US 20060085887A1

(19) United States
(12) Patent Application Publication (10) Pub. No.: US 2006/0085887 A1
Palomo et al. (43) Pub. Date: Apr. 27, 2006

(54) IMPERVIOUS PARTIAL SLEEVE WITH GLOVE RETENTION

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(21) Appl. No.: **11/250,651**

(22) Filed: **Oct. 14, 2005**

Related U.S. Application Data

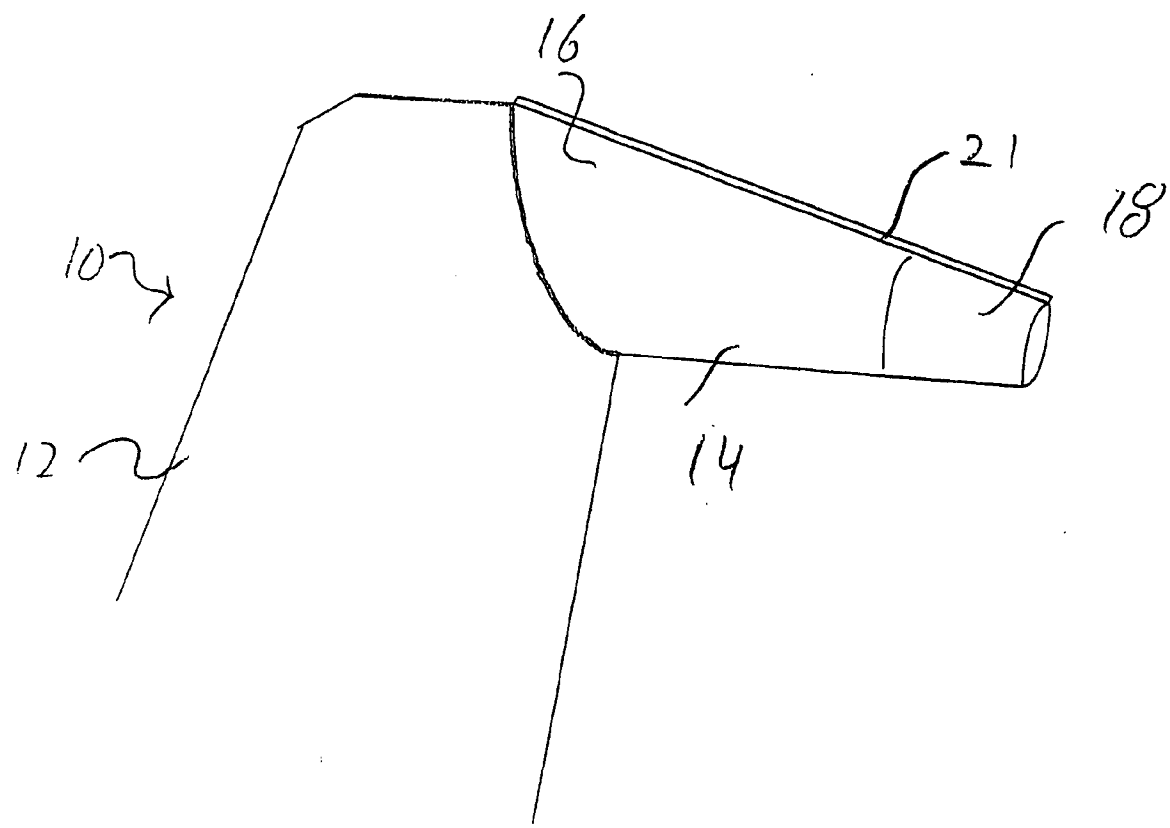
(60) Provisional application No. 60/620,876, filed on Oct. 21, 2004.

Publication Classification

(51) **Int. Cl.**
A41D 27/12 (2006.01)
(52) **U.S. Cl.** **2/59**

(57) **ABSTRACT**

An improved protective garment in accordance with the principles of the present invention provides an improved interface between a glove and sleeve of the protective garment. An improved protective garment in accordance with the principles of the present invention is easily incorporated with the protective garment and economically cost effective to implement and use. An improved protective garment in accordance with the principles of the present invention provides an impervious partial sleeve having a surface exhibiting non-adhesive friction when in contact with dry glove materials.



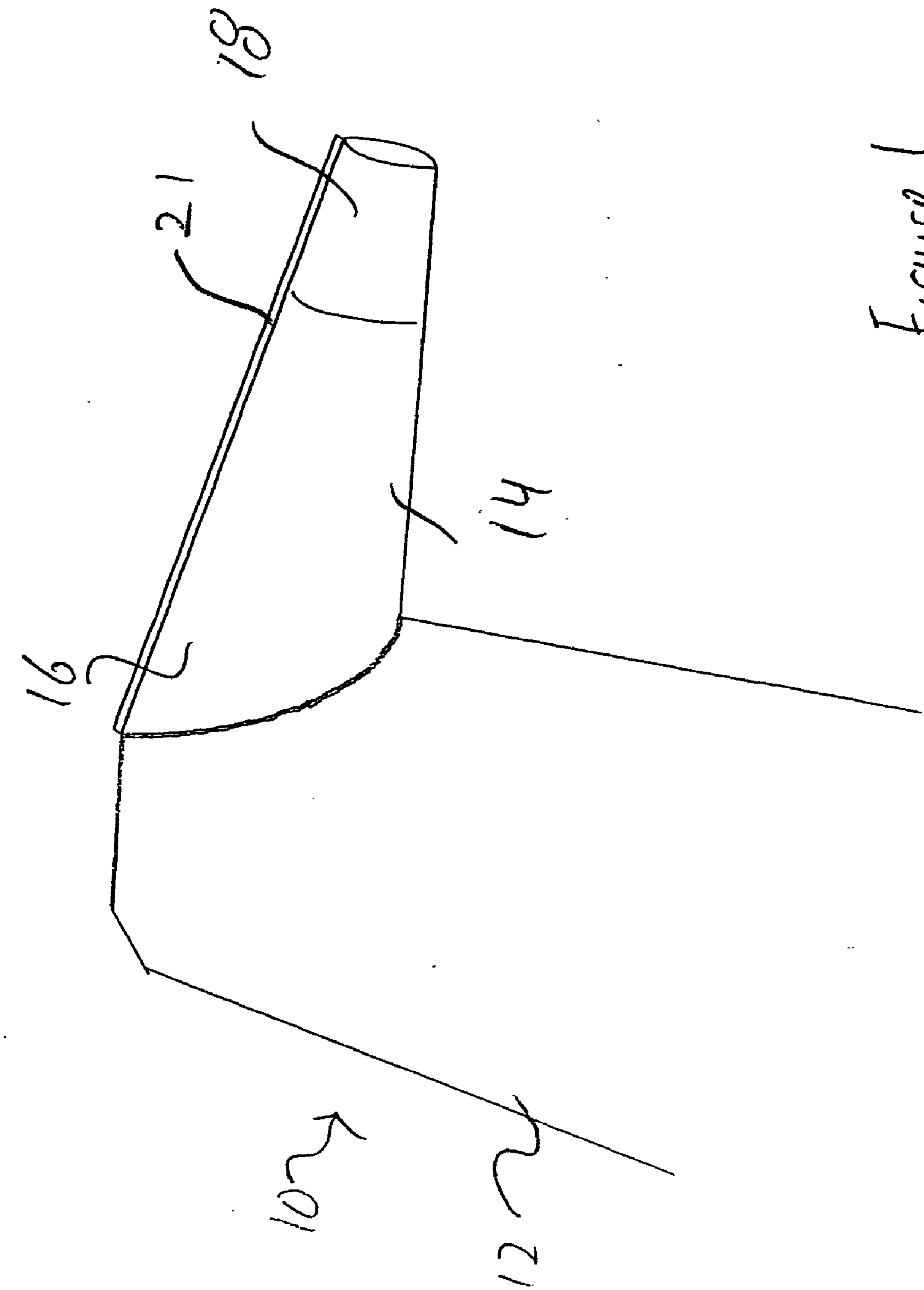


Figure 1

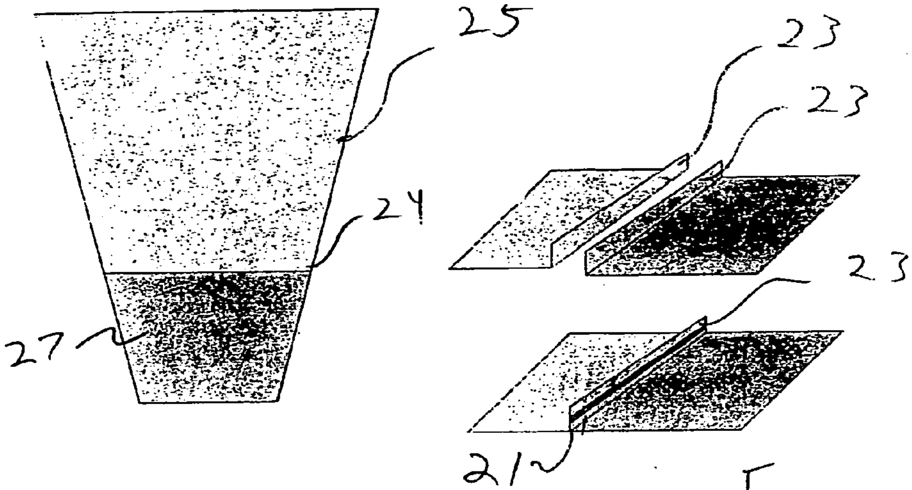


Figure 3

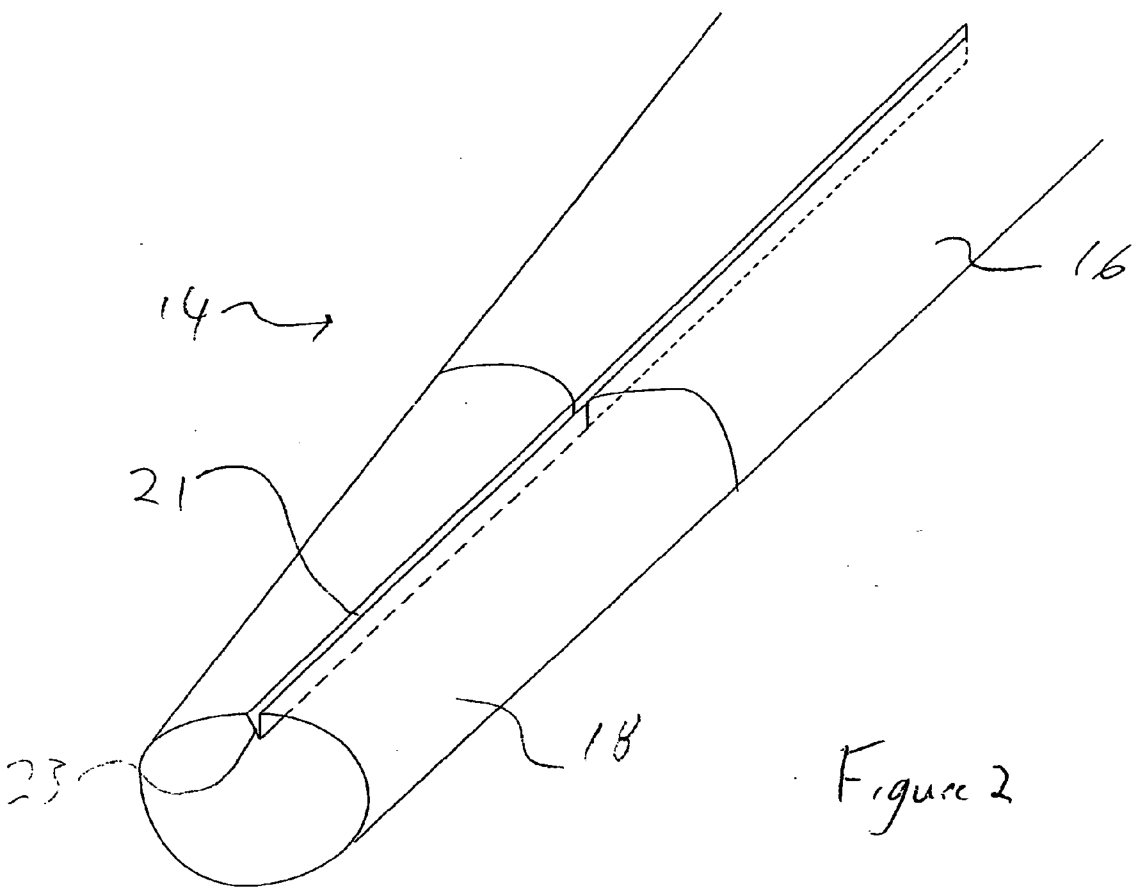


Figure 2

IMPERVIOUS PARTIAL SLEEVE WITH GLOVE RETENTION

RELATED APPLICATION

[0001] This application is related to U.S. Provisional Patent Application Ser. No. 60/620,876 titled "Impervious Partial Sleeve and Method of Manufacture" filed on 21 Oct. 2004.

FIELD OF THE INVENTION

[0002] The present invention relates to protective garments for use with gloves, for example surgical gowns used with surgical gloves.

BACKGROUND OF THE INVENTION

[0003] The practice of wearing of a surgical gown and surgical gloves to protect health care providers from contamination by body fluids is well accepted; however, one risk faced by health care providers is that such protective barrier can become breached during interaction with a patient. With the increase of highly infectious diseases, such as the acquired immune deficiency syndrome (AIDS) and hepatitis, the risk to health care providers of such protective barrier breach has become acute.

[0004] Typically, protective garments rely on the barrier properties of the fabrics used in the garments and on the construction and design of the garment. Openings in the garments that are located in positions subject to contact with body fluids pose a particular risk of contamination.

[0005] In the medical industry, the protective gloves are pulled up and over the sleeve of a gown or garment to reduce the openings in the garment; however, the interface between the glove and the protective garment pose a particular risk of contamination. For example, a common issue with surgical gloves is glove "roll-down" or slippage between the interior side of the glove and the surgical gown sleeve. When the glove rolls down on the sleeve, the wearer is at greater risk of exposure to body fluids.

[0006] An additional problem associated with the use of surgical gloves is a phenomenon known as "channeling". Channeling occurs when the sleeve of the gown is bunched up under the glove as a result of pulling and rolling the glove up over the cuff and sleeve. Channels may develop along the wrist which can become accessible to body fluids running down the outside of the sleeve of the gown. Body fluids can work down along the channels between the outer surface of the gown and inner surface of the surgical glove. These fluids may then contaminate the gown cuff, which lies directly against the wrist or forearm, particularly if the cuff is absorbent or fluid pervious.

[0007] Several attempts have been made to minimize exposure at the glove and gown interface. For example, surgeons commonly use adhesive tape wrapped around the glove portion extending over the gown sleeve to prevent channeling and roll down of the glove; however, common adhesives utilized in tapes are subject to degradation by water and body fluids. It is also common to stretch a rubber band around the glove and sleeve; however, it is difficult to adjust or vary the pressure exerted by the rubber band other than by having a variety of rubber bands of different sizes and tensions available for use.

[0008] More recently, attempts have been made to address the exposure at the glove and gown interface structurally in the garments. One such attempt involves sealing together the interface of the garment and gloves. The seal is produced by narrowing the diameter of the distal end of the gown over which the protective glove is placed. The junction of the garment and glove is then sealed with a liquid adhesive. This attempt produces a costly integrated garment that is cumbersome and difficult to use in practice; for example, it is very difficult to match the appropriate size of the gown for a given user with the right glove size.

[0009] Another such attempt utilizes a raised band disposed on the sleeves of the gown. The raised band attempts to inhibit a glove pulled there over from rolling or sliding. Incorporating a raised band to the sleeves of the gown adds to the complexity and costs of manufacturing the gown and has proven less than optimal. A related attempt involves adding an adhesive to the sleeve to secure the glove thereon. As previously noted, adhesives are subject to degradation by water and body fluids. In addition, the use of adhesives may require a release liner that would be cumbersome to remove prior to pulling on the glove. In addition the glove may stick to the adhesive before it is positioned properly and tear the glove. Other contaminates could be transferred to the adhesive from any incidental contact.

[0010] Thus, what would be beneficial is an improved interface between a glove and a sleeve of a protective garment. Such improved interface should be easily incorporated with the protective garment and economically cost effective to implement and use.

SUMMARY OF THE INVENTION

[0011] A protective garment in accordance with the principles of the present invention provides an improved interface between a glove and sleeve of the protective garment. A protective garment in accordance with the principles of the present invention is easily incorporated with the protective garment and economically cost effective to implement and use. A protective garment in accordance with the principles of the present invention provides an impervious partial sleeve having a surface exhibiting non-adhesive friction when in contact with dry glove materials.

BRIEF DESCRIPTION OF THE DRAWINGS

[0012] **FIG. 1** is a perspective view of a surgical gown in accordance with the present invention.

[0013] **FIG. 2** is a close-up perspective view of a sleeve portion in accordance with the present invention.

[0014] **FIG. 3** is a schematic of a blank or pattern for making a sleeve portion in accordance with the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0015] An improved protective garment in accordance with the principles of the present invention comprises an improved interface between a glove and sleeve of the protective garment. In one embodiment of the present invention, an improved interface is provided between a glove and a sleeve of a protective garment. In one embodiment of the present invention, an improved interface is provided between a surgical glove and a sleeve of a surgical gown. In one embodiment of the present invention, an impervious partial sleeve is designed to augument an unreinforced or fabric reinforced single use surgical gown sleeve from above a cuff hem to about mid-forearm, thus providing an impervious layer underneath the glove cuff. In addition, the impervious partial sleeve comprises a surface exhibiting friction when in contact with dry glove materials will help hold the glove up on the forearm. Thus, an improved protective garment in accordance with the principles of the present invention is an improvement over prior art unreinforced gowns as such prior art gowns that typically consist of a spunlaced or spunbond/meltblown/spunbond (SMS) non-woven fabric throughout the body and sleeves. These fabrics are typically not impervious and do not help to provide significant friction against the inside cuff of the glove.

[0016] In one embodiment, the impervious partial sleeve can be a two-layer structure comprising a non-woven fabric and a film. Typical non-woven fabrics examples that can be used include, but are not limited to carded polyester, spun laced wood pulp and polyester, spun bond polyolefin, and SMS polyolefin. Typical film examples that can be used include, but are not limited to polyethylene, ethylene-vinyl-acetate copolymer (EVA), molten ethylene methyl acrylate (EMA), polyester co-polymers, polyurethanes, and mettalocine polyolefins. In one embodiment, the film can be Hytrel® co-polyester elastomer available from E. I. DuPont De Nemours & Company, 1007 Market Street, Wilmington Del. 19898 U.S.A. Multilayer films that may incorporate some of the example polymers listed but put the friction layer on the top layer for contact with the glove may also be used. The film and non-woven fabric can be laminated for example by adhesive, thermal bonding or by extrusion coating.

[0017] Referring to **FIG. 1**, a perspective view of a portion of a surgical gown in accordance with the present invention is seen. The surgical gown **10** includes a body portion **12** and a sleeve portion **14**. The surgical gown **10** including the sleeve portion **14** can comprise a non-woven fabric such as, for example, spun laced wood pulp and polyester, spun bond polyolefin, and SMS polyolefin. Referring to **FIG. 2**, a close-up perspective view of a sleeve portion **14** in accordance with the present invention is seen. In one embodiment of the present invention, the sleeve portion **14** comprises an upper sleeve **16** and a lower sleeve **18**.

[0018] In accordance with the present invention, the lower sleeve **18** comprises an impervious partial sleeve that augments the sleeve portion **14** from above a cuff hem to about mid-forearm, thus providing an impervious layer underneath the glove cuff. In further accordance with the present invention, the lower sleeve **18** comprises a surface exhibiting friction when in contact with dry glove materials that will help to hold the glove up on the forearm. As previously described, the lower sleeve **18** can comprise a film adhered to the non-woven fabric. In one embodiment, the film can be Hytrel® co-polyester elastomer available from E. I. DuPont De Nemours & Company. The film and non-woven fabric can be laminated for example by adhesive, thermal bonding or by extrusion coating.

[0019] Referring to **FIG. 3**, a schematic of a blank or pattern **20** for making a sleeve portion **14** in accordance with the present invention is seen. The blank **20** comprises an upper sleeve blank **25** and a lower sleeve blank **27**, both in the form of a trapezoid. To make the present invention, the lower sleeve blank **27** can be attached to the non-woven fabric of the upper sleeve blank **25** by heat sealing. A seam **24** is formed where the edges of the upper sleeve blank **25** and the lower sleeve blank **27** overlap and the non-woven fabric can be bonded to the lower sleeve blank **27**. Other means can be used to seal the lower sleeve blank **27** to the upper sleeve blank **25** such as for example adhesive or ultrasonic sealing.

[0020] After the lower sleeve blank **27** is attached to the upper sleeve blank **25**, the whole length of the sleeve blank can be heat sealed to form the sleeve portion **14**. The length of the sleeve portion **14** can be closed into a tube by for example mechanically bonding the outer film layer to itself to form a seam **21** such as for example by hot melt glue. This will yield a sealed ridge **23** on the inside of the sleeve portion **14**. Other means can be used to seal the sleeve portion **14** such as for example adhesive or ultrasonic sealing. In one embodiment, a cuff (not shown) can then be attached to the end of the lower sleeve blank **27**. Both sleeve portions **14** of the gown **10** would have this film of the lower sleeve blank **27**. In an alternative embodiment, the film can be adhered to the lower portion of a full nonwoven sleeve blank.

[0021] A mechanical bond can be achieved with for example thermal, chemical or adhesive bonds. The thermal bond is a method that applies heat to either one or both surfaces with heat from a source, pressure and/or vibration until one or both materials reach an emulsified state, then mechanically pressing the materials together forming a seal. The chemical process is a procedure in which a chemical agent is added between both edges of the materials creating a chemical reaction that emulsifies the material, and then mechanically pressing materials together until the chemical reaction is completed. The mechanical process is a method that puts adhesive between the materials. Pressure is used to bond the layers together and form a seal. Pressing the materials against the adhesive, the material adheres to the adhesive forming a seal. The adhesive is applied for example with an applicator, tape substrates or tapes. The use of a film outer layer and the mechanically bonded seam will allow an impervious claim on the fabric and the seam based on the standard test method of ASTM International F1671, Standard Test Method for Resistance of Materials Used in Protective Clothing to Penetration by Blood-Borne Pathogens Using Phi-X174 Bacteriophage Penetration as a test system.

[0022] The following are examples are presented for the purposes of explanation and not to narrow the scope of the present invention.

EXAMPLE 1

[0023] In this example, a breathable impervious (BI) surgical gown was made in accordance with the principles of the present invention utilizing as the film Hytrel® co-polyester elastomer available from E. I. DuPont De Nemours & Company. The film was adhered to the non-woven fabric by adhesive. The lower sleeve blank was attached to the non-woven fabric of the upper sleeve blank by adhesive, forming a seam where the edges of the upper sleeve blank and the lower sleeve blank overlap. The length of the sleeve blank was then adhered with adhesive to form a tube.

[0024] Using a sample size of 10 of the BI surgical gowns, the coefficient of friction was tested between the surgical gowns and two dry gloves utilizing the INDA Standard Test (IST) 140.1 (01) (Static and Kinetic Coefficient of Friction of Nonwoven Fabrics method. A constant rate of motion machine was used, such as a Zwick tester available from Zwick USA, 1620 Cobb International Blvd., Suite 1, Kennesaw, Ga. 30152. The test used a moving sled with a stationary plane to determine the starting (static) and sliding (kinetic) friction between two substrates. In this case the glove cuff was wrapped around the sled exposing the inside surface, which contacts the gown sleeve. The gown sleeve fabric was attached to the plane so that the sled wrapped with the glove would slide over it. The two dry gloves were the Biogel gloves (Catalog Number 30475) available from Regent Medical, 3585 Engineering Drive, Suite 250, Norcross, Ga. 30092 U.S.A. and the Protegrity gloves (Catalogue Number 2D72N41) available from Cardinal Healthcare, 1430 Waukegan Road, McGaw Park, Ill. 60085 U.S.A.

[0025] The average static coefficient of friction between the BI surgical gown of the present invention and the Biogel glove was 0.64 (with a standard deviation of 0.13) while the average static coefficient of friction between the BI surgical gown of the present invention and the Protegrity glove was 0.71 (with a standard deviation of 0.15).

EXAMPLE 2

[0026] In this example, again using a sample size of 10, the coefficient of friction was tested utilizing the same method between an Astound surgical gown (Catalogue Number 9545) available from Cardinal Healthcare and the Biogel gloves (Catalog Number 30475) and the Protegrity gloves (Catalogue Number 2D72N41). The average static coefficient of friction between the Astound surgical gown and the Biogel glove was 0.07 (with a standard deviation of 0.03) while the average static coefficient of friction between the Astound surgical gown and the Protegrity glove was 0.17 (with a standard deviation of 0.05).

EXAMPLE 3

[0027] In this example, again using a sample size of 10, the coefficient of friction was tested utilizing the same method between an KC Ultra surgical gown (Catalogue Number 95121) available from Kimberly-Clark, 1400 Holcomb Bridge Road, Roswell, Ga. 30076 U.S.A. and the Biogel gloves (Catalog Number 30475) and the Protegrity gloves (Catalogue Number 2D72N41). The average static coefficient of friction between the KC Ultra surgical gown and the Biogel glove was 0.09 (with a standard deviation of 0.03) while the average static coefficient of friction between the KC Ultra surgical gown and the Protegrity glove was 0.17 (with a standard deviation of 0.06).

EXAMPLE 4

[0028] In this example, again using a sample size of 10, the coefficient of friction was tested utilizing the same method between an Impervious Astound surgical gown (Catalogue Number 9040) available from Cardinal Healthcare and the Biogel gloves (Catalog Number 30475) and the Protegrity gloves (Catalogue Number 2D72N41). The average static coefficient of friction between the Impervious Astound surgical gown and the Biogel glove was 0.18 (with a standard deviation of 0.05) while the average static coefficient of friction between the Impervious Astound surgical gown and the Protegrity glove was 0.20 (with a standard deviation of 0.06).

EXAMPLE 5

[0029] In this example, again using a sample size of 10, the coefficient of friction was tested utilizing the same method between an Optima surgical gown (Catalogue Number 9507CE) available from Cardinal Healthcare and the Biogel gloves (Catalog Number 30475) and the Protegrity gloves (Catalogue Number 2D72N41). The average static coefficient of friction between the Optima surgical gown and the Biogel glove was 0.10 (with a standard deviation of 0.01) while the average static coefficient of friction between the Optima surgical gown and the Protegrity glove was 0.29 (with a standard deviation of 0.12).

[0030] It is seen that a surgical gown in accordance with the principles of the present invention marked an increase in the coefficient of friction with dry surgical gloves. Thus, an improved surgical gown in accordance with the principles of the present invention provides an improved interface between a glove and sleeve of a protective garment. An improved surgical gown in accordance with the principles of the present invention is easily incorporated with the protective garment and economically cost effective to implement and practice.

[0031] While the invention has been described with specific embodiments, other alternatives, modifications, and variations will be apparent to those skilled in the art. Accordingly, it will be intended to include all such alternatives, modifications and variations set forth within the spirit and scope of the appended claims.

What is claimed is:

1. A protective garment comprising:

at least a portion of a sleeve having a surface applied thereon to increase non-adhesive friction when in contact with dry glove materials.

2. The protective garment of claim 1 further wherein the surface applied to at least a portion of the sleeve is impervious.

3. The protective garment of claim 1 further wherein the surface exhibiting non-adhesive friction comprises the sleeve from above a cuff to about mid-forearm.

4. The protective garment of claim 1 further wherein the surgical gown comprises an unreinforced single use surgical gown.

5. The protective garment of claim 1 further wherein the surgical gown comprises a fabric reinforced single use surgical gown.

6. The protective garment of claim 1 further wherein the surface exhibiting non-adhesive friction comprises a two-layer structure comprising a non-woven fabric and a film.

7. The protective garment of claim 6 further wherein the film is multilayer.

8. The protective garment of claim 6 further wherein the film is selected from the group comprising co-polyester elastomer, polyurethane, polyethylene, ethylene-vinyl-acetate copolymer (EVA), molten ethylene methyl acrylate (EMA), mettalocine polyolefins, and combinations thereof.

9. The protective garment of claim 6 further wherein the film comprises Hytrel® co-polyester elastomer available from E. I. DuPont De Nemours & Company.

10. A sleeve in a garment comprising:

a surface applied to at least a portion of a sleeve that is impervious and increases non-adhesive friction when in contact with dry glove materials.

11. The sleeve of claim 10 further wherein the surface a surface applied to at least a portion of a sleeve comprises the sleeve from above a cuff to about mid-forearm.

12. The sleeve of claim 10 further wherein the surgical gown comprises an unreinforced single use surgical gown.

13. The sleeve of claim 10 further wherein the surgical gown comprises a fabric reinforced single use surgical gown.

14. The sleeve of claim 10 further wherein the surface exhibiting non-adhesive friction comprises a two-layer structure comprising a non-woven fabric and a film.

15. The sleeve of claim 14 further wherein the film is multilayer.

16. The sleeve of claim 14 further wherein the film is selected from the group comprising co-polyester elastomer, polyurethane, polyethylene, ethylene-vinyl-acetate copolymer (EVA), molten ethylene methyl acrylate (EMA), mettalocine polyolefins, and combinations thereof.

17. The sleeve of claim 14 further wherein the film comprises Hytrel® co-polyester elastomer available from E. I. DuPont De Nemours & Company.

18. A method of manufacturing a protective garment comprising:

adhering to at least a portion of a sleeve a surface that increases non-adhesive friction when in contact with dry glove materials.

19. The method of manufacturing of claim 18 further comprising adhering the surface exhibiting non-adhesive friction to the sleeve from above a cuff to about mid-forearm.

20. The method of manufacturing of claim 18 further comprising manufacturing an unreinforced single use surgical gown.

21. The method of manufacturing of claim 18 further comprising manufacturing a fabric reinforced single use surgical gown.

22. The method of manufacturing of claim 18 further comprising adhering a film exhibiting non-adhesive friction to a non-woven fabric.

23. The method of manufacturing of claim 22 further comprising adhering to a non-woven fabric a film selected from the group comprising co-polyester elastomer, polyethylene, ethylene-vinyl-acetate copolymer (EVA), molten ethylene methyl acrylate (EMA), mettalocine polyolefins, and combinations thereof.

24. The method of manufacturing of claim 22 further comprising adhering to a non-woven fabric Hytrel® co-polyester elastomer available from E. I. DuPont De Nemours & Company.

25. A method of manufacturing a protective garment comprising:

adhering to at least a portion of a sleeve a surface that is impervious and that increases non-adhesive friction when in contact with dry glove materials.

26. The method of manufacturing of claim 25 further comprising adhering the surface exhibiting non-adhesive friction to the sleeve from above a cuff to about mid-forearm.

27. The method of manufacturing of claim 25 further comprising manufacturing an unreinforced single use surgical gown.

28. The method of manufacturing of claim 25 further comprising manufacturing a fabric reinforced single use surgical gown.

29. The method of manufacturing of claim 25 further comprising adhering a film exhibiting non-adhesive friction to a non-woven fabric.

30. The method of manufacturing of claim 29 further comprising adhering to a non-woven fabric a film selected from the group comprising co-polyester elastomer, polyethylene, ethylene-vinyl-acetate copolymer (EVA), molten ethylene methyl acrylate (EMA), mettalocine polyolefins, and combinations thereof.

31. The method of manufacturing of claim 29 further comprising adhering to a non-woven fabric Hytrel® co-polyester elastomer available from E. I. DuPont De Nemours & Company.

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