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(54) A METHOD TO PRODUCE ULTRA-SOFT SOLVENT BASED POLYURETHANE GLOVE

VERFAHREN ZUR HERSTELLUNG EINES ULTRAWEICHEN LÖSUNGSMITTELBASIERTEN
POLYURETHANHANDSCHUHS

PROCÉDÉ POUR PRODUIRE UN GANT POLYURÉTHANE À BASE DE SOLVANT ULTRA-DOUX

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Description**BACKGROUND**

5 **[0001]** Seamless, three-dimensional gloves may be formed using a glove mold and dipping the mold into a liquidized material that may dry to form the glove material. Such gloves may be used to protect a user's hands from chemicals, dust, grease, or other harmful substances. These gloves may be formed in various sizes to accommodate the user.

10 **[0002]** US2016/029721 discloses a glove having an inner glove formed in the shape of a human hand, a protective member secured to the inner glove; and an outer glove attached to at least one of the inner glove and the protective member, the outer glove being formed in the shape of a human hand and configured to fit over the protective member and the inner glove. WO2015/074106 discloses gloves including a fabric liner; a first polymeric composition adhered to at least a portion of the fabric liner, forming a polymeric coating; and a plurality of raised features comprising a second polymeric composition disposed on a surface of the polymeric coating, wherein the polymeric coating and the plurality of raised features comprise different polymeric compositions adapted to enhance at least one of oil grip properties, dry grip properties, or wet grip properties. DE20318173 and DE20318069 disclose protective gloves, especially for protection against chemical weapons, containing a barrier layer comprising a water vapor permeable membrane between the carrier and adsorption layers. US2011/206920 discloses a method and an article of manufacture are disclosed for reinforcing various structures, such as pipes, ducts, vessels, tanks, silos, chimneys, and the like, constructed from various materials including steel, concrete, masonry, wood, plastics, and the like. WO2008/108775 discloses a chemically protective article comprising an outer shell and a separable adsorptive liner is provided. When the adsorption sites of the liner become saturated, the liner alone may be replaced without discarding the entire article. US2003/134063 discloses an elastomeric or polymer material or glove having enhanced cut or penetration resistance.

SUMMARY

25 **[0003]** The invention is set out in accordance with the appended claims. In an embodiment, a chemical protection glove may comprise an outer layer comprising at least one layer of a chemically impermeable material comprising a polyurethane solution; a fabric layer located beneath the outer layer of the glove; and an inner layer configured to contact the user's skin comprising a plurality of hollow beads dispersed throughout the inner layer, wherein the hollow beads at least partially extend from the surface of the inner layer, and wherein the hollow beads create a textured surface on the inner layer;

30 wherein the outer layer (106) and inner layer (108) comprise a polyurethane solution; and wherein the polyurethane solution of the outer layer (106) extends through the fabric layer (104) to form the inner layer (108).

35 **[0004]** In an embodiment, a method for forming a chemical protection glove may comprise placing a fabric layer onto a glove mold; dipping the glove mold with the fabric layer into a polyurethane solution comprising a plurality of hollow beads; forming an outer layer of the polyurethane solution onto the fabric layer, wherein the hollow beads are dispersed through the outer layer; and forming an inner layer of the polyurethane solution by allowing the polyurethane solution to penetrate the fabric layer, wherein the hollow beads are dispersed throughout the inner layer.

40 **[0005]** Preferably, the chemical protection glove may comprise an outer layer comprising at least one layer of a chemically impermeable material, and comprising a plurality of hollow beads dispersed throughout the outer layer, wherein the hollow beads at least partially extend from the surface of the outer layer, and wherein the hollow beads create a textured surface on the outer layer; a fabric layer located beneath the outer layer of the glove, wherein the material of the outer layer at least partially penetrates through the fabric layer; and an inner layer configured to contact the user's skin comprising a plurality of hollow beads dispersed throughout the inner layer, wherein the hollow beads at least partially extend from the surface of the inner layer, and wherein the hollow beads create a textured surface on the inner layer.

BRIEF DESCRIPTION OF THE DRAWINGS

50 **[0006]** For a more complete understanding of the present disclosure, reference is now made to the following brief description, taken in connection with the accompanying drawings and detailed description, wherein like reference numerals represent like parts.

FIGS. 1A-1B illustrate a method for forming a glove according to an embodiment of the disclosure; and

55 FIGS. 2A-2B illustrate cross-sectional views of a glove according to an embodiment of the disclosure.

DETAILED DESCRIPTION

[0007] It should be understood at the outset that although illustrative implementations of one or more embodiments are illustrated below, the disclosed systems and methods may be implemented using any number of techniques, whether currently known or not yet in existence. The disclosure should in no way be limited to the illustrative implementations, drawings, and techniques illustrated below, but may be modified within the scope of the appended claims along with their full scope of equivalents.

[0008] The following brief definition of terms shall apply throughout the application:

The term "comprising" means including but not limited to, and should be interpreted in the manner it is typically used in the patent context;

The phrases "in one embodiment," "according to one embodiment," and the like generally mean that the particular feature, structure, or characteristic following the phrase may be included in at least one embodiment of the present invention, and may be included in more than one embodiment of the present invention (importantly, such phrases do not necessarily refer to the same embodiment);

If the specification describes something as "exemplary" or an "example," it should be understood that refers to a non-exclusive example;

The terms "about" or "approximately" or the like, when used with a number, may mean that specific number, or alternatively, a range in proximity to the specific number, as understood by persons of skill in the art field; and

If the specification states a component or feature "may," "can," "could," "should," "would," "preferably," "possibly," "typically," "optionally," "for example," "often," or "might" (or other such language) be included or have a characteristic, that particular component or feature is not required to be included or to have the characteristic. Such component or feature may be optionally included in some embodiments, or it may be excluded.

[0009] Embodiments of the disclosure include methods and systems for creating a glove comprising a plurality of hollow beads located within the material of the glove. The hollow beads may be dispersed within a coating that is used to form at least one of the inner and/or outer surfaces of the glove.

[0010] Typically, solvent based polyurethane (PU) has been used in the glove coating industry and may be preferred for its low cost and soft hand feeling. Unfortunately, problems may arise with using PU coatings, such as PU penetration and unacceptable coating edge appearance, which may lead to unpleasant hand feeling and unacceptable quality of glove appearance. Some users may be unsatisfied with the comfort levels of PU glove products, because of these issues.

[0011] Embodiments of the disclosure comprises elements for improving the solvent based PU glove with ultra-soft hand feeling, improved wearing comfort, lightweight materials, and good coating edge quality.

[0012] In typical solvent based PU coated gloves, the PU solution may penetrate through fabrics to form a coating on the inner surface of the glove. The inner coating may provide an unwelcome rubber-like feeling as it contacts the user's skin. Embodiments of the disclosure may comprise a plurality of hollow beads within the PU solution, where the hollow beads may also penetrate through the fabric and be present in the inner coating. The hollow beads may at least partially extend from the surface of the coating, creating raised bubbles or "nubbins" which may improve tactile feel for the user's hand. Additionally, the hollow beads may reduce the total weight of the glove by providing hollow areas throughout the material and reducing the amount of PU material that is required. For example, with the same thickness of coating created on the glove, the weight of the glove that incorporates the hollow beads may be reduced by approximately 40% when compared to a typical PU coated glove. In some embodiments, the hollow beads may provide a barrier to spreading of the PU solution, thereby creating a uniform coating edge.

[0013] Referring now to FIGS. 1A-1B, an exemplary process of forming a glove 100 is shown. In FIG. 1A, a fabric layer 104 is placed on a glove mold (or form) 102. Then, the glove mold 102, with the fabric layer 104 attached, may be dipped into a material to form a chemical protection layer 106 (or outer layer), wherein the chemical protection layer 106 may comprise a plurality of hollow beads. In some embodiments, the material of the chemical protection layer 106 may at least partially penetrate through the fabric layer 104, and may form a coating on the inner surface of the fabric layer 104, as well as the outer surface.

[0014] Referring now to FIGS. 2A-2B, a cross-sectional view of the glove 100 is shown, where FIG. 2A corresponds to FIG. 1A and FIG. 2B corresponds to FIG. 1B. In FIG. 2A, the fabric layer 104 is located adjacent to the glove mold 102. Then in FIG. 2B, the glove mold 102 and fabric layer 104 have been dipped to apply the chemical protection layer 106. As described above, the chemical protection layer 106 may comprise a plurality of hollow beads 120, where the hollow beads 120 may be dispersed throughout the glove 100. In some embodiments, the material of the chemical protection layer 106 may penetrate the fabric layer 104 to create an inner coating (or inner layer) 108 on the inner surface of the glove 100. In some embodiments, the hollow beads 120 may penetrate through the fabric layer 104 as well, wherein the hollow beads 120 may be small enough to pass through any openings in the fabric layer 104. In some embodiments, the hollow beads 120 may at least partially extend from the surface of the chemical protection layer 106,

providing a textured surface on the outer layer of the glove 100. The hollow beads 120 at least partially extend from the surface of the inner coating 108 (or inner layer), providing a textured surface on the inner layer of the glove 100. The hollow beads 120 may be dispersed evenly throughout the chemical protection layer 106, fabric layer 104, and inner coating 108.

[0015] The presence of the hollow beads 120 in the chemical protection layer 106 may not compromise the chemical protection qualities of the glove 100. The hollow beads 120 may influence the mechanical properties of the glove 100, especially abrasion, and this may be accounted for by including a crosslink agent in the formulation of the PU coating material.

[0016] In some embodiments, the hollow beads 120 may comprise a hollow glass material. In some embodiments, the hollow beads 120 may comprise one or more materials including hollow glass beads, hollow polyvinyl chloride (PVC) beads, hollow polyvinyl alcohol (PVA) beads, polymethyl methacrylate (PMMA) and/or other hollow organic and inorganic beads. In some embodiments, the hollow beads 120 may comprise a diameter less than approximately 50 micrometers (μm). In some embodiments, the hollow beads 120 may also be known as bubbles, spheres, microspheres, or particles. While described as being hollow, various other low-density materials including beads of micro foamed materials and the like (e.g., having a plurality of internal voids rather than a single internal void) can also be used. The beads formed from such materials can be made of the same materials and have the same dimensions as those described above.

[0017] In some embodiments, the glove 100 described above may provide improved comfort in wearing for a user. This may be demonstrated by the results of a comparison test with a typical PU glove that does not contain the hollow beads. Additionally, for reference, the glove 100 was compared with 100% lamb's wool, which may be considered a standard for softness and comfort. The results of the comparison test are shown below in Table 1. The testing was completed using a PhabrOmeter instrument, where a larger value indicates a higher dexterity and comfort. As can be seen in the table, the testing results for the glove containing the hollow beads are an improvement over the original (or typical) glove, and are closer in number to those results from the 100% lamb's wool.

Table 1: Comparison Test Results

Sample Name	Overall fabric hand	Flexibility	Smoothness	Softness
100% Lamb's wool	1	0.8223	0.1008	0.9048
Glove (with Hollow Beads)	0.7916	0.5265	0.2131	0.7842
Glove (Original)	0.6146	0.247	0.096	0.7077

[0018] A process for making the glove described above may comprise preparing the PU coating dispersion, wherein the PU coating dispersion (or solution) may comprise PU, hollow beads, pigment, and solvent. In some embodiments, the PU dispersion may be mixed by adding PU latex into the solvent (which may comprise dimethylformamide (DMF)). Then, the hollow beads and pigment may be added to the mixture, which may be stirred to control the viscosity of the solution.

[0019] Then, a fabric layer may be placed on the glove mold, and the mold and fabric may be dipped into the PU solution. In some embodiments, the mold and fabric layer may be heated before dipping. The dipping process may comprise one dip into the solution or multiple dips into the solution. The dipping process may allow the mold and fabric to sit in the solution for a set amount of time. In some embodiments, the dipping process may comprise leaching for approximately 30-40 minutes in hot water.

[0020] After the dipping process forms the inner and outer coating of the glove, the glove may be dried. For example, the glove may be dried in an oven at approximately 70 to 120 degrees Celsius. In some embodiments, during the drying process, the beads may float to and extend from the surface of the coating layers, creating the textured surfaces. In other words, when the volume of the wet coating layer is decreased by drying (i.e. some of the coating layer evaporates away), the hollow beads may "appear" on the surfaces of the glove.

[0021] Additionally, the section headings used herein are provided for consistency or to otherwise provide organizational cues. These headings shall not limit or characterize the invention(s) set out in any claims that may issue from this disclosure. Specifically and by way of example, although the headings might refer to a "Field," the claims should not be limited by the language chosen under this heading to describe the so-called field. Further, a description of a technology in the "Background" is not to be construed as an admission that certain technology is prior art to any invention(s) in this disclosure. Neither is the "Summary" to be considered as a limiting characterization of the invention(s) set forth in issued claims. Furthermore, any reference in this disclosure to "invention" in the singular should not be used to argue that there is only a single point of novelty in this disclosure. Multiple inventions may be set forth according to the limitations of the multiple claims issuing from this disclosure, and such claims accordingly define the invention(s), and their equivalents, that are protected thereby. In all instances, the scope of the claims shall be considered on their own merits in light of

this disclosure, but should not be constrained by the headings set forth herein.

[0022] Use of broader terms such as "comprises," "includes," and "having" should be understood to provide support for narrower terms such as "consisting of," "consisting essentially of," and "comprised substantially of." Use of the terms "optionally," "may," "might," "possibly," and the like with respect to any element of an embodiment means that the element is not required, or alternatively, the element is required, both alternatives being within the scope of the embodiment(s). Also, references to examples are merely provided for illustrative purposes, and are not intended to be exclusive.

Claims

1. A chemical protection glove (100) comprising:

an outer layer (106) comprising at least one layer of a chemically impermeable material comprising a polyurethane solution;
a fabric layer (104) located beneath the outer layer (106); and
an inner layer (108) configured to contact a user's skin comprising a plurality of hollow beads (120) dispersed throughout the inner layer (108), wherein the hollow beads (120) at least partially extend from a surface of the inner layer (108), and wherein the hollow beads (120) create a textured surface on the inner layer (108)
wherein the outer layer (106) and inner layer (108) comprise a polyurethane solution; and
wherein the polyurethane solution of the outer layer (106) extends through the fabric layer (104) to form the inner layer (108).

2. The chemical protection glove (100) of claim 1, wherein the outer layer (106) comprises a plurality of hollow beads (120) dispersed throughout the outer layer (106), wherein the plurality of hollow beads (120) at least partially extend from the surface of the outer layer (106), and wherein the hollow beads (120) create a textured surface on the outer layer (106).

3. The chemical protection glove (100) of claim 1, wherein the fabric layer (104) is saturated with a polyurethane solution comprising the hollow beads (120), and wherein the polyurethane solution extends through the fabric layer (104) to form the outer layer (106) and the inner layer (108).

4. The chemical protection glove (100) of claim 3, wherein the polyurethane solution further comprises a dimethylformamide solvent.

5. The chemical protection glove (100) of claim 1, wherein the hollow beads (120) have a diameter of less than or equal to about 50 micrometers.

6. The chemical protection glove (100) of claim 1, wherein the hollow beads (120) comprise a hollow glass material.

7. The chemical protection glove (100) of claim 1, wherein the hollow beads (120) comprise at least one of the following materials: hollow glass beads, hollow polyvinyl chloride beads, hollow polyvinyl alcohol beads, hollow polymethylmethacrylate beads, other hollow organic and inorganic beads, or any combination thereof.

8. The chemical protection glove (100) of claim 1, wherein the polyurethane solution comprises a crosslink agent.

9. A method for forming a chemical protection glove comprising:

placing a fabric layer onto a glove mold;
dipping the glove mold with the fabric layer into a polyurethane solution comprising a plurality of hollow beads;
forming an outer layer of the polyurethane solution onto the fabric layer, wherein the hollow beads are dispersed through the outer layer; and
forming an inner layer of the polyurethane solution by allowing the polyurethane solution to penetrate the fabric layer, wherein the hollow beads are dispersed throughout the inner layer.

10. The method of claim 9, further comprising: drying the glove.

11. The method of claim 9, further comprising: creating a textured surface on the inner layer by at least partially exposing the hollow beads of the inner layer.

12. The method of claim 9, further comprising: creating a textured surface on the inner layer by at least partially exposing the hollow beads of the outer layer.

13. The method of claim 9, further comprising: mixing the polyurethane solution, wherein the polyurethane solution comprises polyurethane latex, a solvent, the hollow beads, and a pigment.

Patentansprüche

1. Chemikalienschutzhandschuh (100), umfassend:

eine äußere Schicht (106), umfassend wenigstens eine Schicht aus einem chemisch undurchlässigen Material, das eine Polyurethanlösung umfasst;

eine Gewebeschicht (104), die unter der äußeren Schicht (106) angeordnet ist; und

eine innere Schicht (108), die zum Kontakt mit der Haut eines Anwenders gestaltet ist, umfassend eine Vielzahl von hohlen Perlen (120), die in der inneren Schicht (108) dispergiert sind, wobei die hohlen Perlen (120) wenigstens teilweise von der Oberfläche der inneren Schicht (108) vorragen, und wobei die hohlen Perlen (120) eine texturierte Oberfläche auf der inneren Schicht (108) erzeugen,

wobei die äußere Schicht (106) und die innere Schicht (108) eine Polyurethanlösung umfassen; und

wobei sich die Polyurethanlösung der äußeren Schicht (106) durch die Gewebeschicht (104) erstreckt, um die innere Schicht (108) zu bilden.

2. Chemikalienschutzhandschuh (100) gemäß Anspruch 1, wobei die äußere Schicht (106) eine Vielzahl von hohlen Perlen (120) umfasst, die in der äußeren Schicht (106) dispergiert sind, wobei die Vielzahl von hohlen Perlen (120) wenigstens teilweise von der Oberfläche der äußeren Schicht (106) vorragt, und wobei die hohlen Perlen (120) eine texturierte Oberfläche auf der äußeren Schicht (106) erzeugen.

3. Chemikalienschutzhandschuh (100) gemäß Anspruch 1, wobei die Gewebeschicht (104) mit einer Polyurethanlösung gesättigt ist, die die hohlen Perlen (120) umfasst, und wobei sich die Polyurethanlösung durch die Gewebeschicht (104) erstreckt, um die äußere Schicht (106) und die innere Schicht (108) zu bilden.

4. Chemikalienschutzhandschuh (100) gemäß Anspruch 3, wobei die Polyurethanlösung ferner ein Dimethylformamid-Lösungsmittel umfasst.

5. Chemikalienschutzhandschuh (100) gemäß Anspruch 1, wobei die hohlen Perlen (120) einen Durchmesser von kleiner als oder gleich etwa 50 Mikrometer aufweisen.

6. Chemikalienschutzhandschuh (100) gemäß Anspruch 1, wobei die hohlen Perlen (120) ein hohles Glasmaterial umfassen.

7. Chemikalienschutzhandschuh (100) gemäß Anspruch 1, wobei die hohlen Perlen (120) wenigstens eines der folgenden Materialien umfassen: hohle Glasperlen, hohle Polyvinylchloridperlen, hohle Polyvinylalkoholperlen, hohle Polymethylmethacrylatperlen, andere hohle oder und anorganische Perlen oder eine Kombination davon.

8. Chemikalienschutzhandschuh (100) gemäß Anspruch 1, wobei die Polyurethanlösung ein Vernetzungsmittel umfasst.

9. Verfahren zur Herstellung eines Chemikalienschutzhandschuhs, umfassend:

Anordnen einer Gewebeschicht auf einer Handschuhform;

Eintauchen der Handschuhform mit der Gewebeschicht in eine Polyurethanlösung, die eine Vielzahl von hohlen Perlen umfasst;

Bilden einer äußeren Schicht der Polyurethanlösung auf der Gewebeschicht, wobei die hohlen Perlen in der äußeren Schicht dispergiert sind; und

Bilden einer inneren Schicht der Polyurethanlösung durch Erlauben, dass die Polyurethanlösung die Gewebeschicht durchdringt, wobei die hohlen Perlen in der inneren Schicht dispergiert sind.

10. Verfahren gemäß Anspruch 9, ferner umfassend: Trocknen des Handschuhs.

11. Verfahren gemäß Anspruch 9, ferner umfassend: Erzeugen einer texturierten Oberfläche auf der inneren Schicht durch wenigstens teilweises Freilegen der hohlen Perlen der inneren Schicht.
12. Verfahren gemäß Anspruch 9, ferner umfassend: Erzeugen einer texturierten Oberfläche auf der inneren Schicht durch wenigstens teilweises Freilegen der hohlen Perlen der äußeren Schicht.
13. Verfahren gemäß Anspruch 9, ferner umfassend: Mischen der Polyurethanlösung, wobei die Polyurethanlösung Polyurethanlatex, ein Lösungsmittel, die hohlen Perlen und ein Pigment umfasst.

Revendications

1. Gant de protection chimique (100) comprenant :

une couche extérieure (106) comprenant au moins une couche d'un matériau imperméable aux produits chimiques comprenant une solution de polyuréthane ;
une couche de tissu (104) située sous la couche extérieure (106) ; et
une couche intérieure (108) configurée pour entrer en contact avec la peau d'un utilisateur, comprenant une pluralité de billes creuses (120) dispersées à travers la couche intérieure (108), les billes creuses (120) s'étendant au moins en partie à partir d'une surface de la couche intérieure (108), et les billes creuses (120) formant une surface texturée sur la couche intérieure (108),
dans lequel la couche extérieure (106) et la couche intérieure (108) comprennent une solution de polyuréthane ;
et
dans lequel la solution de polyuréthane de la couche extérieure (106) s'étend à travers la couche de tissu (104) pour former la couche intérieure (108).

2. Gant de protection chimique (100) selon la revendication 1, dans lequel la couche extérieure (106) comprend une pluralité de billes creuses (120) dispersées à travers la couche extérieure (106), la pluralité de billes creuses (120) s'étendant au moins en partie à partir de la surface de la couche extérieure (106), et les billes creuses (120) formant une surface texturée sur la couche extérieure (106).

3. Gant de protection chimique (100) selon la revendication 1, dans lequel la couche de tissu (104) est saturée d'une solution de polyuréthane comprenant les billes creuses (120), et dans lequel la solution de polyuréthane s'étend à travers la couche de tissu (104) pour former la couche extérieure (106) et la couche intérieure (108).

4. Gant de protection chimique (100) selon la revendication 3, dans lequel la solution de polyuréthane comprend en outre un solvant de type diméthylformamide.

5. Gant de protection chimique (100) selon la revendication 1, dans lequel les billes creuses (120) ont un diamètre inférieur ou égal à environ 50 micromètres.

6. Gant de protection chimique (100) selon la revendication 1, dans lequel les billes creuses (120) comprennent un matériau de type verre creux.

7. Gant de protection chimique (100) selon la revendication 1, dans lequel les billes creuses (120) comprennent au moins l'un des matériaux suivants : billes creuses en verre, billes creuses en chlorure de polyvinyle, billes creuses en alcool polyvinylique, billes creuses en polyméthacrylate de méthyle, autres billes creuses organiques et inorganiques, ou n'importe quelle combinaison de celles-ci.

8. Gant de protection chimique (100) selon la revendication 1, dans lequel la solution de polyuréthane comprend un agent de réticulation.

9. Procédé de formation d'un gant de protection chimique, comprenant :

la disposition d'une couche de tissu sur un moule à gants ;
le trempage du moule à gants portant la couche de tissu dans une solution de polyuréthane comprenant une pluralité de billes creuses ;
la formation d'une couche extérieure de la solution de polyuréthane sur la couche de tissu, les billes creuses

étant dispersées à travers la couche extérieure ; et
la formation d'une couche intérieure de la solution de polyuréthane en laissant la solution de polyuréthane pénétrer dans la couche de tissu, les billes creuses étant dispersées à travers la couche intérieure.

- 5 **10.** Procédé selon la revendication 9, comprenant en outre le séchage du gant.
11. Procédé selon la revendication 9, comprenant en outre la formation d'une surface texturée sur la couche intérieure en exposant au moins en partie les billes creuses de la couche intérieure.
- 10 **12.** Procédé selon la revendication 9, comprenant en outre la formation d'une surface texturée sur la couche intérieure en exposant au moins en partie les billes creuses de la couche extérieure.
13. Procédé selon la revendication 9, comprenant en outre le mélange de la solution de polyuréthane, la solution de
15 polyuréthane comprenant un latex de polyuréthane, un solvant, les billes creuses, et un pigment.

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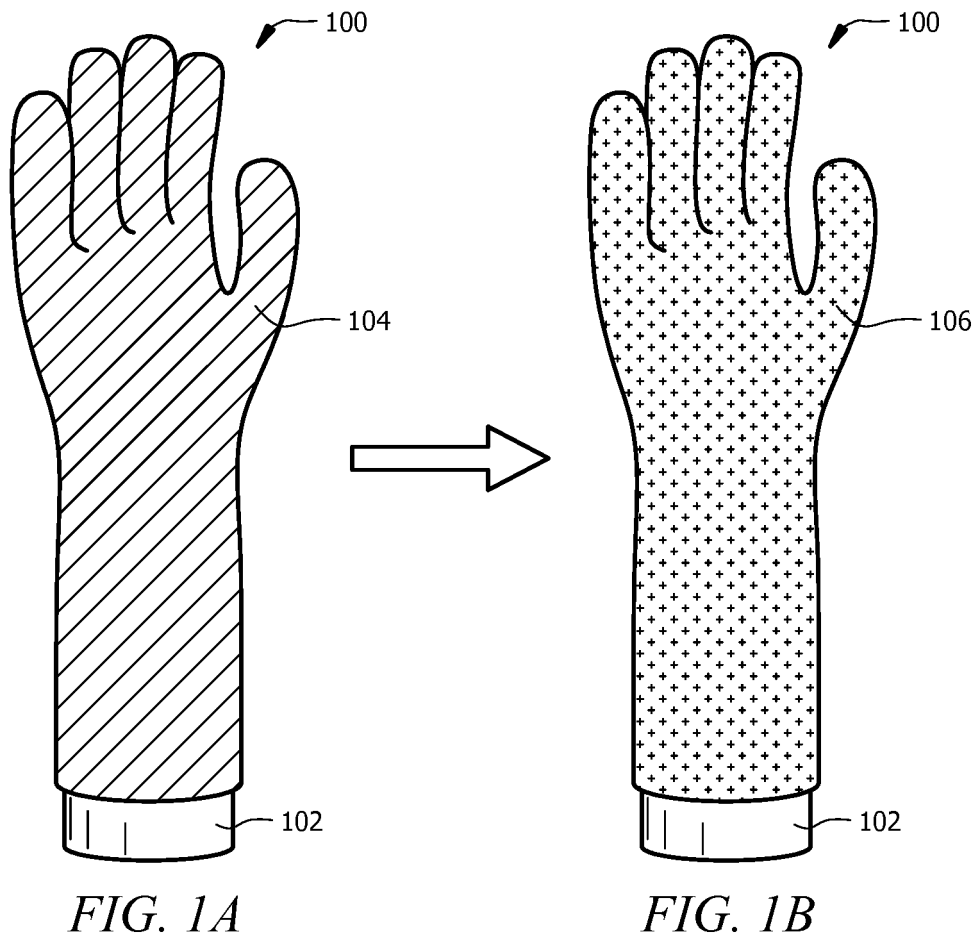
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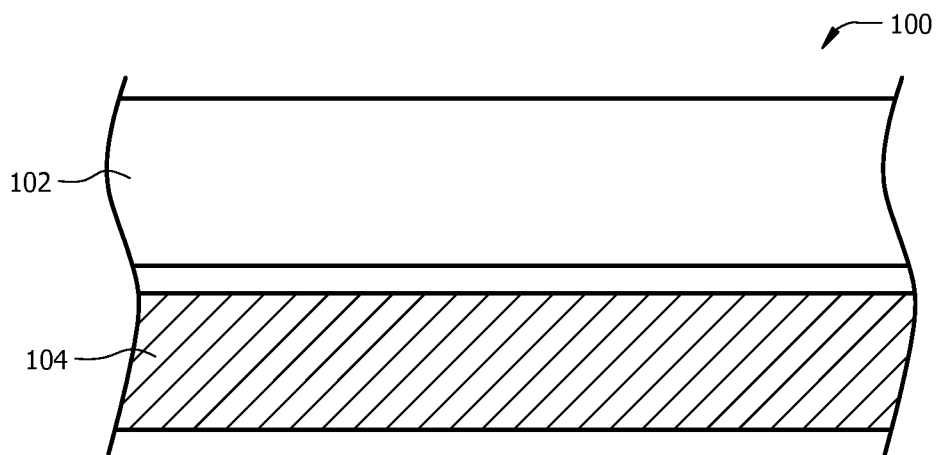


FIG. 2A

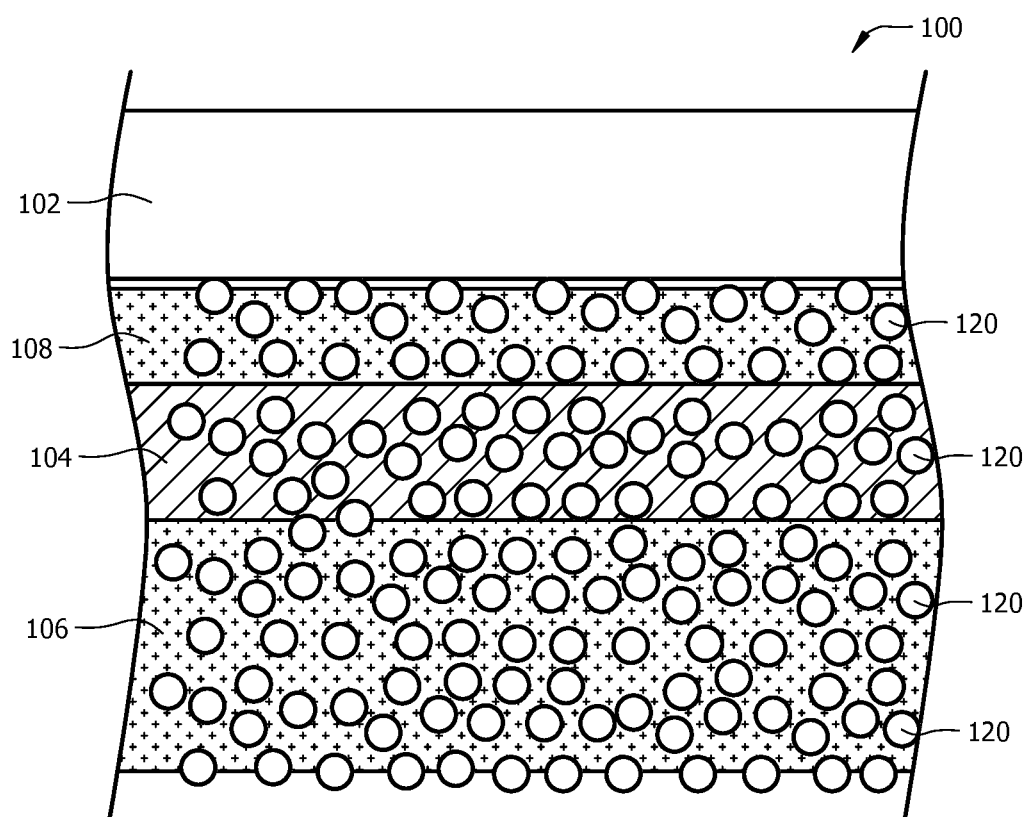


FIG. 2B

REFERENCES CITED IN THE DESCRIPTION

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