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(54) **POLYURETHANE COATED FABRIC PRODUCTS**

(57) A polyurethane-coated fabric product, particularly a polyurethane-coated glove, comprises a fabric liner and, on the surface of the liner, a microporous foam layer comprising polyurethane and a bifunctional sulphur-containing alkoxysilane. The microporous foam layer exhibits increased abrasion resistance, durability and increased resistance to water penetration. Preferably, the bifunctional sulphur-containing alkoxysilane is bis(triethoxysilylpropyl)tetrasulphane.

The polyurethane-coated fabric product is manufactured by a method comprising the steps:

- (a) providing a fabric liner;
- (b) applying a coating to at least part of the surface of the liner, wherein the coating comprises a solution, in a polar aprotic solvent, of a polyurethane resin and a bifunctional sulphur-containing alkoxysilane;
- (c) treating the coated fabric with water, thereby causing the polyurethane to coagulate and form a microporous foam layer on the fabric liner; and
- (d) drying the polyurethane-coated fabric product.

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DescriptionField of the Invention

5 **[0001]** The present invention relates to polyurethane-coated fabric products, such as gloves. More particularly, it relates to polyurethane-coated fabric products wherein the polyurethane exhibits increased abrasion resistance and durability. The invention further relates to polyurethane-coated fabric products having increased water resistance. Also disclosed is a method of manufacturing the polyurethane-coated fabric products.

10 Background to the Invention

[0002] Polyurethane-coated fabrics may be used to produce garments, such as gloves, for workwear and safety applications. In the field of general purpose industrial safety gloves, lightweight polyurethane-coated nylon or polyester gloves have become very popular. In fact, the lightweight polyurethane glove has probably been one of the fastest
15 growing segments of the safety glove market in the last 20 years. Over this last 20 years, the nature of industrial safety gloves has changed, from relatively heavy gloves of leather, cut and sewn cotton-lined gloves coated with PVC or rubber, to ever lighter weight higher performance materials. This was to meet the demands of users who increasingly required more dexterity to perform finer tasks, such as assembly, but at the same time still requiring high physical strength and durability.

20 **[0003]** As such, these days the general purpose glove market is made up of many lightweight polymeric-coated knitted gloves. The glove primary base layer is, typically, a knitted liner. These are typically knitted on automated knitting machines, such as machines manufactured by Shima Seiki of Wakayama City, Japan.

[0004] There are a range of knitting machines in terms of the gauges of machine. There are very fine 18 gauge machines, using fine yarns, through to coarse heavier knitting 7 gauge machines using much heavier yarns. The gauge
25 relates to the number of needles per inch in the knitting bed. So the knitted fabric glove liner produced using an 18 gauge machine is finer than the fabric liner knitted on a 7 gauge machine, where there are only 7 needles per inch. In the case of polyurethane dipped gloves, the knitted liners used generally are 18, 15 and 13 gauge. Most common are the 15 and 13 gauge knitted liners.

[0005] The knitted liners are coated with polymeric, usually elastomeric, coatings. The intention is to provide as soft and dextrous a coating as possible to enable fine touch and dexterity but at the same time offer good abrasion and durability characteristics. Polyurethane has proved to be a very suitable elastomeric coating for such gloves.

[0006] Polyurethane gloves are usually produced by a dipping method. The machine-knitted liners are loaded on a hand-shaped mould. A liquid viscous compound is prepared which is usually a polyurethane (PU) resin dissolved in N, N-dimethylformamide (DMF) along with pigment and processing aids. The lined former is dipped in the compound and
35 the excess PU compound is allowed to drain off. The dipped glove is then immersed in a water treatment tank where the polyurethane resin in the coating solution is precipitated as the water removes and replaces the DMF in the coating. This causes the polyurethane to gel. As the DMF leaches out of the polyurethane, it leaves minute channels and pores in the gelled polyurethane coating so that the final polyurethane or PU-elastomeric coating is both porous and breathable. The leached glove is then finally dried before being removed from the former.

40 **[0007]** The production of polyurethane-coated gloves using polyurethane resin dissolved in DMF is well-known to those practised in the art.

[0008] In the workplace, abrasion resistance of a glove has always been an important feature, both to protect a worker from any abrasive harm and, also, to enhance the durability and longevity of a glove.

[0009] Recently, in Europe, a new glove testing standard (EN388:2016) has been introduced. This standard specifies physical tests for gloves, including abrasion, cut, tear, and puncture tests. In this new glove testing standard, the abrasive paper specified for the abrasion test was changed from a basic sandpaper to an aluminium oxide paper (Klingspor PL31B grit 180). This new abrasion paper has been found to have a substantial effect on polyurethane-coated gloves since it is a more efficient abrasive on polyurethane coatings.

[0010] Since the abrasion test results, according to the new glove testing standard, appear to be lower than those
50 from tests performed under previous testing regimes, there is a recognised need to improve the abrasion resistance of the glove coating.

[0011] It is common practice to use harder elastomer grades in the gloves to improve abrasion resistance. Unfortunately, the use of such harder grades can compromise the dexterity and comfort of the gloves.

[0012] An aim of the present invention is to improve the abrasion resistance of polyurethane-coated fabric products, such as gloves, without having to use harder grade polyurethanes.
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Summary of the Invention

[0013] According to the present invention, there is provided a polyurethane-coated fabric product comprising a fabric liner and, on the surface of the liner, a microporous foam layer comprising polyurethane and a bifunctional sulphur-containing alkoxy silane.

[0014] The present invention also provides a method of manufacturing the polyurethane-coated fabric product of the invention which method comprises the steps:

(a) providing a fabric liner;

(b) applying a coating to at least part of the surface of the liner, wherein the coating comprises a solution, in a polar aprotic solvent, of a polyurethane resin and a bifunctional sulphur-containing alkoxy silane;

(c) treating the coated fabric liner with water, thereby causing the polyurethane resin to coagulate and form a microporous foam layer on the fabric liner; and

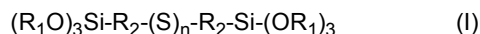
(d) drying the polyurethane-coated fabric product.

[0015] We have found that the incorporation of the bifunctional sulphur-containing alkoxy silane in the polyurethane coating composition influences the formation of the microporous foam in the polyurethane coating. Not only are the pores smaller, compared to when no bifunctional sulphur-containing alkoxy silane is present in the resin, but also the pores in the foam are more evenly distributed. Although we do not wish to be bound by theory, we believe that as a result of this influence on the formation of the microporous foam, the abrasion resistance of the microporous foam is increased. We have, additionally, found that the presence of the bifunctional sulphur-containing alkoxy silane in the polyurethane coating improves the resistance of the coated glove to water penetration.

Detailed Description of the Invention

[0016] The polyurethane-coated fabric product of the present invention comprises a fabric liner and, on the surface of the liner, a microporous foam layer comprising polyurethane and a bifunctional sulphur-containing alkoxy silane.

[0017] By the term "bifunctional sulphur-containing alkoxy silane" we mean compounds containing two trialkoxy silane groups separated by a linker group of the form alkylene-sulphur-alkylene. Such compounds may have the general formula I:



where R_1O is a lower (1-6C) alkoxy group

R_2 is a lower (i.e. 2-6C) alkylene

$n = 2$ to 10

[0018] Examples of compounds having the formula I above include: bis(triethoxysilylpropyl)disulphane, bis(triethoxysilylpropyl)trisulphane, bis(triethoxysilylpropyl)tetrakisulphane and bis(triethoxysilylpropyl)pentakisulphane.

[0019] The compound bis(triethoxysilylpropyl)tetrakisulphane is known to be useful as a silica-rubber coupling agent in rubber compounds containing silica filler to promote the formation of a chemical bond between the silica filler and the rubber matrix.

[0020] The bifunctional sulphur-containing alkoxy silane is typically present in the polyurethane in an amount which is >0% by weight based on the weight of the polyurethane and which is less than 25% by weight based on the weight of the polyurethane. Preferably, the bifunctional sulphur-containing alkoxy silane will be present in an amount of from 1 to 20% by weight and more preferably from 1 to 10% by weight, based on the weight of the polyurethane. Preferably, the bifunctional sulphur-containing alkoxy silane is bis(triethoxysilylpropyl)tetrakisulphane.

[0021] The polyurethane resin used in the present invention is typically a medium hardness polyurethane resin. The fabric liner may be formed from any suitable liner material, either knitted or non-knitted.

[0022] There is a wide range of yarn materials available to knit the glove base liners. Typically, the glove liners range from fine 18 gauge, through 15 gauge, 13 gauge, and on to heavier 10 gauge machine knitted liners produced on flat bed automated knitting machines such as those machines made by Shima Seiki of Katayama, Japan.

[0023] The majority of liners made for polyurethane-coated gloves are more preferably 15 or 13 gauge liners. The yarns used are typically, but not limited to, those formed of nylon or polyester. The nylon or polyester yarns can, if required, be knitted in combination with elastane yarns, such as Lycra RTM or Spandex RTM, to increase elasticity in the liner and enhance fit. Many cut resistant gloves are also made with more technical performance yarns, such as ultra high molecular weight polyethylene (UHMWPE), such as Dyneema RTM and Tsunooga RTM. There are also aramid

yarns, such as Kevlar RTM, that can be used. The yarns may, additionally, be combined with steel or glass yarns.

[0024] As will be understood by those skilled in the art, there are many combinations of yarns available to achieve the desired level or type of protection that the glove can offer. From fine light touch dextrous 18 gauge gloves to more substantial cut resistant heavier 10 gauge gloves.

[0025] As mentioned above, the present invention also provides a method of manufacturing the polyurethane-coated fabric product. This method typically comprises the essential steps of:

(a) providing a fabric liner;

(b) applying a coating to at least part of the surface of the liner, wherein the coating comprises a solution, in a polar aprotic solvent, of a polyurethane resin and a bifunctional sulphur-containing alkoxysilane;

(c) treating the coated fabric with water, thereby causing the polyurethane to coagulate and form a microporous foam layer on the fabric liner; and

(d) drying the polyurethane-coated fabric product.

[0026] The fabric liner used in the method may be as described above. When the desired polyurethane-coated fabric product is a glove, a fabric glove liner will typically be employed in the method loaded onto a hand-shaped metal former. Typically, aluminium hand-shaped formers are used in the glove manufacture. These aluminium formers are usually coated with a layer of poly(tetrafluoroethylene) (PTFE) non-stick coating to allow for easy loading of the fabric liner and the, later, stripping of the finished polyurethane-coated glove. During the glove manufacture, the polyurethane may substantially penetrate the yarns of the fabric glove liner and, during the drying and curing stage, the polyurethane may stick to the metal former. The use of a PTFE non-stick coating on the metal former, thus, aids the release of the finished glove from the metal former.

[0027] Polyurethane resin has a viscosity which is too high for the resin to be used in a dip coating method. Accordingly, the polyurethane resin will be diluted with a polar aprotic solvent in order to obtain a formulation having a suitable viscosity for dip coating. A typical formulation will consist of a polyurethane resin, or resins that can be of various crosslinkable hardnesses. Often, blends of resins are involved to achieve the right feel and performance of a glove. Those who are practised in the art will be aware of this fact.

[0028] The polyurethane resin used in the present invention is typically a medium hardness polyurethane resin diluted to 10 to 15% with polar aprotic solvent. The polar aprotic solvent may be any polar aprotic solvent that dissolves the polyurethane resin. Preferably, the solvent is selected from dimethyl sulphoxide, dimethyl pyrrolidone, dimethylacetamide, methyl ethyl ketone and N,N-dimethylformamide (DMF). DMF is the more preferred solvent. The polyurethane resin may be obtained pre-dissolved in DMF, prepared at around 30% solids content in the solvent, for instance TG 1020 as supplied by Hanyang Enterprises Ltd. of Seoul, South Korea or SW-2030 as supplied by Duksung Co., Ltd. of Suwon, South Korea. A pigment is also usually predissolved in a ratio of polyurethane resin and DMF. The formulations may also include processing aids, such as a polysiloxane defoamer, polyethers, biocidal agents and additional pigments. The polyurethane resin, bifunctional sulphur-containing alkoxysilane, any other additives (such as one or more pigments, processing aids or biocides) and solvent will typically be balanced to give a target viscosity that will give adequate fabric penetration during the dipping process and yet, at the same time, will not allow all of the dipping formulation to drain off the glove. Typically, the target viscosity will be in the range of from 1000 to 1100 centipoise and this can be achieved, if necessary, by the addition of an appropriate amount of the polar aprotic solvent.

[0029] The coating solution containing the polyurethane resin and bifunctional sulphur-containing alkoxysilane, as described above, is applied, according to the method of the invention, to at least part of the surface of the fabric liner. The coating may be applied using any suitable method, for instance, by spraying, curtain or shower coating, printing or dipping. Typically, in the manufacture of a polyurethane-coated glove, a fabric glove liner which is loaded on a hand-shaped metal former, as described above, is dipped into the polyurethane resin solution, typically at a temperature of 50° to 60°C. Such dipping, in the manufacture of a glove, is carried out slowly and steadily, typically for 2 to 5 seconds. Typically, in the manufacture of a glove, the former is rotated to the fingers down position so that excess coating solution can flow down and drain off the former. Typically, the draining time will be from 4 to 9 minutes, more preferably from 5 to 7 minutes. After this draining time, the hand-shaped former may be rotated to the fingers up position to allow any excess coating solution remaining at the fingertips of the fabric glove liner to flow back and even out the coating. After the fabric liner has been coated with the polyurethane resin solution, it is then treated with water. Typically, the coated fabric liner is immersed in water, for instance in a tank containing water or an aqueous solution. As the coated fabric is immersed in the water, typically at a temperature of 30 to 50°C for about 5 minutes, the water penetrates the polyurethane in the coating solution on the fabric by osmosis and rapidly extracts the polar aprotic solvent from the coating solution. The extraction occurs relatively quickly and causes the polyurethane resin, which is not soluble in the water, to coagulate and undergo a gelling reaction. As the water replaces the polar aprotic solvent in the coating, the result is the formation of a microporous polyurethane foam coating, containing the bifunctional sulphur-containing alkoxysilane, on the surface of the fabric liner. Preferably, the coated fabric liner is subsequently treated in one or more water treatment tanks.

[0030] It is known that DMF is an allergen and can be absorbed through the skin. If DMF is used in the manufacture of a glove, it is important, therefore, to remove any residual DMF from the glove. In the case where the polar aprotic solvent used in the method of the invention is DMF, we prefer to leach this out during the treatment of the polyurethane resin solution in the water treatment step of the method. As described above, the solvent is rapidly extracted from the resin coating compound during the water treatment causing the polyurethane resin to gel and for the DMF removed from the coating to enter into the water in the tank. The leaching of DMF from the glove, or other coated fabric product, is facilitated by the presence of a small amount of DMF in the water, or aqueous solution, used in the water treatment described above. Typically, the water treatment will be carried out using a water treatment tank containing water and 5 to 15% by volume of DMF, based on the volume of water in the tank. More typically, the water in the water treatment tank will contain from 8 to 12%, and preferably about 10%, by volume of DMF. The glove, or other coated fabric product, is preferably subsequently immersed in a series of separate leaching tanks, each one in turn containing water and added DMF wherein the amount of DMF added to the water is less than that added to the previous tank in the series. Thus, the amount of DMF added into each separate leaching tank decreases gradually from the 5 to 15% by volume used in the initial water treatment down to 1% or less by volume. Preferably, the final leaching tank in the series, in which the glove or other coated fabric product is immersed contains less than 0.5% by volume, based on the volume of water in the tank, of added DMF and more preferably no added DMF. By the use of this succession of separate leaching tanks, the glove or other coated fabric product obtained after the final tank treatment will be substantially free of residual DMF.

[0031] After the last water treatment/leach tank, the coated fabric product is left to allow the excess contaminated water to drain off. Typically, when the coated fabric product is a glove, the metal former loaded with the coated glove liner is removed from the last water treatment/leach tank in a fingers down position so that the excess contaminated water can drain from the fingers. The formers are then rotated to the fingers up position and are placed in a drying oven.

[0032] In the drying oven, the coated fabric product is heated typically at a temperature of around 80-90°C for about 30 minutes, and then subjected to a temperature of about 100°C to evaporate off most of the water and any remaining polar aprotic solvent, and to cure the polyurethane. The total residence time in the oven is typically 70-75 minutes.

[0033] In the manufacture of gloves, after the drying/heating stage, the formers dressed with the finished dried and cured gloves are allowed to cool slightly before the polyurethane-coated gloves are removed from the metal formers.

[0034] FIG.1 shows a brief schematic outline of the steps in the method of manufacturing a polyurethane glove.

EXAMPLES

Example 1

[0035] A basic polyurethane glove dipping solution was prepared having the formulation below:

Component	% (by weight)
TG 1020 *	38.5 (30% solids)
N,N-dimethylformamide	55.0
HY 60 **	0.5
pigment	5.9
BC 98-56 ***	0.1

* TG 1020 - polyurethane pre-dissolved in N,N-dimethyl formamide at 30% solids content, from Hanyang Enterprises Ltd., Seoul, S. Korea

** HY 60 - polysiloxane defoamer aid, from Heung-il Polychem. Ltd.

*** BC 98-56 - biocide, from Sanitized AG, Switzerland.

Example 2

[0036] The above formulation (as in Example 1) was prepared but with a 1% (by weight, based on the weight of polyurethane content) addition of bis[3-(triethoxysilyl)propyl] tetrasulphide (HP-669, from Jingdezhen Hung Pai Chemistry Technology Co., Ltd. of Jiangxi, China). The formulation, thus, contained 0.115% of HP-669.

Example 3

[0037] The basic formulation as described in Example 1 was prepared but with a 5% by weight (based on the weight of the polyurethane content) addition of HP-669. The formulation, thus, contained 0.575% HP-669.

Example 4

[0038] The basic formulation as described in Example 1 was prepared but with a 10% by weight (based on the weight of the polyurethane content) addition of HP-669. The formulation, thus, contained 1.15% of HP-669.

Experimental

[0039] The dipping compounds were prepared in the following way.

1. Half of the quantity of N,N-dimethylformamide required was measured out. The HY60 defoamer, pigment and BC 98-56 biocide were added to the N,N-dimethylformamide;
2. The mixture from 1. above was then stirred for 5 minutes;
3. The polyurethane resin solution TG 1020 was then added to the mixture from 2. above while stirring;
4. The remaining half of the N,N-dimethylformamide was added to the mixture from 3. above and then left to mix for 3 hours;
5. To the mixture from 4. above, the liquid HP-669 was added and then the mixture was mixed for a further 3 hours.

[0040] The viscosity of the mixture from 5. above was then adjusted by balancing the level of dimethylformamide either increasing to reduce viscosity or reducing the dimethylformamide to increase the viscosity of the compound to a preferred viscosity of 1000-1100 centipoise.

[0041] Dipped glove samples were prepared using the dipping formulations of Examples 1 to 4 above. The glove liners used were a knitted 15 gauge nylon and 13 gauge polyester. The aluminium former with the liner dressed and fitted was dipped slowly and steadily into the polyurethane dipping formulation which was balanced to a viscosity of 1000 to 1100 centipoise.

[0042] The former was then rotated to the fingers down position and the excess dipping formulation was allowed to drain off for 5 to 7 minutes. The former was then rotated to the fingers up position to allow any excess formulation in the fingertips to flow back over the liner.

[0043] The former was then rotated through 180° to the fingers down position and then slowly immersed in a bath of water.

[0044] The water-treated coated liner was then placed in a drying oven at 80°C. The temperature in the drying oven, at the exit of the oven, was 100°C.

[0045] The dried, cured glove was removed from the former.

Experiment 1

[0046] The glove samples prepared, as described above, were subjected to an abrasion test in accordance with European glove testing standard EN 385:2016, clause 6.1. According to this, four circular specimens of each of the glove material were taken from the palm portion of each of the glove samples. Each specimen was mounted in a holder with double-sided adhesive tape. The four mounted samples of each glove were placed on the test machine (Martindale Wear and Abrasion machine, EN ISO 12947-1) and each was provided with an abrasion bed covered with Klingspor PL31B grit 180 paper (mounted and secured with double-sided tape). According to the test method, a load of 9 ± 0.2 kPa was applied. The machine, when switched on, abraded the surface of the test specimen against the Klingspor PL31B abrasive paper in a cyclic planar lissajous pattern motion.

[0047] The specimens were examined at intervals to identify whether the abrasion had caused the wearing of a hole in the specimens. The end point of the test was when one specimen of the four specimens had a hole. The number of revolutions of the machine at this end point was recorded. The testing procedure was carried out on four specimens of each of the finished gloves produced.

[0048] The results of the abrasion test are shown below for each dipping formulation used and for each of the gauge gloves obtained.

Abrasion Machine - number of cycles at hole production**[0049]**

Dipping formulation liner	15 gauge nylon liner	13 gauge polyester liner
Example 1 (0% H-669)	3200	2379
Example 2 (1% H-669)	14186	5629

(continued)

Dipping formulation liner	15 gauge nylon liner	13 gauge polyester liner
Example 3 (5% H-669)	15563	12966
Example 4 (10% H-669)	20006	16440

[0050] The results shown above indicate that the abrasion resistance of the glove samples increases with an increase in the level of incorporation of bis(triethoxysilylpropyl)tetrasulphane in the microporous polyurethane foam coating layer.

Experiment 2

Water Resistance Testing

[0051] Specimens taken from each of the 15 gauge nylon liner gloves prepared as described above were tested to determine resistance to water penetration. Resistance to the penetration of water was tested to ISO 811 using hydrostatic head test equipment. A specimen of each of the polyurethane-coated gloves (15 gauge nylon liner) was subjected to a steadily increasing pressure of water on one face under standard conditions, until penetration occurred in three places. The hydrostatic head supported by the coated fabric is a measure of the resistance to the passage of water through the fabric. The results, which are in millimetres of head of water, are shown below.

Dipping formulation	Millimetres of head of water
Example 1 (0% HP-669)	200
Example 2 (1% HP-669)	343
Example 3 (5% HP-669)	356
Example 4 (10% HP-669)	567

[0052] The results shown above indicate that the resistance to the penetration of water through the polyurethane-coated glove samples increases with an increase in the level of bis(triethoxysilylpropyl)tetrasulphane incorporation in the microporous polyurethane foam coating layer.

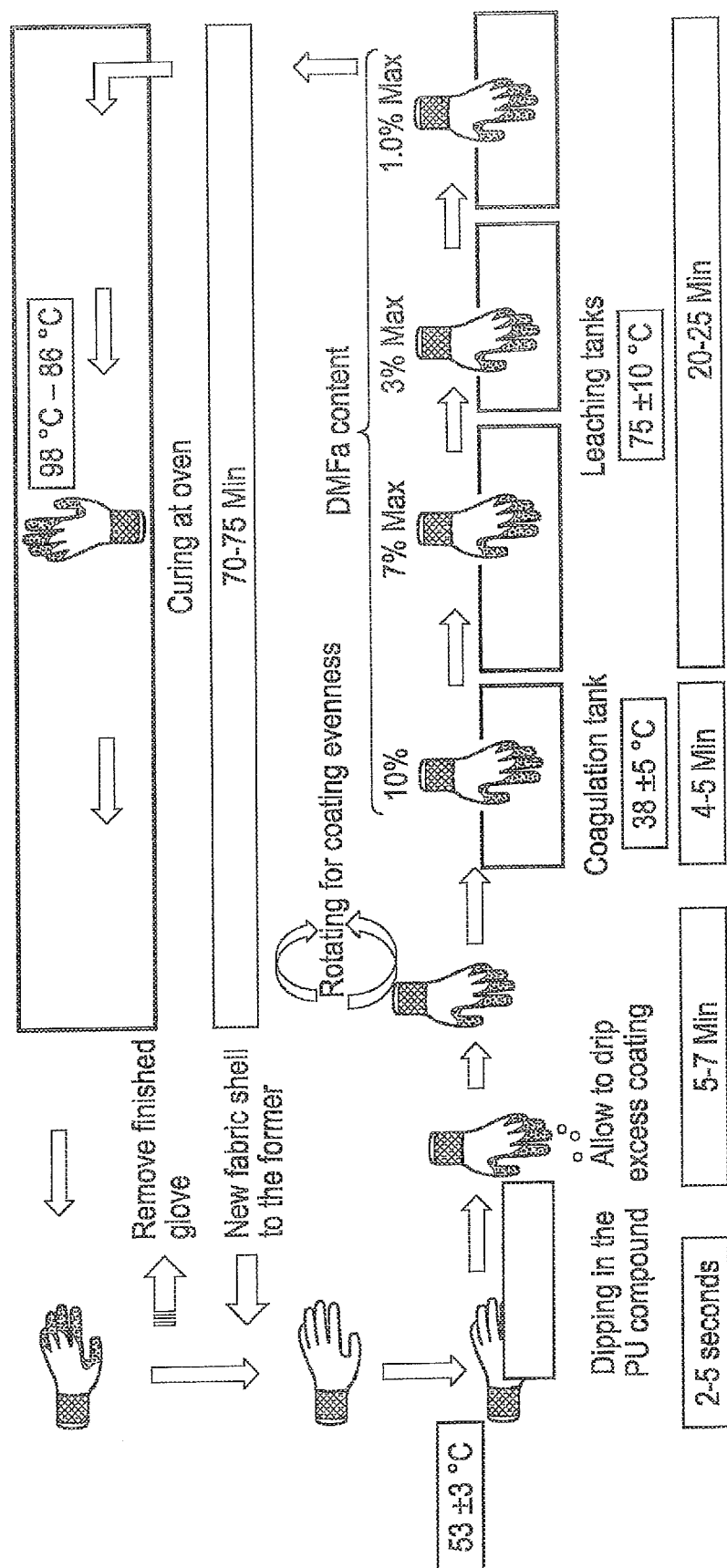
Claims

1. A polyurethane-coated fabric product comprising a fabric liner and, on the surface of the liner, a microporous foam layer comprising polyurethane and a bifunctional sulphur-containing alkoxysilane.
2. A polyurethane-coated fabric product according to claim 1, wherein the bifunctional sulphur-containing alkoxysilane is selected from bis(triethoxysilylpropyl)disulphane, bis(triethoxysilylpropyl)trisulphane, bis(triethoxysilylpropyl)tetrasulphane, bis(triethoxysilylpropyl)penta-sulphane and mixtures of any two or more of these.
3. A polyurethane-coated fabric product according to either claim 1 or claim 2, wherein the bifunctional sulphur-containing alkoxysilane is present in the polyurethane in any amount of from 1 to 20% by weight.
4. A polyurethane-coated fabric product according to claim 3, wherein the bifunctional sulphur-containing alkoxysilane is present in the polyurethane in an amount of from 5 to 15% by weight.
5. A polyurethane-coated fabric product according to any one of claims 1 to 4, wherein the polyurethane-coated fabric product is a polyurethane-coated glove.
6. A polyurethane-coated fabric product according to claim 5, wherein the fabric liner is a glove liner made with nylon, polyester, high performance polyethylene, glass or steel yarns.
7. A method of manufacturing the polyurethane-coated fabric product of claim 1, comprising the steps of
 - (a) providing a fabric liner;
 - (b) applying a coating to at least part of the surface of the liner wherein the coating comprises a solution, in a

polar aprotic solvent, of a polyurethane resin and a bifunctional sulphur-containing alkoxysilane;
 (c) treating the coated fabric liner with water, thereby causing the polyurethane resin to coagulate and form a microporous foam layer on the fabric liner; and
 (d) drying the polyurethane-coated fabric product.

- 5
8. A method according to claim 7, wherein step (c) is followed by one or more additional steps in which the coated fabric liner is treated with water.
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9. A method according to claim 7 or claim 8, wherein the polar aprotic solvent is selected from dimethyl sulphoxide, dimethyl pyrrolidone, dimethylacetamide, methyl ethyl ketone and N,N-dimethylformamide.
10. A method according to claim 9, wherein the polar aprotic solvent is N, N-dimethylformamide.
- 15
11. A method according to any one of claims 7 to 10, wherein in step (b) the coating is applied to the surface of the fabric liner by spraying, curtain or shower coating, printing or dipping.
- 20
12. A method according to claim 11, wherein the coating is applied to the surface of the fabric liner by dipping and wherein the coating comprises an N,N-dimethylformamide solution containing the polyurethane resin and the bi-functional sulphur-containing alkoxysilane having a viscosity in the range of from 1000 to 1100 centipoise.
- 25
13. A method according to claim 12, wherein the polyurethane-coated fabric product is a glove, wherein a fabric glove liner is loaded onto a hand shaped metal former and the loaded former is dipped into the polyurethane resin solution.
- 30
14. A method according to any one of claims 7 to 13, wherein the bifunctional sulphur-containing alkoxysilane is selected from bis(triethoxysilylpropyl)disulphane, bis(triethoxysilylpropyl)trisulphane, bis(triethoxysilylpropyl)tetrasulphane and bis(triethoxysilylpropyl)-pentasulphane and mixtures of any two or more of these.
- 35
15. A method according to claim 14, wherein the bifunctional sulphur-containing alkoxysilane is bis(triethoxysilylpropyl)tetrasulphane.
- 40
16. A method according to any one of claims 7 to 15, wherein the bifunctional sulphur-containing alkoxysilane is present in the polyurethane solution in an amount of from 1 to 20% by weight based on the weight of polyurethane.
- 45
- 50
- 55

Fig. 1



In plant process of PU glove production



EUROPEAN SEARCH REPORT

 Application Number
 EP 20 15 4109

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DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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