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(71) Applicant: **National Starch and Chemical Investment Holding Corporation**
New Castle, Delaware 19720 (US)

(72) Inventor: **Parsons, John C.**
Easton, Pennsylvania 18040 (US)

(74) Representative:
Hagemann, Heinrich, Dr.rer.nat., Dipl.-Chem. et al
Patentanwälte Hagemann, Braun & Held,
Postfach 86 03 29
81630 München (DE)

(54) Process for providing an anti-slip treatment

(57) A process for producing an anti-slip surface on a porous substrate is presented. The process involves applying a polymer formulation having a Tg of from -60°C to -20°C to a porous substrate. Materials formed using the process provide resistance to slipping without being tacky.

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Description

FIELD OF THE INVENTION

[0001] This invention relates to a novel process for producing an anti-slip treatment on a porous substrate by applying a polymer formulation, having a Tg in the range of -60°C to -20°C, to a porous material by spray, foam or print application.

BACKGROUND OF THE INVENTION

[0002] In many applications it is desirable for a porous material to exhibit anti-slip properties. An anti-slip surface is one which allows the treated material to remain in place, without exhibiting tackiness or a peel strength. A non-slip surface is imparted to a porous substrate through the application of a surface treatment.

[0003] U.S. Patent Number 5,786,077 describes the use of colloidal silicas to produce a non-slip surface on paper.

[0004] Patent Number GB 2 187 659 describes the use of an emulsion polymer as a non-slip coating for a non-woven material. The polymer formulation is applied to a flexible web backing, dried, then the dried formulation is foamed in an added step by exposure to steam or irradiation.

[0005] The problem with non-slip treatments produced by other processes is that they either fail to provide an adequate grip, or else are too tacky to the touch. A non-slip surface, in the context of the present invention, is one having an increase in the static and dynamic coefficient of friction - without being tacky. An increase in non-slip properties should have only a minimal effect of other properties of the porous material, such as fabric hand and air permeability.

[0006] Surprisingly it has been found that a porous material, treated by the process of the present invention, has an increased coefficient of friction, and with little or no effect on fabric hand, air permeability, or abrasiveness. The treated porous material also exhibits no roll blocking, which is adhesion between the plies of a roll that inhibits the ability to unwind the roll for conversion into end-use products.

SUMMARY OF THE INVENTION

[0007] Accordingly it is an object of the present invention to provide a process for treating a porous substrate with an anti-slip surface comprising forming a polymer formulation having a Tg of from -60°C to -20°C and applying said polymer formulation to a porous substrate. Another object of the invention is a product containing an anti-slip porous material made by the process of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

[0008] The process of the present invention involves treating a porous substrate with a polymer formulation by spray, foam or print application. The formulation works by increasing the friction between the treated substrate and the counter-substrate.

[0009] The polymer formulation contains a polymer and may also contain additives, including but not limited to, tackifiers, detachers, pigments, surfactants, catalysts, and thickeners. Tackifiers and detackifiers may be used to adjust the Tg of the polymer formulation to that useful in the present invention. The polymer formulation has a Tg of from -60°C to -20°C, and preferably from
-50°C to -40°C. The Tg of the polymer formulation is selected to be low enough to provide anti-slip properties, while being high enough to avoid excessive tackiness.

[0010] The polymer useful in the present invention can be either aqueous-based or solvent based. An aqueous-based polymer formulation, such as an emulsion, solution, suspension or dispersion, is preferred. Most preferred is a polymer formulation based on an emulsion polymer.

[0011] Polymers useful in the present invention are those formed from ethylenically unsaturated monomers by processes known in the art. Exemplary monomers include, but are not limited to, anhydrides, vinyl esters, alpha-olefins, alkyl esters of acrylic and methacrylic acid, substituted or unsubstituted mono and dialkyl esters of unsaturated dicarboxylic acids, vinyl aromatics, unsubstituted or substituted acrylamides, cyclic monomers, monomers containing alkoxylated side chains, sulfonated monomers, and vinyl amide monomers, A combination of ethylenically unsaturated monomers may also be used.

[0012] Suitable anhydride monomers are, for example, maleic anhydride and itaconic anhydride. Suitable vinyl esters are, for example, vinyl acetate, vinyl formate, vinyl propionate, vinyl butyrate, vinyl isobutyrate, vinyl valerate, vinyl 2-ethyl-hexanoate, vinyl isooctanoate, vinyl nonanoate, vinyl decanoate, vinyl pivalate, and vinyl versatate. Suitable alkyl esters of acrylic and methacrylic acid are, for example, methyl acrylate, methyl methacrylate, ethyl acrylate, ethyl methacrylate, propyl acrylate, butyl acrylate, pentyl acrylate, hexyl acrylate, and 2-ethyl hexyl acrylate, etc. Suitable substituted or unsubstituted mono and dialkyl esters of unsaturated dicarboxylic acids are, for example, substituted and unsubstituted mono and dibutyl, mono and diethyl maleate esters as well as the corresponding fumarates. Examples of vinyl aromatic monomers are styrene, 1-vinyl naphthalene, 2-vinyl naphthalene, 3-methyl styrene, 4-propyl styrene, t-butyl styrene, 4-cyclohexyl styrene, 4-dodecyl styrene, 2-ethyl-4-benzyl styrene, 4-(phenylbutyl) styrene, 3-isopropenyl-α, α-dimethylbenzyl isocyanate, and halogenated styrenes.

[0013] Suitable acrylamide based monomers are, for example, acrylamide, N, N-dimethylacrylamide, N-octyl acrylamide, N-methylol acrylamide, dimethylaminoethylacrylate, etc. Suitable cyclic monomers are, for example, vinyl pyrrolidone, vinyl imidazolidone, vinyl pyridine, etc. Suitable sulfonated monomers are, for example, 2-acrylamido-2-methyl propane sulfonic acid, sodium methallyl sufonate, sodium vinyl sulfonate, sulfonated styrene, etc. Suitable vinyl amide monomers are, for example, N-vinyl formamide, N-vinyl acetamide, etc.

[0014] Preferred polymers of the invention include polymers and copolymers of styrene-butadiene, acrylonitrile, silicones, ethylene-vinyl acetate, polyurethane and acrylic monomers. Acrylic copolymers are most preferred.

[0015] Preferably the polymer is one that can undergo cross-linking during or after film formation. Most preferred is a self-cross-linking polymer.

[0016] Polymers useful in the present invention have molecular weights in the range of from 5,000 to 5,000,000, and preferably from 10,000 to 2,000,000.

[0017] It is advantageous that the polymer formulation be formulated to minimize penetration into the porous substrate. Thus, if the substrate is hydrophobic, a hydrophilic polymer formulation is preferred. If the substrate is hydrophilic, the polymer formulation is preferably hydrophobic.

[0018] The solids level of the formulation may vary, depending on the requirements of the application equipment. The rheology may be adjusted by dilution with water or other solvents, or the addition of a thickener.

[0019] The polymer formulation may be applied to the porous substrate in any manner known in the art, including, but not limited to print, foam, or spray application. Spray processes in which the polymer formulation is atomized are preferred. The polymer formulation may be sprayed using both air and airless sprays, and with both internal and external air nozzles. Nozzle spray conditions, including pressure, coating density, and spray type are selected based on the equipment employed.

[0020] The polymer formulation may be applied to the porous substrate as a wet foam, by means known in the art. Foaming of the formulation may occur by both mechanical and chemical means.

[0021] Print application is by means of a gravure press in which a transfer roll coats the polymer formulation onto a gravure roll having many cells, the gravure roll then transfers the polymer formulation to the porous material,

[0022] The polymer formulation may be used to treat one or both sides of the porous substrate depending on the application. For many applications, the anti-slip treatment is applied to one side only. The polymer formulation is typically applied at from 1 to 100 percent by weight, based on dry weight of polymer to dry substrate. Preferably the polymer formulation is applied at from 5 to 40 percent by weight, and most preferably from 5 to 25 percent by weight, based on dry weight of polymer to dry substrate.

[0023] The polymer formulation is applied to a porous substrate. Porous substrates useful in the present invention include, but are not limited to nonwovens, textiles, carpet, and paper. Uses of substrates formed by the process of the present invention include, but are not limited to mattress covers, surgical shoe covers, surgical towels, table covers, placemats, apparel interlining, food packaging liners, synthetic leather, facings, carriers and wall coverings.

[0024] Following application of the polymer formulation to the porous substrate, the coating is dried. Drying may occur at room temperature, or may be accelerated at elevated temperatures.

[0025] Although not needed in all applications, porous materials produced by the process of the present invention preferably possess breathability. Breathablility, measured by air permeability means that the treatment has coated the porous material, while allowing most of the pores to remain open.

EXAMPLES:

Example 1

[0026] A 30 gsm spunbond-melt blown nonwoven material was treated with a self-crosslinking acrylic copolymer emulsion having a Tg of -42°C, as measured by DSC. The emulsion was diluted to 30% solids and applied to the nonwoven material by spraying, printing and foam coating. The material was then dried at 121°C for two minutes. The basis weight (BW) is the fabric weight in grams used per square meter of the substrate. The coefficient of friction (CoF), both static and dynamic, indicates the force in grams required to pull a 5.1 x 5.1 cm piece of the nonwoven across a cotton woven textile while under downward force of 200 grams as per ASTM D 1894 - 78. Air permeability was measured using Frazier Air Permeability IST 70.1-92. Sample 1 is the untreated nonwoven, used as a comparative. Sample 2 is for the nonwoven material treated with the polymer formulation as a liquid foam. The acrylic copolymer was formulated with 2% solids-on-solids ammonium stearate and wisking to a froth via air incorporation. The foam was metered onto the substrate. Sample 3 is the non-woven treated with the polymer formulation by means of a gravure print. Printing was done by viscosifying the polymer formulation to 400 cps with 0.2% solids-on-solids hydroxyethyl cellulose. A 45 Quadrill gravure cylinder was used to apply the print pattern. Sample 4 is the non-woven treated with the polymer formulation by means of a spray. Spraying was performed using a spray nozzle, with an orifice of 0.026" at 40 psi air and 20 psi liquid.

SAMPLE	Application Method	BW, gsm	CoF Static	CoF Dynamic	Air Perm $ft^2/ft^2/min$
1 (comp.)	NA	31	0.59	0.51	110
2	Foam	41	1.51	1.29	12
3	Print	55	1.39	1.22	10
4	Spray	38	2.00	1.93	100

Claims

1. A process for providing an anti-slip surface on a porous substrate comprising:

a) forming a polymer formulation having a Tg of from -60°C to -20°C; and
b) applying said polymer formulation to a porous substrate to produce at least one anti-slip non-tacky surface.

2. The process of claim 1 wherein said application of said polymer formulation is by spray, foam or print application.

3. The process of claim 2 wherein said application of said polymer formulation is by spraying comprises an atomized spray.

4. The process of claim 3 wherein the Tg of the polymer formulation is from -50°C to -40°C.

5. The process of claim 1 wherein said polymer formulation comprises an emulsion polymer.

6. The process of claim 5 wherein said emulsion polymer is self-crosslinking.

7. The process of claim 5 wherein said emulsion polymer comprises an acrylic monomer.

8. The process of claim 1 wherein said substrate is a non-woven material.

9. The process of claim 1 wherein said coating is applied to only one side of the porous substrate.

10. A non-slip porous substrate formed by the process of claim 1.

11. A mattress covering comprising the non-slip porous substrate of claim 10.

12. A surgical shoe cover comprising the non-slip porous substrate of claim 10.

13. A carpet backing comprising the non-slip porous substrate of claim 10.

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EUROPEAN SEARCH REPORT

Application Number
EP 01 11 8715

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
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D21H D06M

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
MUNICH	29 August 2001	Naeslund, P

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Application Number
EP 01 11 8715

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
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