A seamless, form-fitting glove having improved comfort and chemical permeation resistance and a method of manufacture. The glove is multi-layered and formed utilizing a standard, latex dip line.
NOTES:
12: POLYETHYLENE
14: POLYVINYL ALCOHOL
16: POLYVINYL ALCOHOL
18: POLYURETHANE
20: POLYURETHANE
22: POLYURETHANE

FIG. 2
SEAMLESS CHEMICAL RESISTANT GLOVE

FIELD

[0001] The present invention pertains to seamless, chemical-resistant gloves. More particularly, the present invention relates to comfortable, form-fitting, chemical-resistant gloves made by the use of a dippable polyethylene dispersion and a dip-line process.

BACKGROUND

[0002] Although there are many types of chemical-resistant gloves available, most suffer the disadvantage of being uncomfortable to the wearer due to the presence of stiff, inflexible materials and especially due to the presence of a seam.

[0003] Historically, in order to obtain the necessary chemical resistance, various membranes impervious to certain chemical agents were laminated or heat-sealed together to produce a chemical-resistant glove. These types of gloves made hand movement difficult for the wearer.

[0004] Therefore, there exists a great need for a chemical-resistant glove that is seam-free and comfortable.

BRIEF DESCRIPTION OF THE DRAWINGS

[0005] FIG. 1 illustrates a glove that can be formed according to the present invention; and

[0006] FIG. 2 is a depiction of an exemplary cross-section of a portion of the glove of FIG. 1.

DETAILED DESCRIPTION

[0007] While embodiments of this invention can take many different forms, specific embodiments thereof are shown in the drawings and will be described herein in detail with the understanding that the present disclosure is to be considered as an exemplification of the principles of the invention, as well as the best mode of practicing same, and is not intended to limit the invention to the specific embodiment illustrated.

[0008] The present invention relates to a skin-covering, which has improved comfort and also improved resistance to chemical permeation. The present invention includes a method of forming such a skin-covering. Most preferably, the skin-covering is a five-fingered glove, but it also can be a mitten having only a thumb or a mitten having any combination of fingers present from zero to five. (See FIG. 1) Such skin-covering is not limited to a glove or mitten, and can comprise an apron, coat, hat, scarf, or sock.

[0009] The chemical-resistant nature of the glove results from the presence of a multi-layer composition of a substantially water-proof layer and a chemical-resistant layer. Preferably, the substantially water-proof layer is a polyethylene layer, although generally it can be made of any material that imparts a substantially water-proof character to the glove. Preferably, the chemical-resistant layer is a polyvinyl alcohol (PVA) layer, although any material that imparts a chemical-resistant nature to the glove is useful.

[0010] Most preferably, the glove also comprises a donnable layer, which lies next to the skin. In terms of orientation, the PVA layer is necessarily closer in distance and placement to the donnable layer than the polyethylene layer. The layer of polyethylene is nearer to the outer surface of the glove, and provides a substantially water-proof nature to the glove. It also provides some chemical resistance. This arrangement is a multi-layer sandwiched structure.

[0011] The PVA layer primarily provides chemical permeation resistance. It is well-known that a broad range of chemicals such as organic solvents, plasticizers, pesticides and detergents cannot readily permeate PVA.

[0012] U.S. Pat. Nos. 4,902,558 and 5,059,477, both assigned to Honeywell, which are hereby incorporated by reference, discuss the advantages of having a PVA layer in a chemical-resistant glove. These patents also relate that water will tend to swell and plasticize the PVA membrane. Therefore, it is preferable that the PVA layer be protected on both top and bottom from the presence of water. Therefore, if the PVA layer is next to the donnable layer, the donnable layer must be substantially water-proof. Preferably, the donnable layer is polyurethane or latex rubber. A substantially waterproof fabric material is also contemplated.

[0013] It is to be understood that there is no set limitation as to the number of layers that the glove can have so long as the glove is comfortable and flexible enough for its intended use. There is also no limitation as to the presence of duplicate layers. There is only the limitation that at least one PVA layer must be nearer to the donnable layer than the polyethylene layer, such that the polyethylene layer provides protection from water to the PVA layer. Also, in another embodiment, a coagulant can be applied prior to the polyethylene layer.

[0014] A preferred embodiment of the glove (10) comprises multiple layers, comprised of at least one outer layer of polyethylene (12), which enclose and protect two adjacent layers of PVA (114, 16), which are directly adjacent to three polyurethane layers (18-22) for a grand total of six layers. (See FIG. 2) Layer 22 is the donnable layer, which when worn is adjacent to the skin of the wearer. There are no restrictions as to the arrangement of the layers except that the PVA layer preferably is protected from moisture. Also, the thickness of the layers ranges from about 0.5 mm to about 1 mm for both polyethylene and PVA. The glove can contain about 1 to 50 weight percent polyvinyl alcohol and 1 to 50 weight percent polyethylene. The thickness of the donnable layer is in the range of about 0.5 mm to about 6 mm thick, or about 1 to 50 weight percent.

[0015] In another embodiment, the polyvinyl alcohol layer (14, 16) is in the range of about 1 to 30 weight percent and the polyethylene layer (12) is in the range of about 1 to 30 weight percent, and the polyurethane layer (18-22) is in the range of about 1 to 40 weight percent.

[0016] The present invention also contemplates a method of forming a seamless, chemical-resistant glove. Embodiments of this method convert dry polymers into latex that can be economically dipped on standard latex type dip lines. The conversion process entails dissolving a polymer in a solvent, adding water and surfactant, then dispersing to a desired particle size. The solvent is then removed by applying vacuum leaving a polymer latex dispersion. The resulting latex dispersion can be then allowed to coagulate to increase the solids content of the latex.

[0017] In a preferred embodiment, the solvent is toluene. Preferred surfactants include sodium dodecylbenzene sulfonate and 1,2-benzisothiazolin-3-one. The method can also encompass the addition of one or more additives wherein the additives comprise an adhesive, a colorant, an anti-microbial agent, a fiber, a fragrance or mixtures thereof. A coagulant can also be applied between any layers.

[0018] The method of forming a seamless, chemical-resistant glove comprises preparing a dippable polyethylene dispersion; dipping a hand-shaped former into the dippable
polyethylene dispersion so that a continuous layer of polyethylene is deposited on the former and removing the former from the polyethylene solution; dipping the former into an aqueous solution of polyvinyl alcohol so that a continuous layer of polyvinyl alcohol is deposited on the former and removing the former from the polyvinyl alcohol solution; dipping the former into a polyurethane solution so that a continuous layer of polyurethane is deposited on the former and removing the former from the polyurethane solution; and stripping the glove from the former. The paired dipping and removing steps can be independently repeated multiple times to form multiple layers, as desired.

[0019] From the foregoing, it will be observed that numerous variations and modifications may be effected without departing from the spirit and scope of the invention. It is to be understood that no limitation with respect to the specific article and/or method illustrated herein is intended or should be inferred. It is, of course, intended to cover by the appended claims all such modifications as fall within the scope of the claims.

1. A chemical resistant glove comprising:
   a seamless multi-layered composition comprised of:
   at least one polyethylene layer;
   at least one polyvinyl alcohol layer; and;
   a donnable layer;
   wherein the polyvinyl alcohol is nearer to the donnable layer than is the polyethylene layer.

2. The glove of claim 1 wherein the polyethylene layer is in the range of about 0.5 mm to about 1 mm thick and the polyethylene layer is in the range of about 0.5 mm to about 1 mm thick.

3. The glove of claim 1 wherein the polyvinyl alcohol layer is in the range of about 1 to 50 weight percent and the polyethylene layer is in the range of about 1 to 50 weight percent.

4. The glove of claim 1 wherein the polyvinyl alcohol layer comprises multiple polyvinyl alcohol layers, wherein the polyethylene layer comprises multiple polyethylene layers, wherein the donnable layer comprises multiple layers.

5. The glove of claim 1 wherein the donnable layer comprises a substantially water-proof layer.

6. The glove of claim 5 wherein the donnable layer comprises polyurethane or latex rubber.

7. The glove of claim 5 wherein the donnable layer is in the range of about 0.5 mm to about 6 mm thick.

8. The glove of claim 1 wherein the donnable layer is in the range of about 1 to 50 weight percent.

9. The glove of claim 1 further comprising at least one additive wherein the additive comprises an adhesive, a colorant, an anti-microbial agent, a fiber, a fragrance or mixtures thereof.

10. A chemical-resistant glove comprising a seamless multilayer composition comprised of:
    at least one polyethylene layer;
    at least one polyvinyl alcohol layer;
    a donnable layer; and
    at least one additional layer wherein the additional layer comprises:
    a fabric, a polymer, a solid material or mixtures thereof.

11. The glove of claim 10 wherein the donnable layer comprises polyurethane or latex rubber.

12. The glove of claim 10 comprising multiple layers of polyvinyl alcohol and multiple layers of polyethylene.

13. The glove of claim 10 wherein the polyvinyl alcohol layer is in the range of about 0.5 mm to about 1 mm thick; the polyethylene layer is in the range of about 0.5 mm to about 1 mm thick; and the donnable layer is in the range of about 0.5 mm to about 6 mm thick.

14. The glove of claim 10 wherein the polyvinyl alcohol layer is in the range of about 1 to 30 weight percent and the polyethylene layer is in the range of about 1 to 30 weight percent, and the polyurethane layer is in the range of about 1 to 40 weight percent.

15. The glove of claim 10 further comprising:
    at least one additive wherein the additive comprises:
    an adhesive, a colorant, an anti-microbial agent, a fiber, a fragrance or mixtures thereof.

16. A method of forming a seamless chemical-resistant glove comprising:
   a) preparing a dippable polyethylene dispersion;
   b) dipping a hand-shaped former into the dippable polyethylene dispersion so that a continuous layer of polyethylene is deposited on the former and removing the former from the polyethylene solution;
   c) dipping the former into an aqueous solution of polyvinyl alcohol so that a continuous layer of polyvinyl alcohol is deposited on the former and removing the former from the polyvinyl alcohol solution;
   d) dipping the former into a polyurethane solution so that a continuous layer of polyurethane is deposited on the former and removing the former from the polyurethane solution; and
   e) stripping the former of the glove.

17. The method of claim 16 wherein the dipping and removing of b, c, and d are each independently repeated multiple times to form multiple layers.

18. The method of claim 16 wherein the preparation of a dippable polyethylene dispersion comprises:
   dissolving polyethylene in a solvent to form a polyethylene solution;
   adding water and one or more surfactants to the polyethylene solution;
   dispersing to a desired particle size; and
   removing the solvent leaving a polyethylene dispersion.

19. The method of claim 16 wherein the solvent is toluene.

20. The method of claim 16 further comprising:
   adding at least one additive wherein the additive comprises:
   an adhesive, a colorant, an anti-microbial agent, a fiber, a fragrance or mixtures thereof.

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