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TREATMENT OF WOOL FIBERS

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The present invention relates to a treatment of loose fiber or yarn or woven or knitted fabric consisting of or containing wool fibers, whereby novel effects are produced. These effects include an increased stiffness, a reduced affinity for water vapour and a diminished tendency to felt or, for woven or knitted fabrics, to shrink.

According to the invention, material of the kind described is exposed at elevated temperature, but below 100° C., to the combined action of water vapour and the vapour of a volatile monomeric monovinylidene compound containing a $\text{CH}_2=\text{C}=\text{}$ group, for instance, an ester of acrylic or methacrylic acid, styrene or a vinyl ester.

If the material is wetted out with water before exposure to the action of the mixed vapours, more even effects are obtained. The wetting out may be effected by exposing the material to water vapour alone, before exposing to the action of the mixed vapours. Alternatively, when it is required to use a polymerisation catalyst to promote polymerisation of the mono-vinylidene compound on and within the fibers, the material may be impregnated with an aqueous solution containing the catalyst, for example ammonium persulphate. Or the material may be immersed in water or in water containing a wetting agent.

One of the aims of the invention is to effect polymerisation of monomeric vinylidene compounds preferentially within the fibers. It is believed that the application of these compounds to fibers swollen with water vapour at elevated temperatures enables this aim to be realised.

The time of treatment of the material varies with the effect desired. If, for example, an unshrinkable finish on all-wool fabrics is required, using methyl methacrylate, treatment is carried out until the fabrics show an increase in weight of 40% or more. Using styrene, a considerable reduction in shrinking power is also given by continuing the treatment until the fabrics show an increase in weight of about 13%. For increased stiffness, the amount of polymer to be deposited must, of course, increase with the degree of stiffness desired. It is, however, possible to continue the treatment of the materials according to the invention until the increase in weight is as much as 200%.

When polymers are formed within wool fibers, the groups normally conferring affinity for water are occupied or masked by the polymer, which also fills the space normally available for accommodating water, with the result that materials

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treated according to the invention possess a reduced affinity for water vapour. In addition, polymer deposition within the fibers modifies their elastic properties by offering hindrance to relative movement of the protein molecules. Both the reduced affinity for water vapour and the mechanical hindrance come into play in increasing the stiffness of the fibers and in preventing that type of fiber movement which is necessary with loose fiber, as well as with woven and knitted fabrics containing wool, if there is to be felting. As felting is normally accompanied by shrinkage in the case of knitted or woven fabrics containing wool fibers, treatment according to the invention prevents or reduces that type of shrinkage known as milling shrinkage. Further, when polymer is deposited on the surface of, as well as within, wool fibers, the surface scale structure is masked and a supplementary effect in minimising milling shrinkage is thus obtained.

The invention is illustrated but not limited by the following examples, in which the parts are expressed by weight:

Example 1

Wool fabric (1 part air-dry weight) is wetted out in water, wrung until about 1 part of water remains, and wound at open width into a loose roll, which is suspended above a mixture of methyl methacrylate (2 parts) and water (1 part) contained in a water-jacketed vessel, which is fitted with a reflux condenser in such a position that the fabric is not contaminated with condensate. The water jacket is heated so that the space around the wool is at 90°-95° C. After six hours the fabric is removed from the vessel; it shows an increase in weight of about 40% due to deposition of methyl methacrylate polymer on and within the fibers.

A so-treated fabric differs from the original fabric in that it possesses a fuller handle and shows reduced shrinkage in soap milling. For example, when patterns of the treated and untreated fabric are milled together in 5% aqueous soap solution, the following area shrinkages are obtained:

Fabric	Area shrinkage, percent
Untreated.....	46.5
Treated.....	6.6

Example 2

Wool fabric (1 part air-dry weight) is impregnated with a 0.2% aqueous solution of ammonium persulphate and expressed until 1-1.5 parts of solution remain. The fabric is then suspended at 90-95° C. in the vapour from a mixture of methyl methacrylate (2 parts) and water (1 part), as described in Example 1. In this case, the methyl methacrylate contains 0.5% copper rosinate as a non-volatile polymerisation inhibitor. Polymerisation occurs on the fabric, which shows after 30 minutes an increase in weight of about 80%, and after 1 hour an increase in weight of about 150%.

When patterns of the treated and untreated fabrics are milled together in 5% aqueous soap solution, the following area shrinkages are obtained:

Fabric	Area shrinkage, percent
Untreated.....	35.9
Treated for 30 minutes.....	5.4
Treated for 1 hour.....	0.8

Example 3

Wool fabric (2 parts air-dry weight) is wetted out in water and expressed until about 2 parts of water remain. The fabric is then treated at 90-95° C. in the vapour from a mixture of styrene (2 parts) and water (1 part) as described in Example 1. After six hours the fabric is conditioned in air, and it shows an increase in weight of about 13%.

When patterns of the treated and untreated fabrics are milled together in 5% aqueous soap

solution, the following area shrinkages are obtained:

Fabric	Area shrinkage, per cent
Untreated.....	38.0
Treated.....	10.4

We claim:

1. Process for the production of novel effects on wool-fiber-containing textile material which comprises exposing such material at an elevated temperature of the order of 90-95° C. to the combined action of water vapor and the vapor of a volatile monomeric polymerizable compound containing a $\text{CH}_2=\text{C}=\text{}$ group and selected from the class consisting of esters of acrylic acid, esters of methacrylic acid, styrene and vinyl esters until polymer is formed within the fibers.

2. Process of claim 1 wherein the material is wetted out with water before exposure to the action of the mixed vapors.

3. Process of claim 1 wherein the textile material is impregnated with a polymerization catalyst before exposure to the action of the mixed vapors.

4. Process of claim 1 wherein the polymerizable monomer is methyl methacrylate.

5. Process of claim 1 wherein the polymerizable monomer is methyl methacrylate and the textile material is impregnated with a 0.2% aqueous solution of ammonium persulfate before exposure to the action of the mixed vapors.

6. Process of claim 1 wherein the polymerizable monomer is styrene.

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