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[54] **DIFFERENTIAL SHRINKAGE YARN AND FABRIC
MADE THEREFROM**
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[56] **References Cited**
UNITED STATES PATENTS
2,904,953 9/1959 Groombridge et al. 57/157
3,181,224 5/1965 Tanner 57/140X
3,199,281 8/1965 Maerov et al. 57/140
3,350,871 11/1967 Pierce et al. 57/140
3,404,710 10/1968 Pierce 57/140X
3,414,957 12/1968 Langstaff et al. 28/75X
3,439,393 4/1969 Murono 28/72.17
3,444,681 5/1969 Reese 57/140
3,446,005 5/1969 Kosaka et al. 57/140X

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ABSTRACT: A fabric composed of yarn including a yarn which comprises at least two staple fibre polyethylene terephthalate components of high and low shrinkage characteristics, the high shrinkage component possessing at least 25 percent shrinkage and the low shrinkage component possessing less than about 5 percent shrinkage expressed as the reduction in length as a percentage of the initial length, and some of the fibers being melt colored fibers.

DIFFERENTIAL SHRINKAGE YARN AND FABRIC MADE THEREFROM

This invention relates to woven or knitted fabrics which include melt colored polyester staple fibers and polyester staple fibers of high shrinkage in their construction.

It is known to produce fabrics from yarns containing fibers of different shrinkage propensities when subjected to heat, swelling or other influences, as for example mixtures of shrinkable synthetic fibers with relatively unshrinkable synthetic or natural fibers and to produce a bulking effect in such yarns or fabrics by the application of heat or other shrinking influence. It is customary to finish fabrics of this kind by scouring, dyeing and surface treatments such as raising and cropping applied to the piece, which finishing treatments may be used to bring about the shrinkage of the shrinkable fibre components and development of bulk.

According to this invention we provide woven or knitted fabrics wherein at least some of the yarns of which they are constructed contain or consist of melt colored polyester staple fibers and at least some of the yarns contain or consist of polyester staple fibers of at least 25 percent shrinkage as hereinafter defined.

Further according to this invention we provide woven or knitted fabrics comprising 65—90 percent by weight of polyester staple fibers of which 15—40 percent expressed on weight of the fabric are fibers having a shrinkage as hereinafter defined of at least 25 percent and 75—25 percent by weight are polyester fibers of normal shrinkage, at least some of either kind of polyester fibers being melt colored polyester fibers and 35—10 percent expressed on the weight of the fabric of wool or cellulosic fibers.

Also according to the invention we provide yarns comprising at least 65 percent by weight of polyester staple fibers of which 15—40 percent expressed on weight of the fabric are fibers having a shrinkage as hereinafter defined of at least 25 percent and 75—25 percent by weight are polyester fibers of normal shrinkage, at least some of either kind of polyester fibers being melt colored polyester fibers and 35—10 percent expressed on the weight of the fabric of wool or cellulosic fibers.

Hitherto fabrics composed of a major proportion of polyester staple fibers have possessed a harsh, unattractive handle and for this reason the amount of polyester fibers in the fabric has been limited to about 55 percent maximum.

Fabrics according to the invention have an attractive handle and bulkiness. Moreover, if the polyester fibers have an intrinsic viscosity of about 0.40—0.50 (measured in solution in o-chlorophenol at 25° C.) the fabrics will show a reduced tendency to pilling in addition to the other desirable properties.

Fabrics according to the invention may be produced in a number of ways, for example the fabric may be composed wholly of yarns which are a uniform blend of melt colored polyester fibers and polyester fibers having a shrinkage of at least 25 percent. Alternatively the fabric may be composed wholly of yarns which are a uniform blend of melt colored polyester fibers of normal shrinkage, polyester fibres having a shrinkage of at least 25 percent and wool or cellulosic fibers. The high shrinkage polyester fibers and the wool or cellulosic fibers may both be uncolored or they may be dyed to a color which is the same as or different from the melt colored fibers. Further alternatively the fabrics may be composed of yarns containing a uniform blend of melt colored polyester fibers having a high shrinkage, polyester fibers of normal shrinkage which may also be melt colored and cellulosic or wool fibers. Yet another alternative is to produce fabric comprising yarns of at least two of the three foregoing types. In finishing such fabrics a treatment in hot water or hot air is given to produce bulk in the fabric by shrinkage of the high shrinkage components and consequent buckling of the lower shrinkage components. These heat treatments may take the form of the normal scouring or drying processes and the fabric is treated under conditions which allow the shrinkage to occur. Preferably the temperature of treatment is at least 55° C. for

below this temperature little or insufficient shrinkage may occur.

If fabrics according to the invention are to be produced from yarns differing in their propensity to bulk when heat treated the yarns may be mixed according to a specified pattern in the weaving or knitting operation. Thus a fabric may be produced from yarns which are a mixture of melt colored high or low shrinkage polyester fibers and low or high shrinkage polyester fibers and cellulosic or wool fibers, such that there are both high and low shrinkage components therein and yarns of lower or little bulking propensity which may include melt colored polyester and cellulosic or wool fibers. In this way a fabric having a pattern of bulked and unbulk parts may be produced.

In yarns containing high and low shrinkage components subjected to heat not only is a bulked effect produced but also a tendency to concentration of the high shrinkage components at the core of the yarns, which, if the high shrinkage components are melt colored and the other components are uncolored or of a different color (or vice versa), gives rise to a change in shade of the fabric. This change in shade may be uniform over the fabric or, if different yarns are used in a woven or knitted pattern, in the form of a color pattern over the fabric.

Fabrics according to the invention exhibit good handle and bulkiness up to the highest proportion of polyester staple fibers so long as there is present sufficient high shrinkage polyester fibers to produce the desired bulking effect. In general as the proportion of normal shrinkage polyester fibers is increased the proportion of high shrinkage polyester fibers should also be increased. Thus, for example, in a fabric containing 75 percent by weight of polyester fibers and 25 percent of wool fibers there should be a minimum of about 25 percent by weight of high shrinkage polyester fibers for the best effects. The proportion of melt colored polyester fibers in the yarns depends upon whether these fibers are also of high shrinkage, in which case the foregoing considerations apply and on what degree of patterning effect, as herein described, is desired.

In one preferred form of producing fabrics according to this invention melt colored polyester fibers, which also have a shrinkage of at least 25 percent, are blended with low shrinkage uncolored or white pigmented polyester fibers and cellulosic or wool fibers to produce a yarn from which a fabric is constructed. The fabric is then subjected to a heat treatment, preferably at about 60° C., in water, which causes shrinkage of the colored fibers and a lightening of the fabric color by concentration of these fibers within the yarn. In a similar way color patterning of a fabric may be achieved by using yarns containing high shrinkage melt colored polyester fibers with uncolored or white low shrinkage fibers and yarns containing low shrinkage melt colored or dyed polyester fibers. Thus according to another aspect of this invention we provide a process for the production of a woven or knitted fabric having a colored pattern, wherein the fabric is constructed in the form of the pattern from yarns containing melt colored polyester staple fibers of shrinkage at least 25 percent blended with uncolored or white low shrinkage polyester and/or wool or cellulosic staple fibers and yarns containing low shrinkage melt colored or dyed polyester staple fibers and the fabric is subjected to a shrinkage treatment. In a preferred form of this process the fabric contains 65—90 percent by weight of polyester staple fibers of which 15—40 percent by weight of the fabric have a shrinkage of at least 25 percent and 75—25 percent by weight of the fabric have a normal shrinkage and 35—10 percent by weight of the fabric of cellulosic or wool fibers.

In a process according to this aspect of the invention the yarns containing low shrinkage melt colored polyester staple fibers may be composed wholly of such fibers or may also contain low shrinkage polyester or cellulosic or wool fibers.

By low or normal shrinkage fibers as used herein is meant fibers of low shrinkage usually less than about 5 percent and

frequently in the case of polyester staple fibers less than 1 percent. The term includes cellulosic and wool fibers.

Shrinkage of the high shrinkage fibers used in this invention should be at least 25 percent and is preferably of the order of 40—50 percent or even higher and the proportion of these fibers in the yarns depends upon their shrinkage and also upon the effect desired. In general the higher the shrinkage the lower the proportion of high shrinkage fibers required.

The term cellulosic fibers as used herein means natural or regenerated cellulosic staple fibers, as for example cotton, viscose and flax fibers and staple fibers of cellulose derivatives such as cellulose triacetate.

Any polyester fibers which may be produced in melt colored and high shrinkage forms may be used in this invention, as for example poly(ethylene terephthalate). Melt coloration is a known process wherein uncolored or white polymer is colored before conversion into fibers by intimate mixture of the powdered or granular polymer with a finely divided pigment or dyestuff composition which is stable in the fibre spinning process.

In the production of polyester fibers by melt or solution spinning it is usual to heat treat the fibers so as to reduce their subsequent shrinkage propensity, as for example, by heat treatment of the running yarn at constant length during drawing or heat treatment in the relaxed state after drawing, the temperature of treatment being in excess of that to which the fibers are to be exposed later. To produce high shrinkage polyester fibers this heat stabilization treatment is omitted and the strains of drawing remain in the fibers to produce shrinkage on subsequent heat treatment. The shrinkage propensity of the drawn fibers may also be enhanced by using a low draw ratio.

The term shrinkage when mentioned herein means the shrinkage of the fibers in the substantially free state. The measurement may be made either using a length of the fibrous material before cutting into staple lengths or using a number of staple fibers (as for example ten) secured at one end and immersed for 15 minutes in boiling water; the shrinkage is the reduction in length expressed as a percentage of the initial length of the length of material or of the total length of the individual fibers. In the case of the length of fibrous material before cutting a small weight is attached to the free end which is sufficient to cause the specimen to sink but insufficient to impede shrinkage.

Fabrics according to the invention have the important advantage of not requiring to be dyed, which allows a greater degree of control over the point in fabric finishing at which shrinkage is incurred, some additional control of coloration effects in that melt colored, uncolored and dyed fibers may be mixed in various ways and according to the process hereinbefore described novel patterned effects to be obtained. The fabrics also have a very attractive bulk and soft handle.

In an embodiment of this invention a blend consisting of 25 percent by weight of melt colored black poly(ethylene terephthalate) staple fibers (intrinsic viscosity 0.45) of denier 3, length 87 mm. and shrinkage 40 percent; 50 percent white (pigmented with titanium dioxide) poly(ethylene terephthalate) staple fibers (intrinsic viscosity 0.45) of denier 4, length 87 mm. and shrinkage less than 1 percent and 25 percent uncolored 70's wool is spun to 2/30's worsted count with singles and ply twists of 430 turns per meter "Z" and 430 turns per meter "S" respectively. A 2/2 twill fabric with a loom sett of

18 ends per cm. by 20 picks per cm. is woven from this yarn and the fabric is relaxed in water at 60° C., and then given a conventional scouring and cropping to finish it.

The loomstate fabric is grey which after relaxing and finishing is a lighter shade of grey. This fabric has an attractive soft handle and 20 percent greater bulk (measured by the fabric thickness) than a similar fabric in which the high shrinkage melt colored fibers are replaced by melt colored fibers of shrinkage less than 1 percent.

In a further embodiment of this invention a fabric having a patterned effect is produced by weaving a 2/2 twill fabric from warp yarns composed of 25 percent by weight melt colored blue poly(ethylene terephthalate) staple fibers (intrinsic viscosity 0.45) of denier 3, length 87 mm. and shrinkage 45 percent; 50 percent blue dyed poly(ethylene terephthalate) staple fibers (intrinsic viscosity 0.45) of the same denier and length but 1 percent shrinkage and 25 percent blue dyed wool fibers, the blend being spun to 2/40's worsted count with singles and ply twists of 470 turns per meter "Z" and 870 turns per meter "S" respectively and weft yarns composed of the same blend of fibers wherein, the melt and dyed color is black and the 2/40's yarns has 470 turns per metre singles twist and 470 turns per metre ply twist.

The fabric having a loom sett of 22 ends per cm. by 22 picks per cm. is finished as in the foregoing embodiment to produce a bulky fabric of attractive appearance and good handle.

I claim:

1. Yarn comprising at least 65 percent by weight of polyester staple fibers of which 15—40 percent expressed on weight of the yarn are fibers having a shrinkage of at least 25 percent and 75—25 percent by weight of the yarn are polyester fibers having a shrinkage of less than about 5 percent, at least some of either kind of polyester fibers being melt colored polyester fibers and 35—10 percent expressed on the weight of the yarn of wool or cellulosic fibers.

2. A fabric composed of yarn including a yarn which comprises at least two staple fibre polyethylene terephthalate components of high and low shrinkage characteristics, the high shrinkage component possessing at least 25 percent shrinkage and the low shrinkage component possessing less than about 5 percent shrinkage expressed as the reduction in length as a percentage of the initial length, and some of the fibers being melt colored fibers.

3. Fabrics according to claim 2 containing at least 65 percent by weight of said fibers.

4. Fabrics according to claim 2 comprising 65—90 percent by weight expressed on the weight of the fabric of said staple fibers of which 15—40 percent expressed on weight of the fabric are fibers having a shrinkage of at least 25 percent and 75—25 percent by weight are fibers of low shrinkage, at least some of either kind of said fibers being melt colored fibers and 35—10 percent expressed on the weight of the fabric of fibers selected from the group consisting of wool fibers and cellulosic fibers.

5. Fabrics according to claim 2 wherein said fibers are at least in part fibers having an intrinsic viscosity measured in solution in o-chlorophenol at 25° C. of 0.4—0.5.

6. Fabrics according to claim 2 comprising 75 percent by weight of said fibers and 25 percent by weight of wool.

7. Fabrics according to claim 6 wherein at least 25 percent by weight of said fibers have a shrinkage of at least 25 percent are present.