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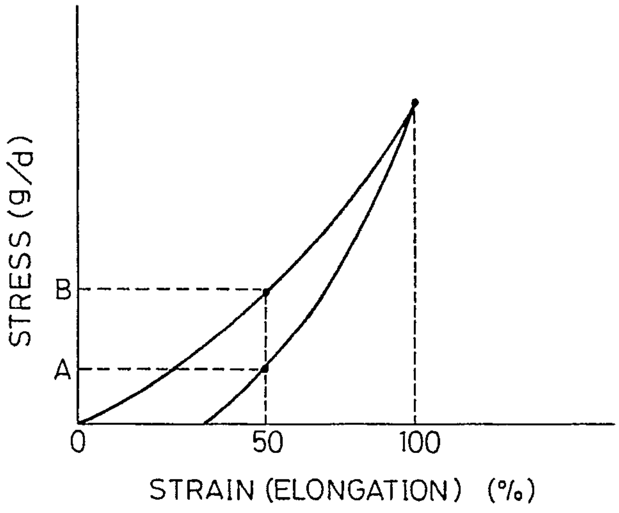
(54) Process for producing a woven or knitted fabric having a high elasticity.

(57) A woven or knitted fabric having a high elasticity, a high resiliency, a good draping property, and a good stretching property is produced by forming a woven or knitted fabric from (A) melt-spun elastic yarns comprising a polyether-polyester block copolymer composed of block-copolymerized polybutylene terephthalate-based polyester hard segments and block-copolymerized polyoxybutylene glycol-based polyether soft segments and (B) a polyethylene terephthalate-based polyester filament yarn; heat treating the resultant woven or knitted fabric, preferably at a temperature of from 20° C above the glass transition point of the hard segments to 160° C; and then treating the heat-treated woven or knitted fabric with an alkali aqueous solution.

Fig.1



EP 0 431 499 A2

PROCESS FOR PRODUCING A WOVEN OR KNITTED FABRIC HAVING A HIGH ELASTICITY

BACKGROUND OF THE INVENTION

1) Field of the Invention

The present invention relates to a process for producing a woven or knitted fabric having a high elasticity. More particularly, the present invention relates to a process for producing a woven or knitted fabric having a high elasticity, a strong resiliency, a good draping property, and a high stretch-elasticity.

2) Description of the Related Arts

A conventional stretchable woven or knitted fabric is usually produced by using stretchable yarns comprising polyurethane elastic filaments and having a high stretch-elasticity.

Usually, the polyurethane elastic filament yarns are used in combination with non-elastic yarns comprising polyamide fibers or filaments.

The polyamide filament yarns, however, are disadvantageous in that, when a heat set operation is applied thereto, the dimensional stability of the resultant heat-set polyamide filament yarn is not as high as that of a polyester filament yarn, and thus the touch of the resultant polyamide filament fabric is not satisfactory.

Also, the conventional elastic woven or knitted fabrics do not have a satisfactory resistance to photo-deterioration and chlorine-deterioration, in practical use.

Further, the use of the polyurethane elastic filament yarns together with polyester filament yarns brings the following problem.

Namely, usually the polyester filament yarns in the fabric are dyed at a high temperature of about 130°C, and this high dyeing temperature causes a thermal decomposition of the polyurethane filament yarns. Also, the polyester filament yarns in the fabric are dimensionally heat set at a high temperature of, for example, 110°C or more, and this high heat-setting temperature causes a thermal deterioration of the polyurethane filament yarns.

Therefore, the polyester filament yarns cannot be used together with the polyurethane filament yarns to provide a stretchable fabric.

The polyester filament yarn-containing woven or knitted fabrics are sometimes treated with an alkali aqueous solution, to improve the touch and softness of the fabric, but this alkali-treatment causes a chemical deterioration of the polyurethane filament yarns.

Also, the polyurethane filament yarns cannot be satisfactorily heat-set to stabilize the dimensions of the yarns, and therefore, when the polyurethane filament yarns are used in combination with the polyester filament yarns, the resultant stretchable fabric has a too high structural density and an unsatisfactorily rigid touch when not under tension.

SUMMARY OF THE INVENTION

An objection of the present invention is to provide a process for producing a woven or knitted fabric having a high elasticity, a strong resiliency, a good draping property, and a high stretch-elasticity.

Another object of the present invention is to provide a process for producing a woven or knitted fabric having a high elasticity, a satisfactory touch, and a high chemical resistance to alkali-deterioration and chlorine-deterioration.

The above-mentioned objects can be attained by the process of the present invention for producing a woven or knitted fabric having a high elasticity, which process comprises the steps of forming a woven or knitted fabric from (A) melt-spun elastic filament yarns comprising a polyether-polyester block copolymer composed of hard segments consisting of a blockcopolymerized polybutylene terephthalate-based polyester polymer and soft segments consisting of a blockcopolymerized polyoxybutylene glycol-based polyether polymer, and (B) polyethylene terephthalate-based polyester filament yarns; heat treating the resultant woven or knitted fabric; and treating the heat treated woven or knitted fabric with an alkali aqueous solution.

BRIEF DESCRIPTION OF THE DRAWING

Figure 1 shows a load-elongation hysteresis curve of an elastic filament yarn usable for the process of the present invention, at an elongation of 100%.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

In the process of the present invention, a woven or knitted fabric is formed from (A) melt-spun elastic filament yarns in combination with (B) non-elastic filament yarns.

The elastic filament yarns (A) comprises a polyether-polyester block copolymer composed of (a) hard segments consisting of a block-copolymerized polybutylene terephthalate-based polyester polymer and (b) soft segments consisting of block-copolymerized polyoxybutylene glycol-based polyether polymer.

The polyethylene terephthalate-based polyester polymer in the hard segments preferably comprises a polycondensation (polyesterification) product of a dicarboxylic acid component comprising (i) 70 to 100 molar%, more preferably 80 to 100 molar% of terephthalic acid or an ester-forming derivative thereof and (ii) 0 to 30 molar%, more preferably 0 to 20 molar% of at least one member selected from the group consisting of an aromatic dicarboxylic acid other than terephthalic acid, for example, isophthalic acid and 2,6-naphthalene dicarboxylic acid, aromatic hydroxycarboxylic acids, for example, p-hydroxy benzoic acid, and ester-forming derivatives of the above-mentioned acids, with a diol component comprising (iii) 70 to 100 molar%, more preferably 80 to 100 molar%, of butylene glycol and 0 to 30 molar%, more preferably 0 to 20 molar%, of at least one diol compound other than butylene glycol, for example, propylene glycol or cyclohexane dimethanol.

The polyoxybutylene glycol-based polyether polymer in the soft segments is preferably a polymerization (polyetherification) product of 70 to 100 molar%, more preferably 20 to 100 molar%, of butylene glycol and 0 to 30 molar%, more preferably 0 to 20 molar%, of at least one diol compound other than butylene glycol, for example, propylene glycol or ethylene glycol.

In the polyether-polyester block copolymer usable for the present invention, the polyoxybutylene glycol-based polyether polymer in the soft segments preferably has a weight average molecular weight of 500 to 5,000, more preferably 500 to 3,000. If the average molecular weight is less than 500, the resultant block copolymer sometimes exhibits an unsatisfactory elasticity. Also, if the average molecular weight is more than 5,000, the resultant soft segments sometimes exhibit an undesirably low compatibility with the hard segments.

Also, in the polyether-polyester block copolymer, the ratio in weight of the soft segments to the hard segments is preferably from 0.25 to 4.0, more preferably 0.25 to 2.5. If the weight ratio is less than 0.25, the resultant block copolymer sometimes exhibits an unsatisfactory elasticity, and if the ratio is more than 4.0, the resultant block copolymer will exhibit a lower melting point, and accordingly, unsatisfactory thermal properties.

The production of the polyether-polyester block copolymer can be effected by a conventional method as disclosed, for example, in Japanese Unexamined Patent Publication No. 58-91819.

The polyether-polyester block copolymer is optionally admixed with an additive, for example, an ultraviolet ray-absorber or an antioxidant.

The elastic filament yarns are produced by melt-spinning the polyether-polyester block copolymer. The melt-spun elastic filament yarns can be used for forming a woven or knitted fabric, without drawing or after drawing.

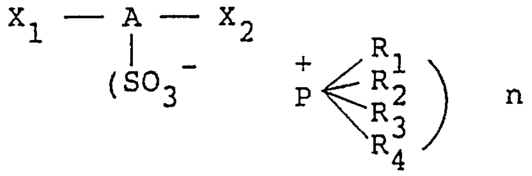
Where the elastic filament yarns are drawn before the weaving or knitting procedure, preferably the yarns are not strictly drawn and heat-treated, because if the drawing and heat-treating procedures are applied to the elastic filament yarns under strict conditions, it becomes difficult to effectively heat set the resultant woven or knitted fabric. Accordingly, the drawing operation for the elastic filament yarns is preferably carried out at a draw ratio of less than 2.0.

The elastic filament yarns to be used for the production of the woven or knitted fabric preferably have an ultimate elongation of 250% or more, more preferably 400% or more.

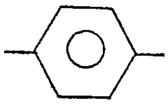
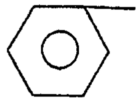
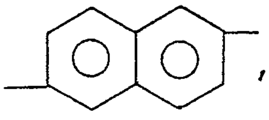
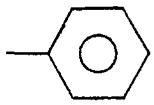
In the production of the elastic woven or knitted fabric of the present invention, the above-mentioned specific polyether-polyester block copolymer filament yarns are used in combination with the polyethylene terephthalate-based polyester filament yarns.

The polyethylene terephthalate-based polyester polymer can be selected from usual polyethylene terephthalate homopolymers, copolyesters of a dicarboxylic acid component comprising 70 to 100 molar% of terephthalic acid and 0 to 30 molar% of at least one other aromatic dicarboxylic acid than terephthalic acid, with a diol component comprising 70 to 100 molar% of ethylene glycol and 0 to 30 molar% of at least one other diol than ethylene glycol, for example, propylene glycol butylene glycol or cyclohexane dimethanol.

The aromatic dicarboxylic acids other than terephthalic acid and usable for the present invention include phosphonium aromatic or aliphatic sulfonates of the formula:



$$\left(X_1 - \underset{(SO_3^-}{\overset{}{A}} - X_2 \quad \overset{+}{P} \begin{matrix} R_1 \\ R_2 \\ R_3 \\ R_4 \end{matrix} \right)_n$$

in which A represents a divalent aromatic or aliphatic structure, for example,  ,  ,  , $>CHCH_2-$, $>CHCH_2CH_2-$, or $-CH_2\overset{|}{C}HCH_2$, X_1 and X_2 represent, respectively and independently from each other, a ester-forming functional group, for example, -COOH, or $-COOCH_3$, R_1 , R_2 , R_3 , and R_4 represent, respectively and independently from each other, a member selected from the group consisting of alkyl radicals, for example, $-CH_3$, $-C_2H_5$, $-C_3H_7$ or C_4H_9 and aryl radicals, for example,  , and n represents a positive integer, for example, 1, 2, or 3.

The phosphonium aromatic or aliphatic sulfonate is preferably copolymerized in an amount of 0.1 to 10 molar % based on the molar amount of the dicarboxylic acid component.

The polyester filaments containing the copolymerized phosphonium sulfonate is dyable with cationic dyes, and the cationic dye-dyable polyester filament yarns can be used in combination with the above-mentioned specific polyether-polyester block copolymer filament yarns to form the elastic woven or knitted fabric.

The specific polyether-polyester block copolymer elastic filament yarns are used in combination with the non-elastic polyester filament yarns, in a known manner, to provide a woven or knitted fabric.

For example, the elastic filament yarns are covered by the non-elastic filament yarns to provide covering yarns. In another example, the individual elastic filament yarns are converted together with the individual non-elastic filament yarns to a union fabric.

To cover the elastic filament yarns with the non-elastic filament yarns, a twist-covering method in which a hollow spindle is utilized, a double-twisting method in which a elastic yarn is doubled with a non-elastic yarn under a tension, the doubled yarn is twisted under a tension, and the tension is released to cause the elastic yarn to shrink at a larger shrinkage rate than that of the non-elastic yarn to be covered by the non-elastic yarn, or a core-spinning method using a fine spinning machine, is used.

The covering yarns can be used together with individual non-elastic yarns to form the union woven or knitted yarns.

The individual elastic filament yarns are used mainly to produce a knitted fabric, for example, tubular knitted fabric or warp knitted fabric.

In the process of the present invention, the elastic filament yarn-containing woven or knitted fabric is treated at at least one stage of the scouring, dyeing and finishing steps, to heat-set the woven or knitted fabric.

Preferably, the heat treatment is carried out at a temperature of from 20 °C above the glass transition point of the hard segments consisting of the polybutylene terephthalate-based polyester polymer, to 160 °C, for a time, for example, of 5 to 60 seconds.

When the heat-treating temperature is lower than the temperature of 20 °C above the glass transition point of the hard segments, the dimensionally stabilizing effect of the heat-treatment is too low, and when the heat-treating temperature is higher than 160° C, an undesirable melt-flow of the elastic filament yarns occurs and the resultant woven or knitted fabric exhibits an unsatisfactory elasticity.

The heat treatment under the above-mentioned conditions effectively promotes the crystallization of the polybutylene terephthalate-based polyester polymer in the hard segments, and thus enhances the pinning effect due to the enhanced crystallization. Also, the heat-treatment effectively releases the orientation of the non-crystalline portion of the polyester polymer, and thus makes the location of the non-crystalline portions more random. This structure contributes greatly to an enhancement of the elasticity of the elastic filament yarns.

Due to the above-mentioned effects, the heat-treated elastic filament yarns exhibit increased elastic properties, for example, ultimate elongation, instantaneous recovery after elongation, modulus of stretch, and modulus of long-term stretch. For example, although the melt-spun, undrawn elastic filament yarns have an ultimate elongation of 250 to 400% and a stretch efficiency of 15 to 20% under a 100% elongation, the heat treated elastic filament yarns in boiling water under no restriction exhibit an increased ultimate elongation of 400 to 550%, and an enhanced stretch efficiency of 40 to 50% under a 100% elongation.

The stretch efficiency is determined from a load-elongation (stress-strain) curve of the filament yarn, as shown in Fig. 1, in accordance with the equation:

$$E\ (\%) = (OA/OB) \times 100$$

wherein E represents a stretch efficiency of the filament yarn, OB represents a load (stress) necessary for stretching the filament yarn at an elongation (strain) of 50%, and OA represents a load (stress) at which the filament yarn exhibits an elongation of 50% when the filament yarn is stretched at a maximum elongation of 100% by increasing the load and then allowing the yarn to contract by reducing the load.

The heat-treatment in the process of the present invention effectively releases internal stress generated in the woven or knitted fabric during the formation of the fabric, fixes the dimensions, and forms the elastic and non-elastic filaments.

Although the conventional polyurethane elastic filament yarns cannot be effectively heat-set, the polyether-polyester block copolymer elastic filament yarns of the present invention can be firmly heat set, and thus the resultant fabric can exhibit a high dimensional stability and a satisfactory touch.

When the fabric is formed from the undrawn polyether-polyester block copolymer filament yarns in which the crystallization of the polymer molecules is in an undeveloped condition, and then heat-treated, the above-mentioned effects of the heat-set can be realized with a high efficiency.

Preferably, in the process of the present invention, the woven or knitted fabric is relaxed in hot water at a temperature of 80° C to 130° C for 1 to 5 minutes, before the heat-treatment is applied thereto.

Preferably, the relaxing operation is applied to the woven or knitted fabric in an opened form. This relaxing operation effectively allows the fabric to be fully shrunk and enhances the stretch-ability thereof.

Also, the heat-treatment is carried out while relaxing the woven or knitted fabric. Note, in the heat-treatment, the fabric is optionally slightly tensed to remove wrinkles in the fabric.

Also, preferably the heat treatment causes the resultant woven or knitted fabric to exhibit an elongation of 20% or more under a constant load of 1.5 kg/5 cm in at least one direction thereof.

In the process of the present invention, the heat-treated woven or knitted fabric is treated with an alkali aqueous solution, to enhance the softness and to improve the touch of the fabric. Preferably, the alkali treatment results in a weight reduction of the fabric of 5 to 30%, more preferably 10 to 20%, based on the weight of the non-alkali-treated fabric. When the weight reduction is less than 5%, the effect of the alkali-treatment on an improvement of the touch of the fabric is unsatisfactory. Also, when the weight reduction is more than 30%, the elastic filament yarns in the fabric are deteriorated at a too high intensity.

The alkali treatment should be carried out under conditions under which the heat-set structure of the fabric is not destroyed. Usually, the alkali treatment operation is carried out by immersing the fabric in an alkali aqueous solution for a certain time, while relaxing, or by leaving the fabric impregnated with the alkali aqueous solution and formed into a loop in a heating atmosphere for a certain time.

The polyether-polyester block copolymer elastic filament yarns have a high resistance to the alkalitreatment and can maintain the mechanical strength and elastic property thereof at a satisfactory level even after the alkali-treatment.

Preferably, the alkali treatment causes the resultant alkali-treated woven or knitted fabric to exhibit an elongation of 80% or more under a constant load of 1.5 kg/5 cm in at least one direction thereof.

The alkali treatment effectively increases the spacing among the yarns in the fabric, and enhances the softness and improves the touch of the fabric. Since the elastic filament yarns in the fabric are dimensionally stabilized by the heat-treatment, an effective increase in the spaces among the yarns can be obtained. If the conventional polyurethane elastic filament yarns are used, it is difficult to increase the spaces among the yarns by the alkali-treatment, because the polyurethane elastic yarns cannot be heat-set and thus are easily shrunk by the alkali-treatment.

EXAMPLES

The specific examples presented below will more fully explain the ways in which the present invention can be practically utilized. It should be understood, however, that those examples are only illustrative and in no way limit the scope of the present invention.

In the examples, an elongation of a specimen fabric under a constant load was determined in the following manner.

A specimen of a fabric having a width of 5 cm and a marked portion with a length of 20 cm was stretched under a load of 1.5 kg for 10 minutes.

The elongation of the specimen was calculated from the equation:

$$\text{Elongation (\%)} = \frac{L_1 - L_0}{L_0} \times 100$$

wherein L_0 represents the length (20 cm) of the marked portion of the original specimen and L_1 represents of the length of the marked portion of the stretched fabric.

Example 1 and Comparative Example 1

In Example 1, a reaction mixture consisting of 167.3 parts by weight of dimethyl terephthalate, 105 parts by weight of tetramethylene glycol, 275 parts by weight of polytetramethylene glycol, and 0.2 part of tetrabutyl titanate was subjected to an ester-exchange reaction in a reactor having an inner temperature of 190° C. At a stage at which methyl alcohol was distilled in an amount corresponding to about 70 molar% of the stoichiometric amount thereof, the inner temperature of the reactor was raised to a level of 200° C to 240° C, and the reaction was further continued at this temperature under a low vacuum for 60 minutes, and then under a high vacuum for 200 minutes. Then a stabilizer consisting of 3.5 parts of Irganox 1010 (trademark, made by Ciba Geigy) and 0.21 part of Thinubin 327 (trademark, made by Ciba-Geigy) was added to the reaction mixture, and the resultant reaction mixture was stirred for 20 minutes to terminate the reaction.

The resultant polyether-polyester block copolymer resin was pelletized in a usual manner, and the pellets were dried and then melted at a temperature of 265° C in a melt-extruder. The copolymer resin melt was extruded through a spinneret with three orifices, at an extruding rate of 3.9 g/min. The extruded melt streams were solidified and wound up through two godet rolls at a take-up speed of 650 m/min.

The resultant undrawn elastic filament yarn had a yarn count of 55 denier/3 filaments.

A stretchable covering yarn was prepared from a core yarn consisting of the above-mentioned elastic yarn and a single sheath yarn consisting of a false-twisted regular polyethylene terephthalate multi-filament yarn having a yarn count of 150 denier/72 filaments.

The stretchable covering yarns were used as warp yarns, and spun yarns consisting of regular polyethylene terephthalate fibers and having a yarn count of 2/48's were used as melt yarns.

A plain weave was prepared from the warp and weft yarns at a warp density of 240 yarns/25.4 mm and a weft density of 200 yarns/25.4 mm.

The plain weave was scoured in a usual manner, relaxed in hot water at a temperature of 90° C for 30 seconds, dried by using a pin tenter, and heat treated in the air atmosphere at a temperature of 160° C for 30 seconds. Then the heat-treated fabric was treated in an alkali aqueous liquid containing 15 g/l of sodium hydroxide at a temperature of 100° C for 90 minutes. The weight reduction of the fabric by the alkali treatment was 10% by weight. The alkali treated fabric was dyed, dried, and finally heat-set in the air atmosphere at a temperature of 160° C for 30 minutes.

The test results of the resultant finished fabric are shown in Table 1.

In Comparative Example 1, the same procedures as in Example 1 were carried out except that, in the melt-spinning procedures, the solidified, undrawn filament yarn was heat treated on two godet rolls heated at a temperature of 180° C, before being converted to the plain weave.

The test results are shown in Table 1. As Table 1 clearly shows, the finished elastic fabric of Example 1 exhibited a low elastic strain, a high resiliency and a satisfactory soft touch, whereas the finished fabric of Comparative Example 1 exhibited a high elastic strain, or a poor resiliency and a rigid touch.

Example 2

The same procedures as in Example 1 were carried out with the following exceptions.

In the preparation of the stretchable covering yarn, the sheath yarn consisted of a cationic dye-dyable polyester multifilament yarn. This cationic dye-dyable filament yarn was prepared in the following manner.

An ester-exchange reaction vessel was charged with a reaction mixture consisting of 100 parts by weight of dimethyl terephthalate, 60 parts by weight of ethylene glycol, 0.03 part (corresponding to 0.024 molar% based on the molar amount of the dimethyl terephthalate), 1.7 molar% of hydrated manganese acetate based on the molar amount of the dimethyl terephthalate) of tetra-n-butyl phosphonium-3,5-dicarbomethoxybenzene sulfonate, and 0.050 molar%, based on the molar amount of the dimethyl terephthalate, of tetra-n-butylphosphonium bromide, the reaction mixture was heated from a temperature of 140 °C to 220 °C in a nitrogen gas atmosphere over a time of 3 hours while distilling away the resultant by-product consisting of methyl alcohol.

The resultant reaction mixture was added with 0.3 part by weight (corresponding to 0.033 molar% based on the molar amount of the dimethyl terephthalate) of a stabilizing agent consisting of an aqueous solution containing 56% by weight of ortho-phosphoric acid and the reaction mixture, in the reactor was further heated to start the distillation away of the excess amount of ethylene glycol from the reaction mixture. Ten minutes after the start of the heating procedures, a polycondensation catalyst comprising antimony trioxide and in an amount of 0.04 part by weight (corresponding to 0.027 molar% based on the molar amount of the dimethyl terephthalate, was added to the reaction mixture.

When the inner temperature of the reaction mixture reached 240 °C, the distillation away operation for ethylene glycol was terminated and the resultant reaction product was moved from the ester-exchange reactor to a polymerization vessel.

The reaction mixture in the polymerization vessel was subjected to a polycondensation reaction under the atmospheric pressure while heating same to 260 °C.

Then, the inside pressure of the polycondensation vessel was reduced from about 760 mmHg to about 1 mmHg over a time of 1 hour while raising the inner temperature of the polycondensation vessel to 280 °C. At this temperature of 280 °C, the reaction mixture was polycondensed under a reduced pressure of 1 mmHg or less for 2 hours.

At the end of the 2 hour polycondensation reaction period, a nitrogen gas was blown into the polycondensation vessel to terminate the polycondensation reaction.

The resultant copolyester resin was collected from the vessel in a nitrogen atmosphere at a temperature of 280−C under a pressure, and conveyed to a melt-spinning process.

The resultant copolyester resin was melt-spun at a temperature of 290 °C to provide a undrawn multifilament yarn having an ultimate elongation of about 350% and a thickness (fineness) of individual filaments of about 6 denier, the resultant undrawn multifilament yarn was taken up at a take-up speed of 1000 m/min.

The resultant undrawn filament yarn was drawn at a drawing temperature of 80 °C to provide a drawn filament yarn having an ultimate elongation of about 30%, and the resultant drawn filament yarn was heat-set at a temperature of 130 °C.

The resultant cationic dye-diable multifilament yarn was converted to a false-twisted yarn having a yarn count of 150 denier/72 filaments.

Also, the weft yarns consisted of spun yarns of the cationic dye-dyable polyester copolymer fibers produced in the same manner as that mentioned above. The spun yarn had a yarn count of 2/48's.

The test results are shown in Table 1.

Table 1

Example No. / Item	Example		Comparative Example 1
	1	2	
Elastic filament yarn			
Yarn count (d/fil.)	55/6	55/6	55/6
Tensile strength (g)	71.6	71.6	75.6
Ultimate elongation (%)	474	474	425
BW S (*)1 (%)	21.5	21.5	8.5
Fabric			
Core of warp yarn	Non-heat treated elastic yarn	Non-heat-treated elastic yarn	Heat-treated elastic yarn
Sheath of warp yarn (d/fil.)	False-twisted PET filament yarn (*)2 (150 d/72 f)	False-twisted CD filament yarn (*)3 (150 d/72 f)	False-twisted PET filament yarn (*)2 (150 d/72 f)
Weft yarn	PET spun yarn (2/48's)	CD spun yarn (2/48's)	PET spun yarn (2/48's)
Finished plain weave			
Shrinkage in warp direction (*)4	35.5%	34.0%	8.3%
Shrinkage in weft direction (*)5	25.0%	23.0%	8.5%
Elongation (%) under 1.5 kg/5 cm (*)5	30.8%	33.4%	28.3%
Elastic strain (%) (*)6	2.0	2.5	5.5
Touch	Soft and highly resilient	Soft and highly resilient	Low resilience

Note:

$(*)_1$: BWS ... Shrinkage (%) in boiling water

$(*)_2$: PET ... Regular polyethylene terephthalate

$(*)_3$: CD .... Cationic dye-dyable polyethylene terephthalate copolyester

$(*)_4$: Shrinkage in warp direction, based on the dimensions of non-treated fabric

$(*)_5$: Shrinkage in weft direction based on the dimension of non-treated fabric

$(*)_6$: Elongation under a load of 1.5 kg/5 cm in the warp direction

$(*)_7$: Elastic strain in the warp direction.

Example 3 and Comparative Examples 1 and 2

In Example 3, the same procedures as in Example 1 were carried out with the following exceptions.

The elastic filament yarn had a yarn count of 40 denier/6 filaments.

The sheath yarn for the elastic covering yarn consisted of a cationic dye-dyable copolyester multi filament yarn having a yarn count of 70 denier/144 filaments.

The alkali treatment was carried out by using an alkali aqueous solution containing 30 g of sodium hydroxide at a temperature of 100 for 20 minutes. The weight reduction was 18% by weight.

The test results are shown in Table 2.

In Comparative Example 2, the same procedures as in Example 3 were carried out except that the alkali treatment was not applied to the heat-treated fabric.

The test results are shown in Table 2.

In Comparative Example 3, the same procedures as in Example 3 were carried out except that the polyether-polyester block copolymer filament yarns were replaced by commercial spandex elastic filament yarns, and the alkali treatment was not applied to the fabric.

The test results are shown in Table 2.

In Example 3, the resultant finished elastic fabric exhibited an elongation of 20% or more in the warp and weft directions and a high draping property and softness whereas, in Comparative Examples 2 and 3, the resultant finished fabric exhibited a poor elongation, softness and resiliency.

Example 4

The same procedures as in Example 3 were carried out with the following exceptions.

The undrawn elastic filament yarn having a yarn count of 40 denier/6 filaments were drawn at a draw ratio of 2.0, the resultant drawn elastic filament yarn was doubled with a false-twisted polyethylene terephthalate multifilament yarn having a yarn count of 75 denier/72 filaments, the resultant doubled yarn was converted to a textured composite yarn by an air turbulence-jetting nozzle, and the textured composite yarn was twisted at a twist number of 1,000 turns/m.

The plain weave was produced from the warp and weft yarns consisting of the above-mentioned textured composite yarns.

The alkali treatment was carried out at a weight reduction of 15% by weight.

The test results are shown in Table 2.

The finished fabric of Example 4 had a high elongation, soft touch and draping property, and a crepe-like appearance.

Table 2

Example No. / Item		Example 3	Comparative Example		Example 4
			2	3	
Elastic filament yarn					
Type		Polyether-polyester copolymer yarn	Polyether-polyester copolymer yarn	Spandex yarn	Polyether-polyester copolymer yarn
Core in covering yarn		Ditto	Ditto	Ditto	(*)8
Sheath in covering yarn		CD yarn (*)3	CD yarn (*)3	CD yarn (*)3	(*)8
(d/fil)		70/144	70/144	70/144	
Plain weave					
Density	Warp	40	40	40	50
(yarns/25.4 mm)	Weft	25	25	25	30
Elongation (*)9 (%)					
Scour-relaxed fabric	Warp	31	25	28	25
	Weft	23	20	18	38
Heat-treated fabric	Warp	32	18	25	20
	Weft	21	15	18	28

Table 2 (Continued)

Example No. / Item		Example 3	Comparative Example 2	Comparative Example 3	Example 4
Alkali-treated fabric	Warp	28	-	-	18
	Weft	19	-	-	31
Dyed fabric	Warp	28	15	17	22
	Weft	22	10	12	33
Finished fabric	Warp	25	12	15	15
	Weft	20	7	10	25
Touch of finished fabric		Soft, and high draping property	Stiff, plastic resin like touch	Poor resilience plastic resin-like touch	Soft, and high resilience

Note: $(*)_8$ ... Doubled, textured composite yarn made from an elastic yarn and a nonelastic yarn

$(*)_9$ ... Elongation under a load of 1.5 kg/5 cm

Claims

1. A process for producing a woven or knitted fabric having a high elasticity, comprising the steps of:
   forming a woven or knitted fabric from (A) melt-spun elastic filament yarns comprising a polyether-polyester block copolymer composed of hard segments consisting of a block-copolymerized polybutylene terephthalate-based polyester polymer and soft segments consisting of a block-copolymerized polyoxybutylene glycol-based polyether polymer, and (B) polyethylene terephthalate-based polyester filament yarns;
   heat treating the resultant woven or knitted fabric; and
   treating the heat-treated woven or knitted fabric with an alkali-aqueous solution.

2. The process as claimed in claim 1, wherein the elastic filament yarns have an ultimate elongation of 250% or more.

3. The process as claimed in claim 1, wherein the heat treatment is carried out at a temperature of from 20° C above the glass transition point of the hard segments consisting of the polybutylene terephthalate-based polyester polymer, to 160° C.

4. The process as claimed in claim 1, wherein the elastic filaments yarn is an undrawn elastic filament yarn.

5. The process as claimed in claim 1, wherein before the heat-treatment, the woven or knitted fabric is relaxed in hot water at a temperature of 80° C to 130° C.

6. The process as claimed in claim 1, wherein the heat treatment causes the resultant woven or knitted fabric to exhibit an elongation of 20% or more under a constant load of 1.5 kg/5 cm in at least one direction of the fabric.

7. The process as claimed in claim 1, wherein the alkali-treatment causes the resultant alkali-treated woven or knitted fabric to exhibit an elongation of 80% or more under a constant load of 1.5 kg/5 cm in at least one direction of the fabric.

8. The process as claimed in claim 1, wherein the alkali-treatment results in a weight reduction of the fabric of 5 to 30% based on the weight of the non-alkali-treated fabric.

9. The process as claimed in claim 1, wherein the polybutylene terephthalate-based polyester polymer in the hard segments comprises a polycondensation product of a dicarboxylic acid component comprising 70 to 100 molar% of terephthalic acid and 0 to 30 molar% of at least one member selected from the group consisting of aromatic dicarboxylic acids other than terephthalic acid and cromatic hydroxycarboxylic acids, with a diol component comprising 70 to 100 molar% of butylene glycol and 0 to 30 molar% of at least one diol compound other than butylene glycol.

10. The process as claimed in claim 1, wherein the polyoxybutylene glycol-based polyether polymer in the soft segments is a polymerization product of 70 to 100 molar% of butylene glycol and 0 to 30 molar% of at least one diol compound other than butylene glycol.

11. The process as claimed in claim 1, wherein the polyoxybutylene glycol-based polyether polymer in the soft segments has a weight average molecular weight of 500 to 5000.

12. The process as claimed in claim 1, wherein the soft segments have a ratio in total weight to the hard segment of 0.25 to 4.0.

13. The process as claimed in claim 1, wherein the polyethylene terephthalate-based polyether is dyeable with cationic dyes.

Fig.1