

1

2

3,618,141

STIFFENED FABRIC ARTICLE AND METHOD OF MANUFACTURE

George H. Collingwood, Hopewell, and Gene C. Weedon and Robert C. Winckelhofer, Richmond, Va., assignors to Allied Chemical Corporation, New York, N.Y.
No Drawing. Continuation-in-part of applications Ser. No. 727,325 and Ser. No. 727,327, both May 7, 1968. This application Apr. 29, 1969, Ser. No. 820,331
Int. Cl. D03d 13/00, 15/02

U.S. Cl. 2—236

12 Claims

ABSTRACT OF THE DISCLOSURE

Stiffened fabric articles useful as garment liners are provided, comprised of multi-constituent yarn elements unidirectionally combined therein in the direction of desired stiffness in said fabric article; said multi-constituent yarn elements being spun from at least two different polymeric materials whose melt temperatures differ by at least 10° C. such that, in a given element, a first fiber-forming polymeric material defines a matrix and a second higher melting polymeric material is dispersed therein in the form of discontinuous fibrils, said matrix comprising at least about 50 percent by weight of the element and having a lower melting point than said dispersed fibrils; and said fabric article 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 desired unidirectional degree of stiffness is imparted thereto, and whereby fabric strength and appearance are retained. The multi-constituent yarn elements are present in the fabric as individual yarn or fill elements in combination with other materials, or are present in a mechanically blended fiber or yarn with other materials.

PRIOR ART

Stiffened fabrics have been produced for many years as illustrated by U.S. Pats. 2,298,071 and 2,754,855. They have been used to reinforce the shape of garments as in hatbands, waistbands, coats, dresses, upholstery, collars, cuffs, and many other articles.

Previously known stiffened fabrics have generally been produced by incorporating a stiff yarn or mono-filament therein. Because of its size the mono-filament is hard to handle in producing the fabric and tends to slip within the fabric structure, thereby producing a non-uniform fabric within a short time.

Resins or thermoplastics incorporated in fabrics to stiffen them have handled easily enough during fabric production, but break down quickly with wear and/or washing.

BACKGROUND

This application is a continuation-in-part of the following copending applications: (a) Ser. No. 727,327, filed May 7, 1968 for "Dimensionally Stable Articles and Method of Manufacture," and (b) Ser. No. 727,325 filed May 7, 1968 for "Dimensionally Stable Articles and Method of Making Same."

In the applications, articles are produced from multi-constituent filament, which, as used herein means filament made by inclusion of at least one polymeric material in a matrix of another as discontinuous fibrils, the two materials having melt temperatures at least 10° C. apart such that fibrous structures composed thereof can be heat-treated by application of heat below the melt temperature of one and equal to or above that of the other, the entire filament composition of any component thereof optionally including any secondary material compatible

with the heat-treating property of the fabric as a whole, such as anti-oxidants and other stabilizing agents, reinforcing particles, fillers, adhesion promoting agents, fluorescent materials, dispersing agents, and others useful in polymerization, extruding, spinning, fabric forming and shaping, heat-treating and product finishing techniques. The preferred multi-constituent filamentary material is prepared in accordance with Twilley, U.S. Pat. 3,369,057, and this patent is therefore incorporated by reference as if fully set out herein.

In Ser. No. 727,327 cited above, it was disclosed that fabric made from multi-constituent filaments could be heated under appropriate conditions to produce novel articles of improved dimensional stability, having improved physical properties, yet retaining a fabric or textile appearance, even after heat-treating to a considerable degree. In Ser. No. 727,325 it was disclosed that fabrics could be prepared from multi-constituent materials, but could also include additional materials interwoven or otherwise combined therewith, including many varieties of natural fibers, modified natural fibers and synthetic fibers, and even with the addition of such other filamentary materials or yarn, the dimensional stability could be achieved and the textile appearance retained within certain heat-treating conditions and with the appropriate amount of the multi-constituent material present.

SUMMARY AND OBJECTS

This invention relates to novel fabric useful as a stiffener material and made by inclusion of multi-constituent yarn or fibers therein in the direction in which stiffness is desired, and heat-treated to the desired degree of stiffness. As compared to mono-filaments, multi-constituent yarn may be handled as any conventional yarn in weaving and may be the same approximate size as the warp yarn. Moreover, the multi-constituent material is easy to cut and otherwise handle. Another advantage is that the multi-constituent material used locks in the other yarn employed in the fabric during the heat-treating phase, thereby reducing or eliminating the possibility of yarn slippage and fabric deformation during use. Still other advantages are that the multi-constituent materials are relatively low in cost and their non-allergenic properties are excellent for purposes in which stiffened fabrics are normally employed, as for example, waistbands in trousers, stiffeners in shirt collars and the like where frequent washing or dry cleaning is an important factor.

The principal object of the present invention is, therefore, to provide novel fabric articles which are stiffened by heat-treatment and which include multi-constituent filamentary materials in the direction of desired stiffness, resulting in novel economies and novel properties of stiffened fabrics. Other objects and advantages will be apparent to those skilled in the art from the appended claims and the following description of the best mode of carrying out the invention and examples thereof.

DESCRIPTION

Multi-constituent filaments are produced by combining at least two different fiber forming polymeric materials, having melting points at least 10° C. apart and preferably as much as 25° C. apart. A major amount of one of the materials is utilized as a matrix in which the other is dispersed. The preferred polymeric materials are nylon 6 (50-90 parts by weight) and polyethylene terephthalate (10-50 parts by weight). The precise nature of the materials and the preferred manner in which they are blended together are fully disclosed in the above cited Twilley patent and reliance on the disclosure made therein is made for details.

In addition to the Twilley multi-constituent materials, other thermoplastic polymers and copolymers alone or in

combination may be used such as polyamide, polysulfones, polyphenylene oxides, polycarbonates, and polyolefins, again with the matrix being present in a major amount and a higher melting dispersion being dispersed in discontinuous fibrils therein, in accordance with the principles disclosed in the Twilley disclosure.

Polyesters and polyamides are preferably of the type disclosed in the Twilley patent. Other suitable polyamides are nylon 6/6 (hexamethylene-diamine adipic acid), methanol- and ethanol-soluble polyamide copolymers and other suitable polyamides such as the alkoxy substituted polyamides. Suitable polyolefinic materials are polyethylene, polypropylene, poly-1-butene, poly-2-butene, polyisobutylene, polystyrene and similar materials.

In fabric association with the multi-constituent yarn, as mentioned above, a wide variety of materials useful in producing fabric may be used, the only limiting criteria for selection of such a material being that it occur as, or may be processed into, a filament or yarn which is further capable of withstanding the temperature necessary to produce the desired stiffness with the multi-constituent yarn being employed in the structure of the fabric article, whether the fabric article be woven, knitted, or otherwise prepared. Such other materials which are suitable are natural fibers of animal origin such as wool, vegetable origin such as cotton, flax, linen, hemp, jute, etc., and mineral origin such as asbestos, glass and spun glass. Modified fibers including cyanoethylated cotton, mercerized cotton and non-shrinkable wool, as well as various synthetics may also be employed.

As an example of the best mode of carrying out the invention, a plain woven fabric was prepared using a warp of 100% cotton (cotton count $\frac{5}{1}$) and filling of 100% of an 840 denier, 136 filament multi-constituent yarn containing 30% polyethylene terephthalate and 70% nylon 6. The latter was prepared according to Example 1 of the above-mentioned Twilley patent, i.e., the nylon 6 and polyethylene terephthalate were heated and blended substantially homogeneously together, spun and drawn, resulting in the 840/136 yarn. The woven fabric was held under tension on a frame and subjected to a temperature of 440° F. in an oven for a period of 30 seconds. The resulting fabric had a bending length of 10.0 inches in the fill-wise direction and a length of 4.0 inches in the warp-wise direction. The length test used was the cantilever ASTM D 1388-64 stiffness test. Briefly, it is the interaction between fabric weight and fabric stiffness as shown by the way in which a fabric bends under its own weight. A piece of the fabric thus produced was cut to the width of a hatband and inserted in the lining thereof where it served satisfactorily as a stiffener.

In most cases good stiffness will be achieved without seriously affecting the pliability in the warp direction by heating a fabric constructed as indicated above at temperatures ranging from 220° C. to 260° C. for 5 to 60 seconds, preferably within the range of 230° C. to 250° C., however.

In another example, a plain woven fabric was prepared. The warp was 1/6 (worst count) spun polyester and the fill was the same, 840/136 multi-constituent 30/70 polyethylene terephthalate, nylon 6. The fabric was again mounted under tension on a frame, and subjected to a temperature of 440° F. for 30 seconds. The bending length, as determined by the ASTM cantilever stiffness test, was 8.6 inches in the fill direction and 3.5 inches in the warp direction.

In still another example, a plain woven fabric was prepared using 8/1 (cotton count) cotton in the warp direction and in the fill direction, 1 pick of 840/136 multi-constituent yarn containing 30/70 percentages of polyethylene terephthalate and nylon 6 alternating with 1 pick of 8/1 (cotton count) cotton. The fabric was mounted on a frame and held under tension while it was subjected to 440° F. for 30 seconds. Bending length, according to

the ASTM cantilever stiffness test was 3.2 inches in the warp direction and 5.8 inches in the fill direction. The stiffened fabric cut into a tape $\frac{5}{8}$ inch thick in the fill direction can be sewn into trousers between the lining and top of the trouser waist section to function as a waist-band.

In view of the above examples, variations in the stiffness are apparent, depending on the materials used, as well as the heat-treatment as mentioned above.

The stiffened fabric constructed in accordance with the above examples are generally useful in any known application in which a stiffener was previously applied. They are particularly useful, however, in waistbands for trousers, lingerie, and foundation garments or in the manufacture of shoes, blouses, collars and cuffs. An excellent degree of stiffness and a pleasing handle is achieved. In addition, the multi-constituent material assures the fabric will have good stability to hot air curing and wet treatments, both in regard to dimensional stability and stiffness. Further advantages lie in the added resistance to abrasion to which foundation pieces are often submitted and the lack of thread slippage.

The heat-treatment temperature for producing the stiffened fabric of this invention preferably is below that of the higher melting dispersion, but above that of the lower melting matrix material whereby the unique stiffening and/or dimensional stability of the multi-constituent is achieved without destroying the strength of the yarn or its general yarn appearance. The temperature in the examples given will be such that the matrix will soften and although it may not necessarily bond to the warp yarn, there will be a certain amount of attraction and fabric adaptation at cross-over points, and in some instances, depending upon the amount of heat-treatment time, fusion will occur. The temperature and extent of heat-treatment cannot be critically defined, except to the extent that heat-treatment should be carried out for a time sufficient to impart the desired amount of stiffness, but for less time that would cause excessive degradation of the yarn.

The invention may be embodied in other specific forms without departing from the essential characteristics thereof. The present embodiments are therefore to be considered in all respects as illustrative and not restrictive, the scope of the invention being indicated by the appended claims rather than by the foregoing description, and all changes which come within the meaning and range of equivalency of the claims are therefore to be embraced therein.

We claim:

1. A fabric stiffener article comprised of multi-constituent yarn elements unidirectionally combined therein in the direction of desired stiffness in said fabric article; said multi-constituent yarn elements being spun from at least two different polymeric materials whose melt temperatures differ by at least 10° C. such that, in a given element, a first fiber-forming polymeric material defines a matrix and a second higher melting polymeric material is dispersed therein in the form of discontinuous fibrils, said matrix comprising at least about 50 percent by weight of the element and having a lower melting point than said dispersed fibrils; and said fabric article 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 desired unidirectional degree of stiffness is imparted thereto, and whereby fabric strength and appearance are retained.

2. A fabric article as defined in claim 1 which is of woven construction and wherein said multi-constituent yarn elements are interwoven therein.

3. A woven fabric article as defined in claim 2 wherein said multi-constituent yarn elements are comprised of 50-90 parts by weight of a fabric forming polymeric matrix material and 10-50 parts by weight of a higher melting micro-fibrillar dispersion therein.

5

4. A woven fabric article as defined in claim 3 wherein said multi-constituent yarn elements are comprised of a polyamide matrix and a polyester dispersion.

5. A woven fabric article as defined in claim 4 wherein said polyamide is nylon 6 and said polyester is polyethylene terephthalate. 5

6. A woven fabric article as defined in claim 2 wherein said multi-constituent yarn elements are interwoven in the weft direction.

7. A woven fabric article as defined in claim 6 and a pair of trousers in combination, said fabric being cut to the thickness of a waistband in the weft direction and sewn in said trousers about the waist section. 10

8. A woven fabric article as defined in claim 7 wherein said multi-constituent yarn elements are comprised of 50-90 parts by weight of a fabric forming polymeric matrix material and 10-50 parts by weight of a higher melting micro-fibrillar dispersion therein. 15

9. A woven fabric article as defined in claim 8 wherein said multi-constituent yarn elements are comprised of a polyamide matrix and a polyester dispersion. 20

10. The method of manufacturing the fabric stiffener article as defined in claim 1, comprising:

(a) providing a fabric article comprised of multi-constituent yarn elements unidirectionally combined therein in the direction of desired stiffness and spun from at least two different polymeric materials whose melt temperatures differ by at least 10° C. such that, in a given element, a first fiber-forming polymeric material defines a matrix and a second higher melting polymeric material is dispersed therein in the form of discontinuous fibrils, said matrix comprising at least 50 percent by weight of the element and having a lower melting point than said dispersed fibrils; and 25

6

(b) heat-treating said fabric article 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 desired degree of unidirectional stiffness is imparted thereto, and whereby fabric strength and appearance are retained.

11. A method as defined in claim 10 wherein said fabric is comprised of multi-constituent yarn elements comprised of a polyamide matrix and polyester dispersion, and said fabric article is subjected to temperatures ranging from between 220° C. to 260° C.

12. A method as defined in claim 10 wherein said fabric is woven in a manner to incorporate the multi-constituent yarn elements in the weft direction.

References Cited

UNITED STATES PATENTS

2,298,071	10/1942	Smith	139—420
3,099,067	7/1963	Merriam et al.	28—82
3,155,986	11/1964	Miller	2—236
3,221,346	12/1965	Johnson et al.	2—236
3,348,993	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.

ROBERT F. BURNETT, Primary Examiner

R. L. MAY, Assistant Examiner

U.S. Cl. X.R.

2—255; 28—72 R; 156—181; 161—70, 91, 92, 176

35