETS, DAS AUS VERSCHIEDENEN SCHICHTEN UND ZONEN BESTEHEN UND METHODEN, UM SOLCHE PRODUKTE ZU PRODUZIEREN

FEUILLES EXTENSIBLES COMPRENANT DIVERSES COUCHES ET ZONES ET PROCÉDÉS DE PRODUCTION DE TELS PRODUITS

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Description

FIELD OF THE INVENTION

[0001] The present invention relates to a method for producing a non-woven and stretchable workpiece that can be used to produce products and sheets such as two-dimensional and three-dimensional products and sheets, composed of flexible, stretchable and/or elastic materials such as natural elastomers and other synthetic polymers. The method of the invention can be used for layering additional material such as fibers, in order to make 2D and 3D stretchable and/or elastic products.

BACKGROUND OF THE INVENTION

[0002] This application is an improvement to our pending U.S. Patent Application No. 12/875,716. Said application introduced a product produced by a method for producing a stretchable nonwoven sheet, comprising a stretchable material such as natural rubber and loose fibers on a workpiece former such as conveyor belt or mold. In this current application, we wish to introduce some new features to the products characteristics to further expand products utilizations and applications.

SUMMARY OF THE INVENTION

[0003] The present invention is related to methods for producing a non-woven and stretchable workpiece as set out in the claims. Methods of the invention may be used to produce a variable layered sheet of stretchable, elastic or shape-retaining products, composed principally of materials such as resilient elastomers including, but not limited to, natural latex rubber or polyurethane. The methods of the invention use controlled spraying for spraying the principal material or materials onto a surface of a wall such as a workpiece former. The resulting product is a sheet having at least two different zones unified within the sheet. The methods of the invention are improved methods for preparing products having a single or double-sided surface coating of same or different types of loose fibers, and a method for generating same or different microporosity regions in such products.

[0004] The method of the present invention can be used to form a sheet with different thicknesses, composites and structures in different areas. The creation of such sheet or fabric is very similar to "3D printing."

[0005] Creating nonwoven disposable fabric, by using the disclosed technology, is in fact 3D printing of fabric.

[0006] In one aspect, the methods of the invention can be used to form sheets comprising two or more zones, wherein at least one zone is characterized by a different composite and features than one of the remaining zones; and the sheet is stretchable and non-woven.

[0007] Methods of the invention for producing a stretchable workpiece can comprise applying one or more materials on a conveyor or a mold using different

machines or compartment or different materials in different layouts so to produce a workpiece having two or more zones, wherein at least one zone comprises a different material feature than one of the remaining zones.

[0008] These and other embodiments of the invention will become apparent in light of the detailed description below.

BRIEF DESCRIPTION OF THE FIGURES

[0009] The following figures show examples for two possible embodiments of this invention:

Fig. 1 represents a section through a sheet formed by a method of the invention, the sheet having two zones - Zone 1 (left) and Zone 2 (right). Each zone comprises three layers. The upper layer of both zones is made out of composite 1. The middle layer of Zone 1 is made out of composite 2, while the middle layer of zone 2 is made out of composite 3. The bottom layer of zone 1 is made out of composite 3, while the bottom layer of zone 2 is made out of composite 2.

Fig. 2 represents a section through a sheet formed by a method of the invention, the sheet having the same structure as described in Fig 1, and further comprising additional layer of composite 4 built on top of the upper layer (composite 1) at a specific location, covering zone 1 in full but only part of zone 2. This specific structure creates differences in the thickness of the different areas of the sheet.

DETAILED DESCRIPTION OF THE INVENTION

[0010] The present invention is generally related to methods for producing stretchable, elastic or shape-retaining products composed of principal materials comprising resilient elastomers such as natural latex rubber, polyurethane or other synthetic materials, in a sprayable liquid state, and methods for producing such products, using a controlled spraying of the liquid material onto a surface of a wall such as a workpiece former. The resulting product is a sheet having at least two different zones as desired. The methods of the present invention can be used to form products having a single or double-sided fiber flocked surface, and form products such as non-woven sheets having a desired level of porosity at each different zone, in order to gain breathability or permeability at the different zones of such products. The product produced by the invention has improved specifications and feeling on both sides of the product. The unified sheet allows the creation of a product with different performances at different areas, without the need to attach together different sheets of different materials.

[0011] The phrase 'unified within the sheet' means the composites of two zones adjacent one to the other, are blended at their connection lines, creating a continuous

seamless sheet.

[0012] The term "flock" or "flocking" refers to the process of applying, attaching, or adhering loose fibers onto a surface.

[0013] The terms "former," "mould," or "workpiece former" are used interchangeably. A former or mould is an object made of any desired shape or size and serves as shape former for the making of products. For example, if a product in the shape of a face mask is desired, then a former or mould may be constructed in a way that displays the shape and size of desired face mask. The former may be flat and two-dimensional such as a flat belt conveyor. Alternatively, the former may be three-dimensional and have a complex shape to which a workpiece substantially conforms. In addition, the former may be made of any suitable material such as metal (e.g., aluminium), porcelain, ceramic, plastics, or composite (e.g., metal and plastic).

[0014] The terms "product" and "workpiece" are used interchangeably and may also include any object that can be produced using the methods, apparatus, and formers of the invention. Stretchable, elastic products have a variety of uses including, without limitation, industrial use such as pipes, seals, membranes, sheets, filtering membranes; food industry such as breathable stretchable wrappers or coverings for objects including perishables such as food; medical industry for medical products such as dressings and bandages; sanitation, athletic, and personal hygiene industries such as garments including protective garments and undergarments like brassieres, undershorts, socks, or gloves and any other garment, undergarment or dressing for veterinary or outdoor use. Other examples of garments are described in USSN 10/723,244, filed November 26, 2003, and in USSN 09/744,779, filed August 5, 1999, both of which are incorporated by reference in their entirety.

[0015] The phrase "loose fibers" refers to any suitable loose flocking fiber material including natural or synthetic materials and may be hydrophilic, hydrophobic, or a combination of the two. Hydrophilic fibers include wettable fibers, i.e., hydrophobic fibers that have been treated to render them hydrophilic, absorbent fibers, and superabsorbent polymer fibers. Examples of wettable fibers include bicomponent fibers, polypropylene fibers, and polyester fibers that have been treated, for example with surfactants. Example of wettable fibers are polyester fibers, such as DuPont-Akra Polyester Type 11A Bright commercially available from DuPont Company treated with a surfactant such as Tween 20 commercially available from ICI Americas Inc. Absorbent fibers are hydrophilic fibers. Absorbent fibers may comprise rayon fibers, acrylic fibers, nylon fibers, polyvinyl alcohol fibers, and fibers of natural or regenerated cellulose. Example of absorbent fiber is rayon fibers. Superabsorbent polymer fibers are hydrophilic fibers that are swellable and capable of absorbing greater than about 5 grams per gram (of fiber weight) of 1% saline solution. Examples of superabsorbent polymer fibers are polyacrylate fibers,

fibers of grafted cellulose, and fibers of maleic acid. Examples of superabsorbent polymer fibers include OASIS Type 101, commercially available from Technical Absorbents Limited and CAMELOT, commercially available from Camelot, Alberta, Canada. A preferred fiber for use in the invention is cotton fibers. Any suitable method for delivering the loose fibers so that they may be applied to the surface can be used. For instance, the loose fibers can be sprayed or blown onto the surface of the wall as well as electrostatically and or pneumatically flocked.

[0016] The phrase "product material" comprises suitable stretchable material such as natural or synthetic polymers. A natural polymer includes, without limitation, latex rubber. A synthetic polymer includes, without limitation, polyurethane. For spraying purposes, emulsions, suspensions, or solutions of the product material, e.g., liquid latex rubber, are generally used. After spraying the product material, with or without additional process steps, the product material is preferably allowed to dry before it is removed from a surface. The drying process may include curing or setting processes, depending on the choice of product material. For example, when latex rubber is used as the product material, the latex rubber would cure as it dries. In practicing this invention, the preferred product material is natural latex rubber, which forms durable, flexible, stretchable, elastic shape-retaining products.

[0017] The term "wall" may refer to a flat or two-dimensional work piece former such as a flat conveyor belt or any suitable shaped flat surface to which a product substantially conforms. Alternatively, the wall may be a three-dimensional workpiece former having a complex shape to which a workpiece substantially conforms. Alternatively, the wall may be non-flat, embossed or complex shaped conveyor belt, perforated conveyor belt, or combination thereof. The wall may be made of any suitable materials such as plastic, rubber, composite (e.g., of metal and plastic or ceramic), ceramics, metal such as aluminum or stainless steel.

[0018] The present invention provides a surprising and significant improvement over technologies known in the art by reducing the number of process steps and entailed costs. Moreover, the present invention provides a surprisingly effective and economical way to produce thin products, sheets and non-woven fabrics that combine different zones, which performs differently in the same unified sheet and may be flocked with fibers at least on one surface.

[0019] A method of the invention, for producing a non-woven and stretchable workpiece, may comprise the steps of: (a) applying at least one type of wetting agent onto a surface of a wall; (b) applying a first layer of at least one type of loose fibers onto at least a portion of the surface of the wall to produce a partially fiber-coated surface. The loose fibers are flocked electrostatically or by any other suitable way so that they hit the wall substantially perpendicular to its surface; and the method can include the further step (c) spraying a liquid product

material of at least one type onto the upright standing fibers to form a product material layer of predetermined thickness on the fiber-coated surface and produce a stretchable workpiece, wherein the product material layer has an inner and outer surface and fibers are attached to the inner surface of the product material layer. Another embodiment further comprises the step of applying a second layer of loose fibers onto at least a part of the outer surface of the product material layer, wherein the product material layer is uncured or partially uncured. In another embodiment, the method further comprises the steps of: allowing the product material layer to dry; and removing the stretchable workpiece from the surface.

[0020] The preceding methods may further comprise using different machine components or different materials in different configurations to produce zones of different qualities in the product.

[0021] For example, the method for producing a stretchable workpiece can comprise applying one or more materials on a conveyor or a mold at the same time using different machines or compartment or different materials in different layouts so to produce a workpiece having two or more zones, wherein at least one zone features a different material characteristics than one of the remaining zones. Each material applied may be a liquid material as defined above.

[0022] In one embodiment at least two different spraying nozzles are used side by side in conveyor cross direction to spray material (e.g., liquid material) in parallel, so that one zone of the product will comprise lower density than the other part. Each nozzle may spray the same material or different materials.

[0023] The nozzles may be arranged in a row. For example, as arranged in a row, a first nozzle can spray at wider angle than a second nozzle to thicken a section of the product by providing thicker elastomeric layer.

[0024] In yet another embodiment, the nozzles are configured to apply at the same time the same or different materials in different rates so to control amount of material sprayed in the different areas.

[0025] In yet another embodiment, the nozzles are configured to apply at the same time the same or different materials in different rates so to control amount of material sprayed in the different areas and to create areas of different porosity.

[0026] Such nozzle arrays may be used, for example, in step (c) as described above to spray different product materials. For example, two different materials (different polymer types) may be sprayed in two or more zones at the same time. In another example, different materials (different colors) may be layered by applying a first material layer and then applying a second material layer over the first.

[0027] In yet another embodiment, at least two similar nozzles are used to spray different polymers, the polymers may differ in: polymer type, formulation or any property or feature, such as, but not limited to any mechanical property, viscosity, color, scents or any other desired fea-

ture.

[0028] In one example, the different polymers can be selected independently from natural rubber, high modulus natural rubber, low modulus natural rubber, polyurethane, silicones, and the like.

[0029] In another embodiment, the polymer applied to one of the zones of the product has a higher modulus than the polymer applied to at least one other zone. In another embodiment, the polymer applied to a first zone of the product has a higher modulus than the polymer applied to a second zone.

[0030] In yet another embodiment, at least two flocking machines are used to apply different types of fibers. Such flocking machines may be used, for example, in step (b), as described above, to apply different types of loose fibers, to the different zones of the product. For example, different types of fibers may be applied to the wetting agent in adjacent zones or one type of fibers may be applied to the wetting agent (one surface of the product material layer), and a second type of flock applied over the second surface of the product material layer.

[0031] In yet another embodiment, at least two flocking machines are used to apply different fibers, the fibers may differ in type, material, length, diameter, color, odor, compostability, water retention, hydrophobicity or any other desired feature.

[0032] When different flocks are applied in two or more zones, the flock may be sprayed on top of the same product material or different product material. In one embodiment, different flocks are applied to at least two different zones and the flocks are sprayed onto the same product material. In another embodiment, different flocks are applied to at least two different zones and each type of flock is sprayed onto a different product material.

[0033] In another embodiment, the wetting agent is coated with a first flock, the first flock is sprayed onto one or more product materials in one or more zones, and a second flock is applied to the outer surface of the product material.

[0034] The preceding methods may be used to form unified stretchable non-woven sheets having two or more zones, wherein at least one zone has a different feature than one of the remaining zones.

[0035] In certain embodiments, the stretchable non-woven sheets may comprise three or more zones; or four or more zones; or five or more zones. In other embodiments, the stretchable non-woven sheets may comprise two to ten zones; or two to five zones; or two to four zones; or two or three zones. In yet other embodiments, the stretchable non-woven sheets can have two zones; or three zones; or four zones; or five zones; or as many zones as necessary for a given purpose. All zones are produced as a unified sheet.

[0036] Each of the zones of the stretchable non-woven sheets can be, for example, but not limited to (1) the upper surface and the bottom surface; (2) the right side and the left side; (3) a longitudinal, middle portion and the remaining side parts; (4) cross direction stripes; or

any other desired zone definition or combination thereof.

[0037] In one embodiment the product zones each comprise different elastomeric materials, such as, but not limited to, natural latex rubber, polyurethane or other synthetic materials.

[0038] The material features of each of the zones may differ in any property, such as, but not limited to, polymer type, formulation, compostability, basis weight, thickness, porosity, water or any other liquid permeability, breathability, tear strength, elongation at break, retractive force after extension, tensile strength, any other mechanical property, color, odor, tactile, or feel.

[0039] In another embodiment, the stretchable non-woven sheet comprises different loose fibers, at different zones, the fibers may differ in type, material, length, diameter, color, odor, compostability, water retention, hydrophobicity or any other desired feature.

[0040] In yet another embodiment, the product zones comprise different porosity levels.

[0041] In particular examples, the sheet may comprise a first zone having a first material and first flock and a second zone, adjacent to the first zone, having the first material and a second flock. In another example, the sheet may comprise a first zone having a first material and first flock; a second zone, adjacent to the first zone, having the first material and a second flock; and a third zone, adjacent to the first or second zone, having a second material and the first flock.

[0042] In another example, layers may be sprayed one on top of the other, such that a sheet may comprise adjacent zones where the stacks of applied layers are different in each zone. That may get different sandwiches side by side unified on the same sheet.

[0043] In another example, at least one of the zones of the sheet may comprise a polymer having a different modulus from the polymer of the remaining zones. Such sheets can be useful for medical usage to provide a bandage having different local pressure requirements.

[0044] In another example, different materials may be using in different zones to create a "breathable" area in the sheet; or an improved leak proof area.

[0045] In another example, different fibers may be applied to the inner and outer surfaces of a sheet, such as providing cotton fibers to the inner surface and artificial fibers to the outer surface. Such sheets may be useful, for example, in manufacturing pants or other garments.

[0046] In another example, different zones may be provided with different colored flock. Such different colors may be applied in adjacent zones on one surface of the sheet to produce a desired design effect; or one color flock may be provided to an inner surface of the sheet and another color flock to the outer surface of the sheet.

[0047] The methods and products provided herein can be used in the non-woven industry, as a sheet of stretchable non-woven fabric to be used as is, or in combination with other materials such as, but not limited to, woven and non-woven fabrics, to create finished ready to use products such as, but not limited to, diapers, sanitary

napkins, bandages, packaging means, beddings upholsteries, curtains, apparels, outdoor and military accessories and the like.

[0048] It will be appreciated by persons skilled in the art that the present invention is not limited by what has been particularly shown and described hereinabove. Rather the scope of the present invention is set out in the claims and includes variations and modification of the various features described in the specification and shown in the drawings which may occur to a person of ordinary skill in the art upon reading the foregoing description and which are not in the prior art.

15 Claims

1. A method for producing a non-woven and stretchable workpiece, comprising:

applying, using a controlled spraying, of a material, in liquid form, for forming the workpiece onto a surface of a wall on a conveyor or a mold so as to produce, at the same time, a workpiece having two or more zones, wherein at least one zone comprises a different material feature than one of the remaining zones; and wherein two adjacent zones are blended at their connection lines, creating a continuous seamless workpiece; and wherein the material feature is selected from polymer type, porosity, liquid permeability, breathability, tear strength, elongation at break, retractive force after extension, tensile strength, color, odor, density, tactile feel, and fibre type.

2. The method according to claim 1, wherein material feature is fibre type and the zones each comprise different loose fibers.

3. The method according to claim 2 where the fibers differ in material, length, diameter, color, odor, compostability, water retention, hydrophilicity or hydrophobicity.

4. The method according to claim 1, wherein one or more materials in liquid form, for forming the workpiece, are applied using at least two different spraying nozzles side by side in a cross direction of the conveyor.

5. The method according to claim 4, wherein the nozzles are configured to apply one or more materials, in liquid form, for forming the workpiece, at different rates so as to control the amount of the one or more material sprayed in the different zones.

6. The method according to claim 4, wherein the nozzles are configured to apply one or more materials

at different rates so as to control the amount of the one or more materials sprayed in the different zones and to create areas of different porosity.

7. The method according to claim 4, wherein the at least two nozzles are used to spray in liquid form, for forming the workpiece, different polymers.
8. The method according to claim 1, wherein at least two flocking machines are used to apply different types of flock.
9. The process according to claim 1, wherein the workpiece has two zones that are a right side and a left side.
10. The process according to claim 1, wherein the workpiece has two zones that are (i) a middle part and (ii) side parts.
11. The process according to claim 1, wherein at least two zones comprise different elastomeric materials.

Patentansprüche

1. Verfahren zur Herstellung eines nicht gewebten und dehnbaren Werkstücks, welches Folgendes aufweist:

Aufbringen eines Materials in flüssiger Form unter Verwendung eines gesteuerten Sprühvorgangs zum Formen des Werkstücks auf einer Oberfläche einer Wand auf einem Förderband oder einer Form, um gleichzeitig ein Werkstück mit zwei oder mehreren Zonen zu erzeugen, wobei zumindest eine Zone ein anderes Materialmerkmal aufweist als eine der restlichen Zonen; und
wobei zwei benachbarte Zonen an ihren Verbindungslinien vermischt werden, wodurch ein kontinuierliches nahtloses Werkstück erzeugt wird; und
wobei das Materialmerkmal ausgewählt ist aus: Polymerart, Porosität, Flüssigkeitspermeabilität, Atmungsfähigkeit, Zugfestigkeit, Bruchdehnung, Rückfederungskraft nach der Dehnung, Zugfestigkeit, Farbe, Geruch, Dichte, Berührungsgefühl und Faserart.

2. Verfahren nach Anspruch 1, wobei das Materialmerkmal die Faserart ist, und wobei die Zonen jeweils unterschiedliche lose Fasern aufweisen.
3. Verfahren nach Anspruch 2, wobei die Fasern bezüglich des Materials, der Länge, des Durchmessers, der Farbe, des Geruchs, der Kompostierbarkeit, der Wasserrückhaltung, der Hydrophilie oder

Hydrophobie abweichen.

4. Verfahren nach Anspruch 1, wobei ein oder mehrere Materialien in flüssiger Form zum Formen des Werkstücks unter Verwendung von mindestens zwei unterschiedlichen Sprühdüsen Seite an Seite in einer Querrichtung des Förderbandes aufgebracht werden.
5. Verfahren nach Anspruch 4, wobei die Düsen konfiguriert sind, um ein oder mehrere Materialien in flüssiger Form zum Formen des Werkstücks mit unterschiedlichen Raten aufzubringen, um die Menge des einen oder der mehreren Materialien zu steuern, das bzw. die in den unterschiedlichen Zonen aufgesprüht werden.
6. Verfahren nach Anspruch 4, wobei die Düsen konfiguriert sind, um ein oder mehrere Materialien mit unterschiedlichen Raten aufzubringen, um die Menge des einen oder der mehreren Materialien zu steuern, das bzw. die in den unterschiedlichen Zonen aufgesprüht werden, um Bereiche von unterschiedlicher Porosität zu erzeugen
7. Verfahren nach Anspruch 4, wobei die mindestens zwei Düsen verwendet werden, um in flüssiger Form unterschiedliche Polymere aufzusprühen, um das Werkstück zu formen.
8. Verfahren nach Anspruch 1, wobei zumindest zwei Beflockungsmaschinen verwendet werden, um unterschiedliche Arten von Flocken aufzubringen.
9. Verfahren nach Anspruch 1, wobei das Werkstück zwei Zonen hat, die eine rechte Seite und eine linke Seite sind.
10. Verfahren nach Anspruch 1, wobei das Werkstück zwei Zonen hat, die (i) ein Mittelteil und (ii) Seitenteile sind.
11. Verfahren nach Anspruch 1, wobei zumindest zwei Zonen unterschiedliche Elastomermaterialien aufweisen.

Revendications

1. Procédé de fabrication d'une pièce non tissée et extensible, comprenant :

appliquer, en utilisant une pulvérisation contrôlée, un matériau sous forme liquide, pour former la pièce sur une surface d'une paroi sur un convoyeur ou un moule de manière à produire, en même temps, une pièce comportant deux ou plusieurs zones, au moins une zone compre-

- nant une caractéristique de matériau différente de celle des zones restantes ; et
 dans lequel deux zones adjacentes sont mélangées au niveau de leurs lignes de connexion, créant une pièce sans couture continue ; et
 dans lequel la caractéristique de matériau est choisie d'après un type de polymère, une porosité, une perméabilité aux liquides, une respirabilité, une résistance à la déchirure, une élongation à la rupture, une force de rétraction après une extension, une résistance à la traction, une couleur, une odeur, une densité, une sensation tactile et un type de fibre.
2. Procédé selon la revendication 1, dans lequel la caractéristique de matériau est un type de fibre et chacune des zones comprend différentes fibres lâches.
3. Procédé selon la revendication 2, dans lequel les fibres diffèrent en matériau, longueur, diamètre, couleur, odeur, compostabilité, capacité de rétention d'eau, propriétés hydrophiles ou hydrophobes.
4. Procédé selon la revendication 1, dans lequel un ou plusieurs matériaux sous forme liquide, pour former la pièce, sont appliqués en utilisant au moins deux buses de pulvérisation différentes côte à côte dans une direction transversale du convoyeur.
5. Procédé selon la revendication 4, dans lequel les buses sont agencées pour appliquer un ou plusieurs matériaux, sous forme liquide, pour former la pièce, à différents débits afin de contrôler la quantité desdits un ou plusieurs matériaux pulvérisés dans les différentes zones.
6. Procédé selon la revendication 4, dans lequel les buses sont agencées pour appliquer un ou plusieurs matériaux à différents débits afin de contrôler la quantité desdits un ou plusieurs matériaux pulvérisés dans les différentes zones et à créer des régions de porosités différentes.
7. Procédé selon la revendication 4, dans lequel lesdites au moins deux buses sont utilisées pour pulvériser sous forme liquide, pour former la pièce, différents polymères.
8. Procédé selon la revendication 1, dans lequel au moins deux machines de flocage sont utilisées pour appliquer différents types de flocage.
9. Procédé selon la revendication 1, dans lequel la pièce comporte deux zones qui sont un côté droit et un côté gauche.
10. Procédé selon la revendication 1, dans lequel la pièce comporte deux zones qui sont (i) une partie inter-
- médiaire et (ii) des parties latérales.
11. Procédé selon la revendication 1, dans lequel au moins deux zones comprennent différents matériaux élastomères.



Fig 1

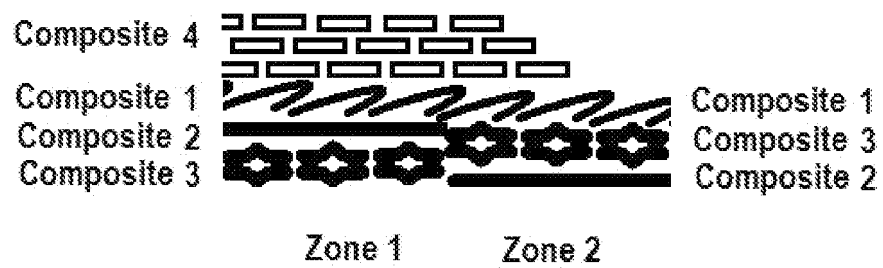


Fig 2

REFERENCES CITED IN THE DESCRIPTION

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