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3,099,067	7/1963	Merriam et al.	28/82
3,348,983	10/1967	Sissons	161/81 X
3,369,057	2/1968	Twilley	260/857
3,382,305	5/1968	Breen	264/171

FOREIGN PATENTS

1,035,908 7/1966 Great Britain

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[54] **DIMENSIONALLY STABLE FABRIC HAVING A**
SUEDELIKE TEXTURE
6 Claims, No Drawings

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[56] **References Cited**

UNITED STATES PATENTS

3,034,194	5/1962	Priester et al.	161/64
3,090,097	5/1963	Ruckstuhl	161/65 X

ABSTRACT: A dimensionally stable fabric having a suedelike texture is produced by a process which comprises brushing or napping a fabric containing filaments comprising a polyamide matrix having microfibers of a higher melting synthetic polymer dispersed therein. A substantial number of the filaments of the base or ground of the napped fabric are then fused together at their crossover points to impart dimensional stability to the fabric and retain the original fabriclike appearance. The dimensionally stable fabric retaining its original fabriclike appearance is then contacted with an alkylene glycol having two to about 10 carbon atoms for a period of time sufficient to soften the dimensionally stable fabric thereby imparting a suedelike texture on the brushed or napped surface of the fabric without any substantial loss of dimensional stability in the fused fabric.

DIMENSIONALLY STABLE FABRIC HAVING A SUEDELIKE TEXTURE

BACKGROUND OF THE INVENTION

This invention relates to dimensionally stable fabric having a suedelike texture. More particularly this invention relates to a process for producing a dimensionally stable fabric having a suedelike texture by treating a fused fabric comprised of a nonconstituent fiber with an alkylene glycol.

Fabrics having a suedelike texture are known in the prior art, however, the novel dimensionally stable fabric having a suedelike texture of the present invention which is comprised of a polyamide matrix having microfibers of a higher melting synthetic polymer dispersed therein is novel to the art and offers many useful advantages over prior art fabrics having a suedelike texture.

The dimensionally stable fabric having a suedelike texture of the present invention is useful in many commercial fields such as apparel, home furnishings, and building materials. A few specific examples are wall paneling, wall paper, lamp shades, shoes, slippers and the like.

An example of the versatility and value of the fabric of the present invention is in the production of a shoe upper. The dimensionally stable fabric having a suedelike texture can be molded into the shape of a shoe upper thereby eliminating the need for resins and resin curing while at the same time retaining the suedelike texture for fashion effects. The dimensional stability of the fabric eliminates the need for backings or reinforcements such as polyurethane foam, however, such backings and reinforcements can be used for any additional desirable effects.

SUMMARY OF THE INVENTION

In accordance with the present invention, a dimensionally stable fabric having a suedelike texture is produced by a process which comprises brushing or napping a fabric containing filaments comprising a polyamide matrix having microfibers of a higher melting synthetic polymer dispersed therein. A substantial number of the filaments of the base or ground of the napped fabric are then fused together at their crossover points to impart dimensional stability to the fabric and retain the original fabriclike appearance. The dimensionally stable fabric retaining its original fabriclike appearance is then contacted with an alkylene glycol having two to about 10 carbon atoms for a period of time sufficient to soften the dimensionally stable fabric thereby imparting a suedelike texture on the brushed or napped surface of the fabric without any substantial loss of dimensional stability in the fused fabric.

The fabric treated in accordance with the present invention can be woven, nonwoven, or knitted from filaments or fibers prepared from dispersions of a higher melting synthetic polymer in a polyamide. Suitable higher melting synthetic polymers include, for example, polyesters, polysulfones, polyphenyl oxides, polycarbonates, polyacetals, crystalline polyvinyl chloride, polystyrene, certain polyolefins such as isotactic poly(3-methyl-1-butene) and isotactic poly(4-methyl-1-pentene) and the like. In a preferred embodiment, the fabric treated in accordance with the present invention can be woven, nonwoven, or knitted from filaments or fibers prepared from dispersions of polyester in polyamide such as disclosed in U.S. Pat. 3,369,057 to Twilley. As disclosed in Twilley, supra, the proportion of end groups of the polyamide, especially amine groups, which are reactive in the melt with the polyester should be restricted to not over 40 percent of the polyamide end groups. In addition, other dispersions of polyester in polyamide are satisfactory for purposes of this invention, including those disclosed in U.S. Pats. 3,378,055, 3,378,056, and 3,378,602; British Pat. 1,097,068; Belgian Pat. 702,813; and Netherlands Pats. 66,06838 and 66,12628, and filaments or fibers can also be prepared from these dispersions by known melt spinning techniques. In the drawn filaments or fibers comprising the fabrics treated in accordance with the

preferred embodiment of the present invention, the polyester ingredient is dispersed as discrete microfibers throughout the polyamide which forms a continuous phase or matrix. The microfibers can be continuous or discontinuous throughout the matrix. The polyester microfibers have average diameter not above 1 micron and preferably not above 0.5 micron. In length the microfibers vary widely, but substantially all are elongated. On the average they are at least 5 times and usually at least 20 times longer than the average diameter, typically averaging in length about 250 times their average diameter. In the drawn filaments, the microfibers lie predominantly in the direction of the filament axis. The dispersion of microfibers in the filament is substantially uniform, both lengthwise and across each filament. Typically at least 100 microfibers traverse each cross section of each filament. The microfibers will generally have essentially round cross section, although their diameter may vary along their length and they may taper toward their ends as a result of the shears imposed during drawing.

The filaments or fibers of the fabrics treated in accordance with the preferred embodiment of this invention comprise, per 100 parts by weight total polyamide and polyester, about 50 to 90 parts of the polyamide as the matrix and dispersed therein about 50 to 10 parts of the polyester.

Suitable polyamides for use in the present invention include, for example, those prepared by condensation of hexamethylene diamine and adipic acid, known as nylon 6,6 or by polymerization of *ε*-caprolactam, known as nylon 6.

The polyesters useful in the practice of this invention can be prepared in general by condensation reactions between dicarboxylic acids or their derivatives and compounds containing two hydroxyl groups, or materials possessing both an alcohol group and a carboxylic acid group or derivative thereof; or by the condensation-polymerization of lactones. Dicarboxylic acid derivatives which can be employed include esters, salts, anhydrides and acid halides. The monomeric species employed in the preparation of the polyesters are preferably not more highly functional than difunctional in their reactivity so as to produce essentially linear, noncrosslinked polymer structures.

Suitable polyesters for use in the present invention include those polymers in which one of the recurring units in the polyester chain is the diacylaromatic radical from terephthalic acid, isophthalic acid, 5-*t*-butylisophthalic acid, a naphthalene dicarboxylic acid such as naphthalene 2,6 and 2,7 dicarboxylic acids, a diphenyl-dicarboxylic acid, a diphenyl ether dicarboxylic acid, a diphenyl alkylene dicarboxylic acid, a diphenyl sulfone dicarboxylic acid, an azo dibenzoic acid, a pyridine dicarboxylic acid, a quinoline dicarboxylic acid, and analogous aromatic species including the sulfonic acid analogues; diacyl radicals containing cyclopentane or cyclohexane rings between the acyl groups; and such radicals substituted in the ring, e.g. by alkyl or halo substituents.

The dioxy radical representing the other principal recurring unit in the polyester chain can be an open chain aliphatic such as ethylene glycol or ether thereof, for example, the diether, or can contain rings such as those which form part of the above noted diacyl radicals. The carboxy and/or the oxy chain members can be directly attached to a ring or removed by one or more carbon atoms therefrom, as in the 1,4 dioxymethyl cyclohexane radical.

The fabric treated in accordance with the present invention can be a conventional knitted, woven or nonwoven fabric, however, it is preferred that the fabric be of such a construction which is designed for brushing or napping.

The brushing or napping of the fabric can be carried out on conventional brushing or napping equipment. Generally, the fabric is brushed or napped on only one side, however, it may, in some cases, be desirable to brush or nap both sides of the fabric and it is within the scope of the present invention that both sides of the fabric can be brushed or napped if desired.

Several systems are suitable for heat treating the napped fabric of the present invention, as for example, a forced air oven with a nitrogen purge, a static draft oven without

nitrogen, heated match-die molds, a molding press (without pressure) or a steam autoclave. The method of heating is of little consequence, with the autoclave having only slight advantages in that there is less discoloration since lower fusion temperatures can be achieved thereby.

For any given fabric, the temperature and time will vary depending on the ratio of polymeric materials, article size, shape, desired rigidity, mode of heat application and other variables. In general, it is necessary to apply heat without excessive degradation of sufficient intensity and duration at least as high as the melting point of the nylon matrix until the fabric yarns have fused to each other yet still retain the yarn or fabric identity. If the fabric yarns are spun from staple fibers, the fibers forming the yarn will fuse together individually in addition to fusion at the cross points of the fabric. Fusion can be achieved without undesirable flow; it is this phenomenon which permits the present invention to provide unique dimensional stability and appearance to textile materials and, therefore, regulates the minimum and maximum heat-set conditions. Thus, the fabric interstices are practically unaltered by the fusion as described herein since there is no polymer flow or migration, provided the dimensions of the fabric are maintained.

Thus, while no empirical or mathematical formula has been found for determining the minimum heat-setting conditions to fuse the filaments used in the present invention, appearance after heating, and in particular, after fusion and removal of the nylon by formic acid has been found to be an important criterion.

The discovery has been made that an unusual fusion characteristic of this invention exists in the structure formed by the dispersed fibrils which unexpectedly are bonded together even though the melt temperature thereof has not been reached during the heat-set operation. The appearance of this fused microfibrillar dispersion can be evaluated as a reliable index of the degree of fusion.

The optimum fusion temperature for a nylon-polyester combination containing 30 parts by weight of polyethylene terephthalate microfibers dispersed in 70 parts by weight of nylon 6, is about 240° C. for efficient fusion, fiber integrity retention, coloration, and controllable hand and texture suitable for treatment. Naturally the time for fusion is dependent on many factors, including the amount of polyester dispersed in the polyamide matrix, the filament or yarn size, fabric construction, that is, knit, weave, loose, tight, etc. and, of course, the ultimate texture desired in the fabric having a suede-like texture. Thus, time periods are determined by the mass to be heated and the type of heat source employed. For example, when employing an oven, durations as short as about 15-20 seconds at about 230° C. have been found effective for at least partial fusion when a softer fabric is desired. Fusion times of up to about 10 minutes and longer at about 255° C. can be employed, however, the breaking strength of the fabric is reduced somewhat.

To summarize, for 70 denier yarn, 10 to 300 seconds in a dry oven at 240° C. appears to be the optimum fusion condition where substantially complete fusion is obtained, as determined by removing the nylon with formic acid to determine if the remaining polyester has maintained a true fabric appearance, being cohesive and elastic.

The fused napped fabric prepared in accordance with the above procedure is then treated with an alkylene glycol having two to about 10 carbon atoms which can be substituted with nonreactive groups such as alkyl, for example, methyl, ethyl, and the like, and alkoxy, for example, methoxy, ethoxy, and the like. Suitable alkylene glycols include ethylene, propylene, butylene, diethylene and triethylene glycol and the like with ethylene glycol being preferred. The fused, napped fabric can be wound on tubes or similar packaging devices and immersed in the alkylene glycol or the fused, napped fabric can be continuously passed through the alkylene glycol. The alkylene glycol can be used in undiluted form or the alkylene glycol can be diluted with a nonreactive solvent such as water. The con-

centration of alkylene glycol in water can range as low as about 40 weight percent or even lower depending upon the texture desired of the treated fabric. The alkylene glycol treatment of the fused napped fabric is conducted at a temperature ranging from about 20° to 100° C. for a period of time sufficient to produce the desired suedelike texture on the fused napped fabric. Generally speaking, the fused napped fabric is treated with heated undiluted alkylene glycol for about 10 to 120, preferably about 15 to 60, minutes. Longer or shorter treatment times can be used depending upon the treatment temperature, amount of alkylene glycol dilution, if any used, and degree of softness and pliability desired in the resulting suedelike material. The weight of the glycol treating solution to the weight of the fused fabric can vary depending upon the treating conditions. For most treating conditions, the weight of the glycol solution is about 30 to 100 times the weight of the fused fabric treated, however, lower or higher ratios may be used for certain treating conditions.

Rinsing is desirable to clear the fabric of any excess alkylene glycol left over from the alkylene glycol contacting stage. After rinsing, the dimensionally stable fused napped fabric having a suede-like texture can be dried at ordinary temperature, usually not more than 100° C.

PREFERRED EMBODIMENTS

The following examples illustrate the practice and principles of this invention and mode of carrying out the invention.

EXAMPLE 1

A synthetic multifilament yarn containing 30 parts by weight of polyethylene terephthalate microfibers dispersed in 70 parts by weight of nylon 6 was knitted into a two bar tricot fabric. The yarn contained twelve filaments and was drawn at a draw ratio of about 3.5X to a final denier of 40. The polyethylene terephthalate microfibers had an average diameter not above 1 micron and had an average length at least 20 times their average diameter. The microfibers lay predominantly in the direction of the filament axis. One side of the knitted fabric was then brushed or napped on conventional napping equipment. The napped fabric was then bonded by fusing it on a tenter frame at 30 percent overfeed for 10 seconds at about 244° C. in accordance with the method described in U.S. application Ser. No. 727,327, filed May 7, 1968. The fused fabric was dimensionally stable and had a crisp, paperlike stiffness. The napped side of the fabric had a rough, sand paperlike texture and the unnapped side retained its original fabric appearance.

EXAMPLE 2

A sample of the fused fabric prepared in example 1 was placed in a watch glass containing heated ethylene glycol. The ethylene glycol was heated by placing the watch glass over a beaker of boiling water. The fused fabric was immersed in the heated ethylene glycol for about 30 minutes, removed, and dried in air at room temperature for about 24 hours. The ethylene glycol treatment produced a soft, suedelike texture on the napped side of the fabric which had a rough and sand paperlike texture prior to the ethylene glycol treatment.

Other commercial fabric softeners were evaluated on samples of the fused fabric prepared in example 1. The softeners evaluated were Achovel NC (a nonionic, antistatic textile softening agent), Avitone T (a chemical material based on hydrocarbon sodium sulfonates that is used principally as a softening agent), Ceranine HCS (a cationic fatty acid condensation product), and Tanalube RF (a sulfated fatty ester surfactant of the anionic type). The softener solutions were prepared by dissolving 2.5 grams of each softener in 1,300 ml. of hot tap water. The fused fabric samples were placed in the respective softener solutions and agitated for 20 minutes. A control sample of fused fabric was also run under the above conditions using only hot tap water as the softener. The fused fabric samples were removed from their respective softener

solutions and were evaluated for softness and suedelike texture prior to drying. None of the softeners evaluated produced a suedelike texture on the fused fabrics. The treatment with Achovel NC produced the greatest amount of softening but was not as effective a softener as ethylene glycol. In addition, the Achovel NC treated fabric lost its dimensional stability. The treatments with the other softeners did not affect the dimensional stability and were effective as softeners in the following order: Tanalube RF, Ceranine NCS, Avitone T, hot water. The treated fused fabric samples were then dried in air at room temperature for about 3 hours. There was no appreciable change in any of the fabric samples after drying.

It is claimed:

1. A dimensionally stable fabric having a suedelike texture which comprises a fused napped fabric containing filaments comprising a polyamide matrix having microfibers of a higher melting synthetic polymer dispersed therein, said napped fabric having been fused in such a manner to thereby retain its original fabriclike appearance and said fused napped fabric having been softened to thereby have said suedelike texture; said textile material having been heat-treated at a temperature in the range above the melting point of the matrix but below the melting point of the dispersed fibrils such that the multiconstituent filaments thereof are set and fusion bonded at least at their cross points without substantial polymer flow or

migration so that the fabric interstices are maintained substantially unaltered; and said fused textile material being characterized by said dispersed fibrils being bonded together as determined by removing the polymeric material with a solvent to show the remaining dispersed fibrils have maintained a true fabric appearance, being cohesive and elastic.

2. The fabric of claim 1 wherein the higher melting synthetic polymer is selected from the group consisting of polyesters, polysulfones, polyphenyl oxides, polycarbonates, polyacetals, crystalline polyvinyl chloride, polystyrene, and polyolefins selected from the group consisting of isotactic poly(3-methyl-1-butene) and isotactic poly(4-methyl-1-pentene).

3. The fabric of claim 2 wherein the higher melting synthetic polymer is a polyester.

4. The fabric of claim 3 wherein said filaments comprising a polyamide matrix having polyester microfibers dispersed therein contain, per 100 parts by weight total polyamide and polyester, about 50 to 90 parts of polyamide and dispersed therein about 50 to 10 parts of polyester.

5. The fabric of claim 4 wherein said polyamide is nylon 6.

6. The fabric of claim 4 wherein said polyester is polyethylene terephthalate.

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