



(11)

EP 4 273 312 A1

(12)

EUROPEAN PATENT APPLICATION
published in accordance with Art. 153(4) EPC

(43) Date of publication:

08.11.2023 Bulletin 2023/45

(51) International Patent Classification (IPC):

D04B 1/16 ^(2006.01) **A47C 7/00** ^(2006.01)
D01F 8/14 ^(2006.01)

(21) Application number: **22746003.7**

(52) Cooperative Patent Classification (CPC):

A47C 7/00; D01F 8/14; D03D 15/20; D03D 15/283;
D03D 15/292; D03D 15/513; D03D 15/56;
D04B 1/16; D04B 1/18

(22) Date of filing: **27.01.2022**

(86) International application number:

PCT/JP2022/003188

(87) International publication number:

WO 2022/163784 (04.08.2022 Gazette 2022/31)

(84) Designated Contracting States:

AL AT BE BG CH CY CZ DE DK EE ES FI FR GB
GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO
PL PT RO RS SE SI SK SM TR

Designated Extension States:

BA ME

Designated Validation States:

KH MA MD TN

• **TAKADA, Nana**

Otsu-shi, Shiga 520-2141 (JP)

• **OKUNAGA, Kenichi**

Nagoya-shi, Aichi 455-0025 (JP)

• **RYOMOTO, Takuya**

Tokyo 103-0023 (JP)

• **NISHIGUCHI, Takahiro**

Okazaki-shi, Aichi 444-8512 (JP)

(30) Priority: **29.01.2021 JP 2021013376**

(74) Representative: **Prüfer & Partner mbB**

Patentanwälte · Rechtsanwälte

Sohnckestraße 12

81479 München (DE)

(71) Applicant: **Toray Industries, Inc.**
Tokyo 103-8666 (JP)

(72) Inventors:

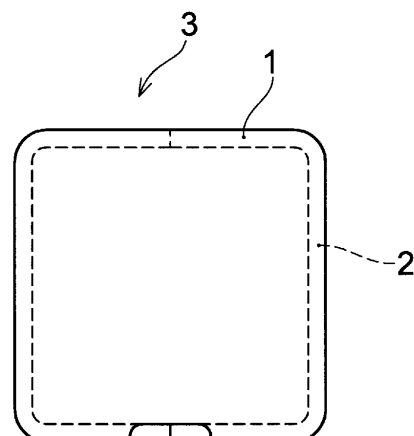
• **SAKAI, Kenichi**

Otsu-shi, Shiga 520-2141 (JP)

(54) **FABRIC, FABRIC OBJECT, AND SHEET**

(57) It is an object of the present invention to provide a fabric, a fabric body, and a seat that exhibit excellent appearance, sitting comfort, and air permeability, and exhibit an excellent flame retardancy. Provided is a fabric, comprising 50% by mass or more of monofilament, wherein the monofilament is a core-sheath composite fiber having a core and a sheath, wherein the core is contained in 60 to 90% by volume with respect to the core-sheath composite fiber and contains a first flame retardant and a polyester elastomer, and wherein the sheath is contained in 10 to 40% by volume with respect to the core-sheath composite fiber and consists of polyester excluding the polyester elastomer of the core.

FIG. 2



EP 4 273 312 A1

Description

TECHNICAL FIELD

5 **[0001]** The present invention relates to a fabric, a fabric body, and a seat. More particularly, the present invention relates to a fabric, a fabric body, and a seat having good sitting comfort, flame retardancy, and air permeability.

BACKGROUND ART

10 **[0002]** Conventionally, a fabric for attachment to a frame and a seating seat having the fabric attached to the frame have been developed (Patent Document 1).

PRIOR ART DOCUMENT

15 Patent Document

[0003] Patent Document 1: JP 2019-143283 A

SUMMARY OF THE INVENTION

20 **[0004]** A fabric of the seating seat is required to be flame-retardant so that, for example, if a fire occurs, it will not spread. However, Patent Document 1 does not disclose that the fabric and the seating seat provide flame retardancy. Moreover, in order to provide the fabric with flame retardancy, it is conceivable to provide a flame retardant. However, the flame retardant may appear on a surface as scum during spinning and knitting steps. As a result, problems occur
25 that an amount of the flame retardant contained in the fabric may vary, an appearance may become poor, and a desired flame retardancy cannot be provided.

[0005] The present invention has been made in view of such conventional problems, and it is an object of the present invention to provide a fabric, a fabric body, and a seat that exhibit excellent appearance, sitting comfort, and air permeability, and exhibit an excellent flame retardancy.

30 **[0006]** The fabric of one aspect of the present invention for solving the above-described problems comprises 50% by mass or more of monofilament, wherein the monofilament is a core-sheath composite fiber having a core and a sheath, wherein the core is contained in 60 to 90% by volume with respect to the core-sheath composite fiber and contains a first flame retardant and a polyester elastomer, and wherein the sheath is contained in 10 to 40% by volume with respect to the core-sheath composite fiber and consists of polyester excluding the polyester elastomer of the core.

35 **[0007]** Moreover, the fabric body of one aspect of the present invention for solving the above-described problems is a fabric body having the above-described fabric and a frame member.

[0008] Furthermore, the seat of one aspect of the present invention for solving the above-described problems is a seat using the above-described fabric body.

40 BRIEF DESCRIPTION OF THE DRAWINGS

[0009]

FIG. 1 is a schematic view for explaining a method of attaching a frame member to a fabric.

45 FIG. 2 is a schematic view of a fabric body.

EMBODIMENT FOR CARRYING OUT THE INVENTION

(Fabric and fabric body)

50 **[0010]** The fabric of one embodiment of the present invention comprises 50% by mass or more of monofilament. The monofilament is a core-sheath composite fiber having a core and a sheath. The core is contained in 60 to 90% by volume with respect to the core-sheath composite fiber and contains a first flame retardant and a polyester elastomer. The sheath is contained in 10 to 40% by volume with respect to the core-sheath composite fiber and consists of polyester
55 excluding the polyester elastomer of the core.

[0011] Moreover, the fabric body of one embodiment of the present invention has the above-described fabric and a frame member. Each component will be described below.

(Fabric)

[0012] The fabric comprises 50% by mass or more of monofilament. The monofilament is a core-sheath composite fiber having a core and a sheath.

(Core)

[0013] The core contains a first flame retardant and a polyester elastomer.

(Polyester elastomer)

[0014] The polyester elastomer is not particularly limited. By way of an example, the polyester elastomer is a thermoplastic polyester elastomer or the like. A thermoplastic polyester elastomer resin may contain, as constituent components, for example, a high-melting point crystalline segment having a crystalline aromatic polyester as a main structural unit and a low-melting point polymer segment having an aliphatic polyether unit and/or an aliphatic polyester unit as a main structural unit.

(High-melting point crystalline segment)

[0015] The high-melting point crystalline segment is a polyester formed of an aromatic dicarboxylic acid or an ester-forming derivative thereof (hereinafter also referred to as an "acid component") and a diol or an ester-forming derivative thereof (hereinafter also referred to as a "diol component").

[0016] The aromatic dicarboxylic acid include, for example, terephthalic acid, isophthalic acid, phthalic acid, naphthalene-2,6-dicarboxylic acid, naphthalene-2,7-dicarboxylic acid, anthracenedicarboxylic acid, diphenyl-4,4'-dicarboxylic acid, diphenoxyethanedicarboxylic acid, 4,4'-diphenyletherdicarboxylic acid, 5-sulfoisophthalic acid, sodium 3-sulfoisophthalate, and the like.

[0017] The aromatic dicarboxylic acid may be mainly used in the present embodiment. Some of the aromatic dicarboxylic acids may be replaced by an alicyclic dicarboxylic acid such as 1,4-cyclohexanedicarboxylic acid, cyclopentanedicarboxylic acid, and 4,4'-dicyclohexyldicarboxylic acid, or an aliphatic dicarboxylic acid such as adipic acid, succinic acid, oxalic acid, sebacic acid, dodecanedioic acid, and dimer acid. An ester-forming derivative of dicarboxylic acid (e.g., a lower alkyl ester, an aryl ester, a carbonic acid ester, an acid halide, etc.) may also be used.

[0018] The diol is, for example, a diol having a molecular weight of 400 or less, or the like. The diol having a molecular weight of 400 or less includes an aliphatic diol such as 1,4-butanediol, ethylene glycol, trimethylene glycol, pentamethylene glycol, hexamethylene glycol, neopentyl glycol, and decamethylene glycol; an alicyclic diol such as 1,1-cyclohexanedimethanol, 1,4-dicyclohexanedimethanol, and tricyclodecanedimethanol; an aromatic diol such as xylylene glycol, bis(p-hydroxy)diphenyl, bis(p-hydroxy)diphenylpropane, 2,2'-bis[4-(2-hydroxyethoxy)phenyl]propane, bis[4-(2-hydroxyethoxy)phenyl]sulfone, 1,1-bis[4-(2-hydroxyethoxy)phenyl]cyclohexane, 4,4'-dihydroxy-p-terphenyl, and 4,4'-dihydroxy-p-quarterphenyl; and the like. These diols may also be used in a form of an ester-forming derivative (e.g., an acetyl derivative, an alkali metal salt, etc.).

(Low-melting point polymer segment)

[0019] The low-melting point polymer segment is at least one of an aliphatic polyether and an aliphatic polyester.

[0020] The aliphatic polyether includes ethylene oxide adducts of poly(oxyethylene) glycol, poly(oxypropylene) glycol, poly(oxytrimethylene) glycol, poly(oxytetramethylene) glycol, poly(oxyhexamethylene) glycol, and poly(oxypropylene) glycol, a copolymer of ethylene oxide and tetrahydrofuran, and the like. Among them, the aliphatic polyether is preferably an ethylene oxide adduct of poly(oxytetramethylene) glycol and/or poly(oxypropylene) glycol and/or a copolymer of ethylene oxide and tetrahydrofuran.

[0021] The aliphatic polyester includes poly(ϵ -caprolactone), polyenantholactone, polycaprylactone, polybutylene adipate, polyethylene adipate, and the like.

[0022] The low-melting point polymer segment is preferably an ethylene oxide adduct of poly(oxytetramethylene) glycol or poly(oxypropylene) glycol, a copolymer glycol of ethylene oxide and tetrahydrofuran, poly(ϵ -caprolactone), polybutylene adipate, polyethylene adipate, or the like, and more preferably an ethylene oxide adduct of poly(oxytetramethylene) glycol or poly(oxypropylene) glycol, or a copolymer glycol of ethylene oxide and tetrahydrofuran, from the viewpoint that a polyester block copolymer obtained has an excellent elastic property.

[0023] A number average molecular weight of the low-melting point polymer segment is preferably 300 to 6000, and more preferably 1000 to 3000, in a copolymerized state. When the number average molecular weight of the low-melting point polymer segment is within the above-described ranges, a fabric obtained has an excellent fatigue resistance, thus

improving durability to exhibit a more excellent sitting comfort.

[0024] Referring back to the description of the polyester elastomer as a whole, for the polyester elastomer constituting the core, two types of polyester block copolymers (a polyester block copolymer (A1) and a polyester block copolymer (A2)) are preferably used, from the viewpoints of an effect of improving flame retardancy by improving dispersibility of a flame retardant and that stretchability and heat shrinkability of a filament can be improved.

[0025] The polyester block copolymer (A1) contains, as constituent components, for example, a high-melting point crystalline segment (H1) having a crystalline aromatic polyester as a main structural unit and a low-melting point polymer segment (L1) having an aliphatic polyether unit and/or an aliphatic polyester as a main structural unit.

[0026] In the polyester block copolymer (A1), the high-melting point crystalline segment (H1) may be composed of one selected from the above-described acid components and one or more selected from the above-described diol components. The high-melting point crystalline segment (H1) is, for example, a polybutylene terephthalate unit derived from terephthalic acid or dimethyl terephthalate and 1,4-butanediol.

[0027] The low-melting point polymer segment (L1) may be selected from the above-described aliphatic polyethers and/or aliphatic polyesters.

[0028] A compounding ratio of the high-melting point crystalline segment (H1) to the low-melting point polymer segment (L1) in the polyester block copolymer (A1) is preferably 50 to 95% by mass of the high-melting point crystalline segment (H1) to 5 to 50% by mass of the low-melting point polymer segment (L1), more preferably 65 to 95% by mass of the high-melting point crystalline segment (H1) to 5 to 35% by mass of the low-melting point polymer segment (L1), and further preferably 80 to 95% by mass of the high-melting point crystalline segment (H1) to 5 to 20% by mass of the low-melting point polymer segment (L1). When the compounding ratio of the high-melting-point crystalline segment (H1) to the low-melting-point polymer segment (L1) is within the above-described ranges, a fabric body obtained has an excellent balance between heat resistance and durability with processability.

[0029] A melting point of the polyester block copolymer (A1) is preferably 200°C to 225°C, and more preferably 210°C to 225°C. When the melting point of the polyester block copolymer (A1) is within the above-described ranges, a polyester elastomer obtained has sufficient rigidity and heat resistance and has an excellent fatigue resistance.

[0030] The polyester block copolymer (A2) contains, as constituent components, a high-melting point crystalline segment (H2) having a crystalline aromatic polyester as a main structural unit and a low-melting point polymer segment (L2) having an aliphatic polyether unit and/or an aliphatic polyester as a main structural unit.

[0031] In the polyester block copolymer (A2), the high-melting point crystalline segment (H2) may be composed of two or more selected from the above-described acid components and one or more selected from the above-described diol components. Examples of the high-melting point crystalline segment (H2) include, for example, a combination of terephthalic acid and isophthalic acid, a combination of terephthalic acid and dodecanedioic acid, a combination of terephthalic acid and dimer acid, and the like.

[0032] When the polyester block copolymer (A2) using two or more acid components is used, a polyester elastomer obtained can improve dispersibility of a flame retardant and suppress aggregation of flame retardants. As a result, the polyester elastomer easily improves in flame retardancy. Moreover, the polyester elastomer may improve stretchability and heat shrinkability of a filament.

[0033] The high-melting point crystalline segment (H2) preferably consists of a polybutylene terephthalate unit derived from terephthalic acid and/or dimethyl terephthalate and a polybutylene isophthalate unit derived from isophthalic acid and/or dimethyl isophthalate and 1,4-butanediol.

[0034] The low-melting point polymer segment (L2) may be selected from the above-described aliphatic polyethers and/or aliphatic polyesters.

[0035] A compounding ratio of the high-melting point crystalline segment (H2) to the low-melting point polymer segment (L2) in the polyester block copolymer (A2) is preferably 40 to 90% by mass of the high-melting point crystalline segment (H2) to 10 to 60% by mass of the low-melting point polymer segment (L2), more preferably 45 to 85% by mass of the high-melting point crystalline segment (H2) to 15 to 55% by mass of the low-melting point polymer segment (L2), and further preferably 70 to 85% by mass of the high-melting point crystalline segment (H2) to 15 to 30% by mass of the low-melting point polymer segment (L2).

[0036] A melting point of the polyester block copolymer (A2) is preferably 120°C to 170°C, and more preferably 130°C to 165°C. When the melting point of the polyester block copolymer (A2) is within the above-described ranges, the polyester block copolymer (A2) contributes to improvement of dispersibility of a flame retardant or the like when used in combination with the polyester block copolymer (A1). As a result, a fabric body obtained does not impair heat shrinkability and has excellent abrasion resistance, toughness, flame retardancy, and appearance.

[0037] In the polyester elastomer of the present embodiment, a compounding amount (part by mass) of the polyester block copolymer (A1) and the polyester block copolymer (A2) is preferably 50 to 99 parts by mass of the polyester block copolymer (A1) and 1 to 50 parts by mass of the polyester block copolymer (A2), more preferably 60 to 95 parts by mass of the polyester block copolymer (A1) and 5 to 40 parts by mass of the polyester block copolymer (A2), and further preferably 70 to 95 parts by mass of the polyester block copolymer (A1) and 5 to 30 parts by mass of the polyester block

copolymer (A2). When the compounding amount (part by mass) of the polyester block copolymer (A1) and the polyester block copolymer (A2) is within the above-described ranges, a polyester elastomer obtained has an excellent fatigue resistance and has excellent toughness and flame retardancy due to improvement of dispersibility of a flame retardant.

[0038] The polyester block copolymer (A1) and the polyester block copolymer (A2) can be produced by known methods.

For example, the polyester block copolymer (A1) and the polyester block copolymer (A2) may be produced by a method of transesterifying a lower alcohol diester of a dicarboxylic acid with an excessive amount of a low molecular weight glycol and a low-melting point polymer segment component in presence of a catalyst and polycondensing the obtained reaction product, a method of esterifying a dicarboxylic acid with an excess amount of glycol and a low-melting point polymer segment component in presence of a catalyst and polycondensing the obtained reaction product, and the like.

[0039] Besides, to the polyester elastomer of the present embodiment, as necessary, additives such as antioxidants (a phosphonite compound, a phosphorous compound, a hypophosphorous compound, a hindered phenol-based compound, a thioether-based compound, etc.), UV absorbers (benzotriazole-based, benzophenone-based, etc.), light stabilizers (HALS: hindered amine-based compound, etc.), antistatic agents (a polyether ester amide, etc.), lubricants (a stearyl alcohol, a stearic acid metal salt, a stearic acid amide, a stearic acid glyceride, etc.), dyes (organic dyes such as nigrosine), pigments (carbon black, titanium dioxide, etc.), plasticizing agents (phthalic acid-based, adipic acid-based, trimellitic acid-based, etc.), release agents (a paraffin wax, saturated fatty acid ester-based, unsaturated fatty acid ester-based, etc.), and transesterification inhibitors, or other thermoplastic resins such as a styrene-based resin, an olefin-based resin, and a polyvinyl chloride-based resin may be added.

[0040] Examples of a phosphorus-containing compound include a hydrate of metal hypophosphite, in addition to an organic phosphorus-containing compound exemplified as a flame retardant. When the hydrate of metal hypophosphite is used, the polyester elastomer easily suppresses oxidative deterioration and easily improves surface appearance and color tone.

(First flame retardant)

[0041] The first flame retardant is a flame retardant contained in a core. The first flame retardant preferably contains at least one selected from the group consisting of an organic phosphate compound, a metal phosphinate, and a triazine skeleton-containing compound. As a result, a fabric body obtained becomes less likely to generate scum in a spinning step, a knitting step, and the like, and exhibits more stable and excellent appearance and flame retardancy.

[0042] The organic phosphate compound includes, for example, tetrakis(2,6-dimethylphenyl) 1,3-phenylene bisphosphate, and resorcinol bis(diphenyl phosphate), as resorcinol phosphates; hydroquinone bis(diphenyl phosphate) as hydroquinone phosphates; biphenol bis(diphenyl phosphate) as biphenol phosphates; bisphenol-A bis(diphenyl phosphate) as bisphenol phosphates; and the like.

[0043] The organic phosphate compound exhibits a melting point lower than that of a general thermoplastic polyester elastomer and further has a good compatibility with a polyester elastomer. Therefore, the organic phosphate compound has an excellent dispersibility during melt-kneading. In addition, the organic phosphate compound may improve flame retardancy of the polyester elastomer and suppress deterioration of mechanical strength property.

[0044] Moreover, as the organic phosphate compound, an aryl spirodiphosphinate condensed with a polyhydric alcohol such as pentaerythritol is also appropriately used.

[0045] Moreover, among organic phosphate compounds, a diphosphinate compound having a spiro-type ring-fused structure exhibits a high melting point, easily improves in dispersibility to a polyester elastomer, and has a high heat resistance. Therefore, the diphosphinate compound having a spiro-type ring-fused structure is more appropriately used since it can suppress bleeding out during processing.

[0046] A melting point of the aryl spirodiphosphinate is preferably 100 to 300°C. When the melting point is within the above-described range, the aryl spirodiphosphinate is less likely to bleed out during melt processing and has excellent dispersibility and processability during melt processing. As a result, a filament or a molded article obtained easily improves in toughness, fatigue resistance, and surface appearance.

[0047] An acid value of the aryl spirodiphosphinate is preferably 1.0 mgKOH/g or less, and more preferably 0.5 mgKOH/g or less. When the acid value is within the above-described ranges, a polyester elastomer obtained has excellent flame retardancy and hue. In addition, a filament using the obtained polyester elastomer easily suppresses deterioration of heat aging resistance and hydrolysis resistance.

[0048] The aryl spirodiphosphinate is, for example, a pentaerythritol diphosphinate compound or the like. Specifically, the pentaerythritol diphosphinate compound includes 2,4,8,10-tetraoxa-3,9-diphosphaspiro[5.5]undecane, 3,9-dibenzyl-3,9-dioxide, 2,4,8,10-tetraoxa-3,9-diphosphaspiro[5.5]undecane, 3,9-di- α -methylbenzyl-3,9-dioxide, 2,4,8,10-tetraoxa-3,9-diphosphaspiro[5.5]undecane, 3,9-di(2-phenylethyl)-3,9-dioxide, 2,4,8,10-tetraoxa-3,9-diphosphaspiro[5.5]undecane, 3,9-bis(diphenylmethyl)-3,9-dioxide, and the like.

[0049] A content of the organic phosphate compound is preferably 1% by mass or more, and more preferably 10% by mass or more, based on the entire core. Moreover, the content of the organic phosphate compound is preferably

30% by mass or less, and more preferably 20% by mass or less, based on the entire core. When the content of the organic phosphate compound is within the above-described ranges, a fabric body obtained does not impair heat shrinkability and has excellent toughness, flame retardancy, and appearance.

[0050] The metal phosphinate is a group of compounds described by a general formula $R^1R^2P(=O)OM$ or $\{[OP(=O)R^1]-R^3-[P(=O)R^2-O]\}_M$. R^1 and R^2 are organic groups which may be the same or different, and R^3 is methylene, ethylene, n-propylene, isopropylene, n-butylene, t-butylene, phenylene, or naphthylene and may have various substituents on its aromatic ring. M is aluminum, zinc, calcium, or magnesium.

[0051] Specific examples of the metal phosphinate (also referred to as a metal phosphinate compound) include a metal phosphinate substituted with an aliphatic hydrocarbon group, such as a metal salt of diethylphosphinate and a metal salt of methylethylphosphinate, preferably an aluminum phosphinate (aluminum diethylphosphinate) or a zinc phosphinate (zinc diethylphosphinate). Among them, the metal phosphinate is more preferably an aluminum phosphinate, since it can significantly improve flame retardancy of a polyester elastomer and suppress bleed-out during processing.

[0052] A content of the metal phosphinate is preferably 1% by mass or more, and more preferably 10% by mass or more, based on the entire core. Moreover, the content of the metal phosphinate is preferably 30% by mass or less, and more preferably 20% by mass or less, based on the entire core. When the content of the metal phosphinate is within the above-described ranges, a polyester elastomer obtained has an excellent flame retardancy and an excellent processability.

[0053] Besides, the organic phosphorus-containing compound and the metal phosphinate are melt-kneaded together with the polyester elastomer described above in a specific range to prepare a flame-retardant masterbatch in advance, and further the flame-retardant masterbatch is melt-kneaded with the polyester elastomer, so that aggregation of organic phosphorus-containing compounds can be suppressed, deterioration of mechanical property can be suppressed, and a flame-retardant polyester elastomer resin composition and a flame-retardant polyester elastomer filament which have excellent flame retardancy, surface appearance, surface smoothness, toughness, and fatigue resistance can be obtained.

[0054] A thermoplastic resin used in preparing a masterbatch containing an organic phosphorus-containing compound may be the polyester elastomer described above, and a thermoplastic polyester resin such as polyethylene terephthalate (PET), polybutylene terephthalate (PBT), polyethylene naphthalate (PEN), and polybutylene naphthalate (PBN) may be used.

[0055] Moreover, the organic phosphorus-containing compound may be used together with a polyester elastomer in molding a masterbatch.

[0056] In the present embodiment, the thermoplastic polyester elastomer and the organic phosphorus-containing compound contained in the masterbatch are preferably melt-kneaded with a compositional ratio in a range of 100 parts by mass of the polyester elastomer to 10 to 100 parts by mass of the organic phosphorus-containing compound from the viewpoint that deterioration of processability of a polyester elastomer obtained is suppressed to obtain an excellent flame retardancy, and they are more preferably melt-kneaded with a compositional ratio in a range of 100 parts by mass of the polyester elastomer to 20 to 70 parts by mass of the organic phosphorus-containing compound from the viewpoint that aggregation of organic phosphorus-containing compounds is suppressed to improve surface appearance and surface smoothness.

[0057] The triazine skeleton-containing compound is, for example, melamine cyanurate, melamine, cyanuric acid, isocyanuric acid, a triazine derivative, an isocyanurate derivative, or the like, preferably melamine cyanurate.

[0058] Melamine cyanurate is preferably in a form of a particle (powder). Moreover, melamine cyanurate may be untreated or surface-treated with a coupling agent (particularly a silane coupling agent).

[0059] In addition, as the triazine skeleton-containing compound, a group of compounds having a triazine ring in a hindered amine structure which is generally used as a radical scavenger can also be appropriately used. By adding a triazine ring-containing hindered amine compound to a polyester elastomer, not only a general effect of improving weather resistance but also an effect of improving flame retardancy can be obtained.

[0060] This is because an effect of suppressing combustion can be obtained by a synergistic effect of a chain reaction mediated by active radicals in a combustion process of a polyester elastomer with a triazine skeleton-containing hindered amine compound contributing as a radical scavenger.

[0061] When the triazine skeleton-containing compound has the hindered amine structure, aggregation of triazine rings can be suppressed to improve dispersibility of the triazine skeleton-containing compound. This improves surface appearance, surface smoothness, toughness, and fatigue resistance of a polyester elastomer obtained.

[0062] The hindered amine compound is preferably a triazine ring-containing N-alkoxy hindered amine compound. The triazine ring-containing N-alkoxy hindered amine compound generates a nitroxide radical having a higher radical scavenging ability during combustion than a N-H type hindered amine compound and a N-R type hindered amine compound, and easily improves in flame retardancy compared with an alkyl-substituted type hindered amine compound.

[0063] Specifically, the triazine ring-containing N-alkoxy hindered amine compound includes 1,5,8,12-tetrakis[2,4-bis(N-butyl-N-(2,2,6,6-tetramethyl-4-piperidyl)amino)-1,3,5-triazin-6-yl]-1,5,8,12-tetraazadodecane, 1,5,8,12-tetrakis[2,4-bis(N-butyl-N-(2,2,6,6-tetramethyl-4-piperidyl)amino)-1,3,5-triazin-6-yl]-1,12-dimethyl-1,5,8,12-tetraazado-

decane, and the like, and includes, as commercially available products, Flamestab NOR116FF manufactured by BASF Japan Ltd., and the like.

[0064] A content of the triazine skeleton-containing compound is preferably 1% by mass or more, and more preferably 3% by mass or more, based on the entire core. Moreover, the content of the triazine skeleton-containing compound is preferably 30% by mass or less, and more preferably 10% by mass or less, based on the entire core. When the content of the triazine skeleton-containing compound is within the above-described ranges, a polyester elastomer obtained has an excellent flame retardancy and has excellent toughness, fatigue resistance, and surface appearance.

[0065] Referring back to the description of the first flame retardant as a whole, a total compounding amount of the organic phosphate compound, the metal phosphinate, and the triazine skeleton-containing compound is preferably 1% by mass or more, and more preferably 10% by mass or more, based on the entire core. Moreover, the total compounding amount of the organic phosphate compound, the metal phosphinate, and the triazine skeleton-containing compound is preferably 30% by mass or less, and more preferably 20% by mass or less, based on the core. When the total compounding amount of the organic phosphate compound, the metal phosphinate, and the triazine skeleton-containing compound is within the above-described ranges, a fabric body obtained becomes less likely to generate scum in the spinning step, the knitting step, and the like, and exhibits a more stable and excellent flame retardancy.

[0066] Referring back to the description of the core as a whole, a content of the core may be 60% or more by volume, preferably 70% or more by volume, based on the core-sheath composite fiber. Moreover, the content of the core may be 90% or less by volume, more preferably 80% or less by volume, based on the core-sheath composite fiber. When the content of the core is 60% or more by volume, a fabric body obtained does not impair heat shrinkability and exhibits a more excellent sitting comfort. On the other hand, when the content of the core is 90% or less by volume, a fabric body obtained becomes less likely to generate scum in the spinning step, the knitting step, and the like, and exhibits a more stable and excellent flame retardancy.

(Sheath)

[0067] The sheath contains polyester excluding the above-described polyester elastomers contained in the core. Moreover, the sheath appropriately contains a second flame retardant.

(Polyester excluding polyester elastomers contained in core)

[0068] The polyester other than the polyester elastomers contained in the core is not particularly limited. By way of an example, the polyester other than the polyester elastomers contained in the core is polyethylene terephthalate (PET), polybutylene terephthalate (PBT), polyethylene naphthalate (PEN), polybutylene naphthalate (PBN), or the like. Among them, the polyester other than the polyester elastomers contained in the core is preferably PET from the viewpoint of productivity.

(Second flame retardant)

[0069] The sheath preferably contains a second flame retardant. The second flame retardant is not particularly limited. By way of an example, the second flame retardant preferably contains at least one of an aryl phosphinic acid compound and an alkyl phosphinic acid compound. Furthermore, in the second flame retardant, at least one of the aryl phosphinic acid compound and the alkyl phosphinic acid compound is more preferably copolymerized with the above-described polyester. When at least one of the aryl phosphinic acid compound and the alkyl phosphinic acid compound is contained as the second flame retardant, a fabric body obtained becomes less likely to generate scum in the spinning step, the knitting step, and the like, and exhibits more stable and excellent appearance and flame retardancy. When the second flame retardant is an aryl phosphinic acid compound or an alkyl phosphinic acid compound, it is further preferable that they are added to a polymerization system prior to polycondensation after transesterification or during an initial stage of a polycondensation reaction and copolymerized in a polyester main chain.

[0070] The aryl phosphinic acid compound is not particularly limited. By way of an example, the aryl phosphinic acid compound is 2-carboxyethyl(phenyl)phosphinic acid, 2-carboxyethyl(naphthyl)phosphinic acid, 2-carboxyethyl(tolyl)phosphinic acid, or the like. Among them, the aryl phosphinic acid compound is preferably 2-carboxyethyl(phenyl)phosphinic acid.

[0071] The alkyl phosphinic acid compound is not particularly limited. By way of an example, the alkyl phosphinic acid compound is 2-carboxyethylmethylphosphinic acid, 2-carboxyethyl-tert-butylphosphinic acid, or the like. Among them, the alkyl phosphinic acid compound is preferably 2-carboxyethylmethylphosphinic acid.

[0072] A content of the second flame retardant is preferably 0.3% by mass or more, more preferably 0.5% by mass or more, and further preferably 0.6% by mass or more, in terms of phosphorus element, based on the sheath. Moreover, the content of the second flame retardant is preferably 1.1% by mass or less, more preferably 1.0% by mass or less,

and further preferably 0.9% by mass or less, in terms of phosphorus element, based on the sheath. When the content of the second flame retardant is within the above-described ranges, a fabric body obtained becomes less likely to generate scum in the spinning step, the knitting step, and the like, and exhibits a more stable and excellent flame retardancy.

[0073] Referring back to the description of the sheath as a whole, a content of the sheath may be 10% or more by volume, preferably 20% or more by volume, based on the core-sheath composite fiber. Moreover, the content of the sheath may be 40% or less by volume, more preferably 30% or less by volume, based on the core-sheath composite fiber. When the content of the sheath is 10% or more by volume, a fabric body obtained becomes less likely to generate scum in the spinning step, the knitting step, and the like, and exhibits a more stable and excellent flame retardancy. On the other hand, when the content of the sheath is 40% or less by volume, deterioration of heat shrinkability of a fabric body obtained can be suppressed.

[0074] Referring back to the description of the fabric as a whole, a content of the monofilament in the fabric may be 50% by mass or more, preferably 60% by mass or more, and more preferably 70% by mass or more. When the content of the monofilament is 50% by mass or more, a fabric body obtained exhibits an appropriate amount of deflection when attached to a frame member.

[0075] A fineness of the monofilament is preferably 300 dtex or more, and more preferably 500 dtex or more. Moreover, the fineness of the monofilament is preferably 3000 dtex or less, and more preferably 2000 dtex or less. When the fineness of the monofilament is 300 dtex or more, a fabric has an excellent strength. On the other hand, when the fineness of the monofilament is 3000 dtex or less, the monofilament has an excellent process passing property. Besides, the fineness of the monofilament may be calculated based on JIS L 1018 (2010) 8.7.1.

[0076] A dry heat shrinkage of the monofilament is preferably 5.0% or more, more preferably 10.0% or more, and further preferably 20.0% or more. Moreover, the dry heat shrinkage of the monofilament is preferably 50.0% or less, more preferably 45.0% or less, and further preferably 40.0% or less. When the dry heat shrinkage of the monofilament is within the above-described ranges, a fabric obtained shrinks appropriately by being applied with heat and is easily attached to the frame member. In addition, the fabric is easily adjusted to have an appropriate amount of deflection when attached to the frame member. Besides, a dry heat shrinkage of a fiber can be adjusted depending on a base polymer constituting the fiber, a core-sheath ratio, a type of a flame retardant, an amount of the flame retardant added, a spinning condition, and the like. In addition, a monofilament that is also a core-sheath composite fiber containing a polyester elastomer with a fineness of 300 to 3000 dtex adjusted to a dry heat shrinkage of 5.0 to 50.0% can be appropriately used for the fabric body of the present invention. Moreover, the dry heat shrinkage may be measured based on JIS L 1013 (8.18.2) (2010) B method (filament shrinkage rate).

[0077] A melting point of the core-sheath composite fiber constituting the monofilament is not particularly limited. By way of an example, the melting point of the core-sheath composite fiber is preferably 200°C or higher, and more preferably 225°C or higher. Moreover, the melting point of the core-sheath composite fiber is preferably 280°C or lower, and more preferably 260°C or lower. When the melting point of the core-sheath composite fiber is within the above-described ranges, a fabric obtained has improved durability such as abrasion resistance.

[0078] In addition, a melting point of the core is not particularly limited. By way of an example, the melting point of the core is preferably 200°C or higher, and more preferably 210°C or higher. Moreover, the melting point of the core is preferably 230°C or lower, and more preferably 220°C or lower. On the other hand, a melting point of the sheath is not particularly limited. By way of an example, the melting point of the sheath is preferably 225°C or higher, and more preferably 235°C or higher. Moreover, the melting point of the sheath is preferably 280°C or lower, and more preferably 260°C or lower. When the melting points of the core and sheath are within the above-described ranges, a fabric obtained has improved durability such as abrasion resistance.

[0079] A method of producing a monofilament that is also a core-sheath composite fiber is not particularly limited. By way of an example, the monofilament can be produced by a core-sheath composite spinning method using conventionally known co-extrusion equipment. According to the core-sheath composite spinning method, the monofilament may be produced with high productivity and at low cost.

[0080] More specifically, a first flame retardant and a polyester elastomer constituting a core and a polyester constituting a sheath are molten in separate extruders, and then weighed by a gear pump and flowed into a composite pack, respectively. The two types of polymers that constitute the core and the sheath flowed into the composite pack are filtered through a metal non-woven fabric filter or a metal mesh in the pack, and then introduced into a composite spinneret and spun with the core being surrounded by the sheath.

[0081] In addition, when a monofilament is given functions such as spindyeing, light resistance, and antibacterial property, a master chip containing large amounts of a pigment, a light resistance agent, an antibacterial agent, etc. as desired is prepared, and necessary amounts of these components can be mixed with the first flame retardant and the polyester elastomer constituting the core and/or the polyester constituting the sheath to perform spinning.

[0082] A molten monofilament spun from the composite spinneret is cooled, extended, and heat-set according to a standard method, so that a monofilament that is also a core-sheath composite fiber may be produced efficiently.

[0083] Besides, a fabric may contain fibers other than the above-described monofilaments. By way of an example,

fibers other than monofilaments are synthetic fibers that are multifilaments. Among them, a multifilament of polyester fibers, a multifilament of polyamide fibers, and the like are appropriate as the fibers. The multifilament may be a textured yarn subjected to processing such as false twisting. Among them, fibers other than monofilaments are preferably false-twisted PET from the viewpoint of improving texture and feeling of touch of the fabric and from the viewpoint of productivity.

A content of fibers other than monofilaments is less than 50% by mass, preferably 40% by mass or less.

[0084] The fabric may be knitted or woven. The fabric of the present embodiment is preferably a knitted fabric because it exhibits an excellent sitting comfort as it has an excellent stretchability, has improved air permeability, and has a wide variety of pattern expressions.

[0085] The knitted fabric preferably has a knitting density of 10 yarns/25.4 mm or more, and more preferably 15 yarns/25.4 mm or more, in at least one of a warp direction and a weft direction. Moreover, the knitting density is preferably 50 yarns/25.4 mm or less, and more preferably 40 yarns/25.4 mm or less. When the knitting density is within the above-described ranges, a fabric (knitted fabric) having an appropriate amount of deflection and strength when attached to the frame member is easily obtained. As a result, a fabric body obtained exhibits more excellent sitting comfort and air permeability.

[0086] An amount of deflection of the fabric when a load of 400 N is applied to the central part thereof is preferably 20 mm or more, and more preferably 30 mm or more. Moreover, the amount of deflection is preferably 60 mm or less, and more preferably 50 mm or less. When the amount of deflection is within the above-described ranges, a fabric body obtained using the fabric may have an appropriate range of an amount of deflection when a load is applied to a support surface that supports a user (for example, when the fabric body is a backrest of a sitting seat, or seat base). As a result, the fabric body obtained has an excellent sitting comfort. In addition, the fabric body obtained may retain a moderate elasticity. Besides, the central part of the fabric refers to a center of gravity of a planar shape of a fabric. That is, for example, when the fabric has a polygonal shape, the center of gravity of the polygonal shape becomes a central part of the fabric.

[0087] In addition, air permeability of the fabric is preferably $5 \text{ cm}^3/\text{cm}^2/\text{sec}$ or more, and more preferably $20 \text{ cm}^3/\text{cm}^2/\text{sec}$ or more. Moreover, air permeability of the fabric is preferably $300 \text{ cm}^3/\text{cm}^2/\text{sec}$ or less, and more preferably $180 \text{ cm}^3/\text{cm}^2/\text{sec}$ or less. When air permeability of the fabric is within the above-described ranges, a fabric body obtained can have a reduced stuffy feeling and sufficiently support a body when used by a user. In the present embodiment, air permeability may be measured based on JIS L 1096 (8.27.1) (2010) A method (Frazier type method).

[0088] The fabric of the present embodiment contains a first flame retardant at the core of the core-sheath composite fiber that constitutes the monofilament. Such a first flame retardant contained in the core does not easily generate scum in steps such as a spinning step and a knitting step. As a result, a fabric obtained exhibits an excellent appearance and also exhibits an excellent flame retardancy. For example, flammability of the fabric preferably has a burn rate of 0 mm/min in FMVSS 302 (horizontal method). This indicates that the fabric will extinguish itself before an A marker line. When the burn rate is 0 mm/min in FMVSS 302 (horizontal method), the fabric exhibits selfextinguishing property and thus has an excellent flame retardancy. For flammability of the fabric, a judgment grade by a 20 mm vertical combustion test (UL94V test) is more preferably V-0. When the judgment grade is V-0 in the 20 mm vertical combustion test (UL94V test), the fabric has an excellent flame retardancy.

(Frame member)

[0089] The frame member is not specifically limited. The frame member is a member having strength enough to withstand tension of the fabric when the fabric is fixed under tension in at least one direction. Specifically, the frame member is made of a metal such as iron, aluminum, and titanium, carbon, wood, plastic, or the like. Among them, the frame member is preferably made of metal or carbon from the viewpoint of high strength, and more preferably made of carbon from the viewpoint of weight reduction.

[0090] Referring back to the description of the fabric body as a whole, a method of attaching the fabric to the frame member to prepare a fabric body is not particularly limited. FIG. 1 is a schematic view for explaining a method of attaching a frame member to a fabric. FIG. 2 is a schematic view of a fabric body.

[0091] As shown in FIG. 1, a fabric 1 is a bag-shaped knitted fabric processed into a three-dimensional shape so that a frame member 2 can be inserted therein. The knitted fabric can be knitted using a weft knitting machine. A weft knitting structure is not particularly limited. By way of an example, the weft knitting structure is a jersey structure, a garter structure, a smooth structure, a rib structure, or the like. The fabric 1 is formed with an opening 1a for inserting the frame member. As shown in FIG. 1, for example, frame members disassembled into two parts (a first frame member 2a and a second frame member 2b) are inserted from the opening 1a and assembled to form a frame member 2 in a substantially rectangular shape in the fabric 1. Next, the fabric 1 is thermally shrunk to closely attach to the frame member 2 by, for example, performing heat treatment, as shown in FIG. 2. As a result, a non-sewn and non-bonded fabric body 3 may be formed. The non-sewn and non-bonded fabric body can be used in various applications where it is desirable to form a three-dimensional fabric surface, despite being non-sewn and non-bonded.

[0092] An application of the fabric body of the present embodiment is not particularly limited. By way of an example, the fabric body is appropriate for various types of seats, since it maintains an excellent flame retardancy and exhibits excellent sitting comfort and air permeability. More specifically, the fabric body is appropriate for a seat surface, a backrest, etc., such as a seat for an office chair, a car seat, and a seat for a railroad vehicle.

[0093] One embodiment of the present invention has been described above. The present invention is not particularly limited to the above-described embodiment. Besides, the above-described embodiment mainly describes an invention having the following configurations.

(1) A fabric, comprising 50% by mass or more of monofilament, wherein the monofilament is a core-sheath composite fiber having a core and a sheath, wherein the core is contained in 60 to 90% by volume with respect to the core-sheath composite fiber and contains a first flame retardant and a polyester elastomer, and wherein the sheath is contained in 10 to 40% by volume with respect to the core-sheath composite fiber and consists of polyester excluding the polyester elastomer of the core.

[0094] According to such a configuration, the first flame retardant contained in the core is less likely to appear as scum in a spinning step or a knitting step. As a result, the fabric has an excellent appearance and easily maintains an excellent flame retardancy. In addition, the fabric exhibits excellent sitting comfort and air permeability.

[0095] (2) The fabric of (1), wherein the fabric is a knitted fabric, wherein the knitted fabric has a knitting density of 10 to 50 yarns/25.4 mm in at least one of a warp direction and a weft direction, and wherein a fineness of the monofilament is 300 to 3000 dtex.

[0096] With such a configuration, the fabric exhibits more excellent seating comfort and air permeability.

[0097] (3) The fabric of (1) or (2), wherein the first flame retardant contains at least one selected from the group consisting of an organic phosphate compound, a metal phosphinate, and a triazine skeleton-containing compound, which is contained in an amount of 1 to 30% by mass based on the core.

[0098] According to such a configuration, the fabric becomes less likely to generate scum in the spinning step, the knitting step, and the like, and exhibits a more stable and excellent flame retardancy.

[0099] (4) The fabric of any one (1) to (3), wherein the sheath contains a second flame retardant, and wherein the second flame retardant contains at least one of an aryl phosphinic acid compound and an alkyl phosphinic acid compound, which is contained in an amount of 0.3 to 1.1% by mass in terms of phosphorus element, based on the sheath.

[0100] According to such a configuration, the fabric becomes less likely to generate scum in the spinning step, the knitting step, and the like, and exhibits a more stable and excellent flame retardancy.

[0101] (5) A fabric body having the fabric of any one of (1) to (4) and a frame member.

[0102] According to such a configuration, the fabric body has an excellent appearance and easily maintains an excellent flame retardancy. In addition, the fabric body exhibits excellent sitting comfort and air permeability.

[0103] (6) The fabric body of (5), wherein the fabric is non-sewn and non-bonded.

[0104] According to such a configuration, the fabric can be used in various applications where it is desirable to form a three-dimensional fabric surface, despite being non-sewn and non-bonded.

[0105] (7) A seat using the fabric body of (5) or (6).

[0106] With such a configuration, the seat easily maintains an excellent flame retardancy. In addition, the seat exhibits excellent sitting comfort and air permeability.

EXAMPLE

[0107] The present invention will be described in detail below based on Examples. The present invention is not limited to these Examples. In addition, performances in Examples were measured by the following methods.

[Measuring method]

(1) Volume ratio of core and sheath of core-sheath composite fiber

[0108] A monofilament was taken from a fabric and cut in a direction perpendicular to a fiber axis to observe a cut surface obtained using a digital microscope (VHX-6000, manufactured by KEYENCE CORPORATION), diameters of a core and a sheath were measured using a length measurement tool of the digital microscope, and a volume ratio % of the core and a volume ratio % of the sheath were calculated from a cross-sectional area of the monofilament and respective cross-sectional areas of the core and the sheath using an area measurement tool of the digital microscope. The ratios were calculated from an average value with the number of observation samples being as 10. Besides, figures below the first decimal place were rounded off.

(2) Content of phosphorus element

[0109] 7 g of a sample was molten and molded into a plate shape, intensity was measured by fluorescent X-ray analysis (fluorescent X-ray analyzer model 3270 manufactured by Rigaku Corporation), and a content of phosphorus element (% by mass) was calculated using a calibration curve prepared in advance with a known content of the sample.

(3) Melting point of core and sheath of core-sheath composite fiber

[0110] An extreme value of a heat-fusing curve was measured for 10 mg of a monofilament sample taken from a fabric at a temperature rising rate of 10 °C/min from 30°C to 280°C using a differential scanning calorimeter DSC-7 manufactured by PerkinElmer Co., Ltd., and the temperature giving the obtained extreme value of the heat-fusing curve was taken as each melting point.

(4) Fineness of monofilament

[0111] 25 monofilaments collected from a fabric based on JIS L 1018 (2010) 8.7.1 were loosened, and their length (mm) and mass (mg) were measured to calculate a fineness (dtex) of the monofilament using the following equation.

$$T=W/L \times 100$$

wherein,

T: Fineness (dtex)

W: Total mass (mg) of 25 filaments

L: Total length (mm) of 25 filaments

(5) Dry heat shrinkage of monofilament

[0112] A dry heat shrinkage of a monofilament was measured based on JIS L 1013 (8.18.2) (2010) B method (filament shrinkage rate). An initial load was applied to the sample, 500 mm of which was accurately measured to make two points of marks, and after removing the initial load, the sample was left in a dryer set at 185°C while being hung for 15 minutes and then taken out. After cooling to room temperature, an initial load is applied again to the sample, a length (mm) of which between the two points was measured, and a dry heat shrinkage (%) was measured by the following equation $((500 - \text{length between the two points after heat treatment})/500 \times 100)$ to calculate an average value of 5 time measurement. Here, the initial loads were set in accordance with JIS L 1013 (8.5.1) depending on a fineness of the sample, respectively.

(6) Spinnability

[0113] Continuous spinning for 12 hours was performed to judge 4 items (filter clogging, scum generation, yarn breakage, number of occurrences of bump yarn) according to the following criteria, and as a comprehensive evaluation on the 4 items, evaluations were performed in two stages of rating as "A" when all of the 4 items are rated as A and rating as "B" when at least one of the 4 items is rated as B.

a. filter clogging

[0114]

A: There was no filter clogging, discharge state was stable, and there was no trouble in spinning.

B: Filter clogging occurred, discharge state became unstable, and spinning became impossible due to an increase in filtering pressure.

b. Scum generation

[0115]

A: No scum was generated in the spinning step.

B: Generation of scum was confirmed in the spinning step.

c. Yarn breakage

5 [0116]

A: Yarn breakage occurred no more than once.

B: Yarn breakage occurred two or more times.

10 d. Number of occurrences of bump yarn

[0117]

15 A: There were less than 10 times/ton of occurrences of bump yarn as exceeding +20% of an average diameter of monofilaments.

B: There were 10 times/ton or more of occurrences of bump yarn as exceeding +20% of an average diameter of monofilaments.

20 [0118] Besides, the number of occurrences of bump yarn was expressed by a total weight (kg) of extruded polymers/1000 kg $\times$ the number of occurrences of bump yarn.

(7) Air permeability

25 [0119] Air permeability was measured based on JIS L 1096 (8.27.1) (2010) A method (Frazier type method). A test piece of 20 cm $\times$ 20 cm was taken from five different sites on a fabric, and the test piece was attached to one end (intake side) of a cylinder using a Frazier type tester. In attaching the test piece, the test piece was placed on the cylinder, and a load of about 98 N (10 kgf) was evenly applied from the top of the test piece so as not to block the intake part to prevent air leakage at the mounting part of the test piece. After attaching the test piece, a suction fan was adjusted so that a tilt-type barometer indicated a pressure of 125 Pa by a rheostat, and an amount of air passing through the test piece was measured with the table attached to the tester from a pressure indicated by a vertical-type barometer and a type of an air hole used at that time to calculate an average value for the measurements for five test pieces.

(8) Amount of deflection when load of 400 N is applied

35 [0120] For a fabric body having a fabric stretched in a tense state over a frame member, an amount of deflection when a load of 400 N was applied was measured using a seat static load deflection tester (FGS-TV, manufactured by NIDEC DRIVE TECHNOLOGY CORPORATION). Specifically, the fabric was stretched in a tense state over a frame member made of metal to obtain a fabric body. Next, the fabric body was placed on a fixing jig with a height of 30 cm and applied with an initial load of 5 N by a pressure plate having a horizontally long oval shape and a width of 250 mm $\times$ 300 mm so that the load center of the pressure plate was overlapped with the central part of the fabric to define the load center of the pressure plate at that time as a starting point. First, the fabric body was applied with a load up to 900 N at a speed of 50 mm/min, as precompression, then unloaded at a speed of 50 mm/min, and left for 1 minute, followed by similarly applied with a load up to 900 N and then unloaded at a speed of 50 mm/min to measure an amount of deflection from the starting point when each load was applied at that time. The "amount of deflection when a load of 400 N is applied" here refers to an amount of deflection from the starting point when a load of 400 N is applied to the fabric body. Here, there is no particular restriction on directionality of the fabric when fixing the fabric body on a frame fixing jig, which may be any of a vertical direction and a horizontal direction.

(9) Flammability (horizontal method)

50 [0121] Three test pieces each having a size of 250 mm in length and 120 mm in width were randomly taken from a fabric in vertical and horizontal directions, respectively. Next, they were evaluated based on FMVSS 302 (horizontal method). The test pieces were pinched with a special jig, placed horizontally, and flame-contacted at the ends thereof with a 38 mm flame for 15 seconds to measure burn times (sec) until reaching 254 mm between an A standard line and a B standard line, or if not reaching the B standard line, burn distances (mm) and burn times (sec) thereof. Moreover, if not reaching the A standard line, burn distances and burn times were recorded as 0 mm and 0 second, respectively. In addition, from the measured burn times and burn distances, burn rates were calculated for the vertical and horizontal directions of the fabric using the equation 1 below, respectively. Here, the "flammability (horizontal method)" refers to

an average value of burn rates of three test pieces each in the vertical and horizontal directions of the fabric.

Equation 1: Burn rate (mm/min) = burn distance (mm) / burn time

(seconds) × 60

(10) Flammability (UL94V)

[0122] Five test pieces each having a size of 125 mm in length and 13 mm in width were randomly taken from a fabric in vertical and horizontal directions, respectively. Next, they were evaluated based on a 20 mm vertical combustion test (UL94V test) in the UL94 standard. Here, UL is a safety standard for an electronic equipment as established and approved by Underwriters Laboratories Inc. in the United States, and UL94 is also a flame retardant standard. After the evaluations, flammability (UL94V) grades were judged according to the defined judgement criteria. Flammability (flame retardancy) has three stages of judgement criteria, V-0, V-1, and V-2, and is ranked in an order of V-0>V-1>V-2, in which V-0 indicates the most excellent flame retardancy among the three grades. Besides, V-0 was set to satisfy the V-0 judgement criteria for all 10 test pieces in total in the vertical and horizontal directions. V-2 was set to satisfy the V-2 judgement criteria for at least one of all 10 test pieces in total in the vertical and horizontal directions.

(11) Comprehensive evaluation

[0123] A comprehensive evaluation of a fabric body obtained was performed according to the following criteria.

A: An amount of deflection of a fabric body when a load of 400 N is applied is in a range of 20 to 60 mm, flammability (horizontal method) of the fabric is 0 mm/min, a judgment grade of flammability (UL94V) of the fabric is V-0, and a comprehensive evaluation of spinnability of a monofilament used for the fabric was A.

B: An amount of deflection of a fabric body when a load of 400 N is applied is in a range of 20 to 60 mm, flammability (horizontal method) of the fabric is 0 mm/min, a judgment grade of flammability (UL94V) of the fabric does not satisfy V-0, and/or a comprehensive evaluation of spinnability of a monofilament used for the fabric was B.

C: Satisfying at least one of the following conditions: an amount of deflection of a fabric body when a load of 400 N is applied is less than 20 mm or more than 60 mm; and flammability of the fabric (horizontal method) is more than 0 mm/min.

[Reference example]

(Pellet)

[0124] Constituent materials were dry-blended and melt-kneaded at a temperature setting of 240°C using a twin-screw extruder having a screw of 45 mmφ, followed by discharged in a strand shape, and then pelletized to φ3 mm and a length of 3 mm using a pelletizer. First, a method of producing a polyester elastomer will be described.

(Method of producing polyester elastomer (A1))

[0125] A polyester block copolymer (A1-1) containing, as constituent components, 80% by mass of a high-melting point crystalline segment (H1) having a crystalline aromatic polyester as a main structural unit and 20% by mass of a low-melting point polymer segment (L1) having an aliphatic polyether as a main structural unit was produced. 58.0 parts of terephthalic acid, 36.7 parts of 1,4-butanediol, and 15.0 parts of poly(oxytetramethylene) glycol having a number average molecular weight of about 1000 were charged together with 0.04 parts of titanium tetrabutoxide and 0.02 parts of mono-n-butyl-monohydroxy tin oxide in a reaction vessel equipped with a helical ribbon type stirring blade and heated at 220 to 245°C for 3 hours to perform an esterification reaction while allowing reaction water to flow out of a system. 0.2 parts of tetra-n-butyl titanate was additionally added to the reaction mixture, 0.05 parts of "Irganox" 1098 (a hindered phenol-based antioxidant manufactured by Ciba-Geigy AG) was added, and then the temperature was raised to 255°C, and next, a pressure in the system was reduced to 27 Pa over 50 minutes to perform polymerization for 1 hour and 50 minutes under this condition. The resulting polymer was discharged into water in a strand shape and cut into a pellet. The melting point was 217°C.

(Method of producing polyester elastomer (A2))

[0126] A polyester block copolymer (A2-1) containing, as constituent components, 80% by mass of a high-melting point crystalline segment (H2) having a crystalline aromatic polyester as a main structural unit and 20% by mass of a low-melting point polymer segment (L2) having an aliphatic polyether as a main structural unit was produced, the high-melting point crystalline segment (H2) being composed of two kinds of acid components and a diol component. 45.0 parts of terephthalic acid and 20.0 parts isophthalic acid, as two kinds of acid components, 41.6 parts of 1,4-butanediol, and 18.5 parts of poly(oxytetramethylene) glycol having a number average molecular weight of about 1000 were charged together with 0.04 parts of titanium tetrabutoxide and 0.02 parts of mono-n-butyl-monohydroxy tin oxide in a reaction vessel equipped with a helical ribbon type stirring blade and heated at 190 to 220°C for 3 hours to perform an esterification reaction while allowing reaction water to flow out of a system. 0.15 parts of tetra-n-butyl titanate was additionally added to the reaction mixture, 0.05 parts of "Irganox" 1098 (a hindered phenol-based antioxidant manufactured by Ciba-Geigy AG) was added, and then the temperature was raised to 245°C, and next, a pressure in the system was reduced to 27 Pa over 50 minutes to perform polymerization for 1 hour and 50 minutes under this condition. The resulting polymer was discharged into water in a strand shape and cut into a pellet. The melting point was 164°C.

(Method of producing polyester (A3))

[0127] A slurry of 1100 parts by mass of terephthalic acid and 480 parts by mass of ethylene glycol was supplied over 3 hours to an esterification reaction vessel charged with 1950 parts by mass of bis(hydroxyethyl) terephthalate and maintained at a temperature of 245°C to perform an esterification reaction while distilling water out of the reaction system. 1300 parts by mass of a low polymer after the reaction was transferred to a polycondensation reaction vessel. Next, a previously prepared slurry of 65 parts by mass of 2-carboxyethyl(phenyl)phosphinic acid and 150 parts by mass of ethylene glycol was added to the transferred low polymer 40 minutes before starting a polycondensation reaction, then 500 ppm of diantimony trioxide was added to the mixture, and then the temperature of the reaction system was gradually raised from 250°C to 290°C, while distilling off ethylene glycol at the same time, to reduce the pressure of the reaction system to 50 Pa. Besides, the slurry of 2-carboxyethyl(phenyl)phosphinic acid and ethylene glycol was prepared 50 minutes before starting the addition of the slurry into the polycondensation reaction system. When a predetermined torque of a stirrer is obtained, nitrogen is flowed into the reaction system to return the pressure to normal to stop the polymerization reaction, and the mixture was discharged in a strand shape from a lower part of a polymerization can, cooled and solidified, and then cut to obtain a pellet of a phosphorus atom-containing flame-retardant polyester composition. The obtained phosphorus atom-containing polyester had an intrinsic viscosity of 0.75, a melting point of 239°C, and a content of phosphorus elemental of 0.67 wt%.

(Method of producing polyester elastomer (A4))

[0128] A polyester block copolymer (A1-2) containing, as constituent components, 65% by mass of a high-melting point crystalline segment (H1) having a crystalline aromatic polyester as a main structural unit and 35% by mass of a low-melting point polymer segment (L1) having an aliphatic polyether as a main structural unit was produced. 101 parts of terephthalic acid, 50.0 parts of 1,4-butanediol, and 71.0 parts of poly(oxytetramethylene) glycol having a number average molecular weight of about 1400 were charged together with 0.06 parts of titanium tetrabutoxide and 0.04 parts of mono-n-butyl-monohydroxy tin oxide in a reaction vessel equipped with a helical ribbon type stirring blade and heated at 190 to 225°C for 3 hours to perform an esterification reaction while allowing reaction water to flow out of a system. 0.4 parts of tetra-n-butyl titanate was additionally added to the reaction mixture, 0.1 parts of "Irganox" 1098 (a hindered phenol-based antioxidant manufactured by Ciba-Geigy AG) was added, and then the temperature was raised to 245°C, and next, a pressure in the system was reduced to 27 Pa over 50 minutes to perform polymerization for 2 hours and 50 minutes under this condition. The resulting polymer was discharged into water in a strand shape and cut into a pellet. The melting point was 208°C.

(Method of producing polyester elastomer (A5))

[0129] A polyester block copolymer (A1-3) containing, as constituent components, 50% by mass of a high-melting point crystalline segment (H1) having a crystalline aromatic polyester as a main structural unit and 50% by mass of a low-melting point polymer segment (L1) having an aliphatic polyether as a main structural unit was produced. 88 parts of terephthalic acid, 33.0 parts of 1,4-butanediol, and 101 parts of poly(oxytetramethylene) glycol having a number average molecular weight of about 1400 were charged together with 0.06 parts of titanium tetrabutoxide and 0.04 parts of mono-n-butyl-monohydroxy tin oxide in a reaction vessel equipped with a helical ribbon type stirring blade and heated at 190 to 225°C for 3 hours to perform an esterification reaction while allowing reaction water to flow out of a system.

0.4 parts of tetra-n-butyl titanate was additionally added to the reaction mixture, 0.1 parts of "Irganox" 1098 (a hindered phenol-based antioxidant manufactured by Ciba-Geigy AG) was added, and then the temperature was raised to 245°C, and next, a pressure in the system was reduced to 27 Pa over 50 minutes to perform polymerization for 2 hours and 50 minutes under this condition. The resulting polymer was discharged into water in a strand shape and cut into a pellet.

(Method of producing polyester (A6))

[0130] 100 parts by mass of dimethyl terephthalate, 57.5 parts by mass of ethylene glycol, 0.03 parts by mass of magnesium acetate dihydrate, and 0.03 parts by mass of antimony trioxide were molten at 150°C under a nitrogen atmosphere. This molten material was heated to 230°C over 3 hours while stirring, and methanol was distilled off to complete the transesterification reaction. After completion of the transesterification reaction, an ethylene glycol solution (pH 5.0) in which 0.005 parts by mass of phosphoric acid was dissolved in 0.5 parts by mass of ethylene glycol was added. The intrinsic viscosity of the polyester composition at this time was less than 0.2. Thereafter, the polymerization reaction was made to reach a final reaching temperature of 285°C, and the pressure of the reaction system was reduced to 13 Pa to obtain a polyester having an intrinsic viscosity of 0.65 and a melting point of 265°C.

(Method for producing polyester (A7))

[0131] A slurry of 1100 parts by mass of terephthalic acid and 480 parts by mass of ethylene glycol was supplied over 3 hours to an esterification reaction vessel charged with 1950 parts by mass of bis(hydroxyethyl) terephthalate and maintained at a temperature of 245°C to perform an esterification reaction while distilling water out of the reaction system. 1300 parts by mass of a low polymer after the reaction was transferred to a polycondensation reaction vessel. Next, a previously prepared slurry of 46 parts by mass of (2-carboxyethyl)methylphosphinic acid and 150 parts by mass of ethylene glycol was added to the transferred low polymer 40 minutes before starting a polycondensation reaction, then 500 ppm of diantimony trioxide was added to the mixture, and then the temperature of the reaction system was gradually raised from 250°C to 290°C, while distilling off ethylene glycol at the same time, to reduce the pressure of the reaction system to 50 Pa. Besides, the slurry of (2-carboxyethyl)methylphosphinic acid and ethylene glycol was prepared 50 minutes before starting the addition of the slurry into the polycondensation reaction system. When a predetermined torque of a stirrer is obtained, nitrogen is flowed into the reaction system to return the pressure to normal to stop the polymerization reaction, and the mixture was discharged in a strand shape from a lower part of a polymerization can, cooled and solidified, and then cut to obtain a pellet of a phosphorus atom-containing flame-retardant polyester composition. The obtained phosphorus atom-containing polyester had an intrinsic viscosity of 0.72, a melting point of 245°C, and a content of phosphorus elemental of 0.50 wt%.

[Example 1]

(Pellet)

[0132] A polyester elastomer (A1) and a flame retardant (B1) were kneaded to obtain a pellet (A1-B1) containing the flame retardant and the polyester elastomer. Besides, as (B1), an organic phosphorus-containing compound "Fireguard" FCX-210 manufactured by TEIJIN LIMITED was used.

(Monofilament)

[0133] The pellet (A1-B1) containing the flame retardant and the polyester elastomer was used as a polymer used for the core and a polyester (A3) was used as a polymer used for the sheath to be spun so as to achieve the ratios of the core and sheath as described in Table 1 to obtain a monofilament. Here, the monofilament was a core-sheath composite fiber, which had a 70% by volume of fraction of the core and a 30% by volume of fraction of the sheath. As for spinnability, filter clogging was rated as A, scum generation was rated as A, yarn breakage was rated as A, and the number of occurrences of bump yarn was rated as A and a comprehensive evaluation of spinnability was A. Moreover, dry heat shrinkage of the obtained monofilament was 23.0%. Besides, a flame retardant contained in the sheath was a phosphorus compound 1 (2-carboxyethyl(phenyl)phosphinic acid), and a content of phosphorus element contained in the sheath was 0.7% by mass.

(Fabric body)

[0134] The obtained monofilament and a two-ply yarn of a false twisted polyester yarn of 167 dtex as another yarn

were used to be knitted with a weft knitting machine so that a content of the monofilament to a fabric was 70% by mass. Next, the edge of the fabric was supported and attached by a metal frame member having an inner frame size of 500 mm × 500 mm to obtain a fabric body in which shrinkage is expressed in the fabric by dry heat treatment (185°C × 15 minutes). Table 1 shows configurations and performances of this fabric body. In this fabric body, a comprehensive evaluation of spinnability of the monofilament used in the fabric was rated as A, which was excellent in spinnability, flammability (horizontal method) of the fabric was 0 mm/min, which was excellent in flammability, and an amount of deflection when a load of 400 N was applied was 32 mm, resulting in a comprehensive evaluation of the fabric body being rated as A.

[Example 2] to [Example 10]

[0135] A fabric and a fabric body were produced and evaluated in the same manner as in Example 1, except that a ratio of a core and a sheath, a content of a flame retardant, and a content of phosphorus element were changed as shown in Table 1. The results are shown in Table 1.

[Example 11]

[0136] Regarding a flame retardant contained in a core, a fabric and a fabric body were produced and evaluated in the same manner as in Example 1, except that B2 as described below was added to the flame retardant of Example 1. The results are shown in Table 1.

[0137] (B2): Flamestab NOR116FF, a hindered amine-based light stabilizer (HALS) manufactured by BASF Japan Ltd.

[Example 12]

[0138] Regarding a flame retardant contained in a core, a fabric and a fabric body were produced and evaluated in the same manner as in Example 1, except that the flame retardant in Example 1 was changed to B3 as described below. The results are shown in Table 1.

[0139] (B3): Aluminum phosphinate OP-1240 manufactured by CLARIANT, which does not have a melting point below 300°C and has a decomposition temperature of 300°C or higher.

[Example 13]

[0140] Regarding a flame retardant contained in a core, a fabric and a fabric body were produced and evaluated in the same manner as in Example 1, except that the flame retardant in Example 1 was changed to B4 as described below. The results are shown in Table 1.

[0141] (B4): Aluminum hydroxide (SB303, manufactured by Nippon Light Metal Company, Ltd., average particle size: 27 μm)

[Example 14]

[0142] Regarding a flame retardant contained in a sheath, a fabric and a fabric body were produced and evaluated in the same manner as in Example 1, except that the flame retardant in Example 1 was changed to B3 as described below. The results are shown in Table 1.

[0143] (B3): Aluminum phosphinate OP-1240 manufactured by CLARIANT, which does not have a melting point below 300°C and has a decomposition temperature of 300°C or higher.

[Example 15]

[0144] Regarding a polymer used in a core, a fabric and a fabric body were produced and evaluated in the same manner as in Example 1, except that the polymer in Example 1 was changed to a polyester elastomer (A1) and a polyester elastomer (A2) that were used in combination. The results are shown in Table 2.

[Example 16]

[0145] Regarding a polymer used in a core, a fabric and a fabric body were produced and evaluated in the same manner as in Example 1, except that the polymer in Example 1 was changed to a polyester (A6) that contains no phosphorus element as a flame retardant. The results are shown in Table 2.

[Example 17]

[0146] Regarding a polymer used in a core, a fabric and a fabric body were produced and evaluated in the same manner as in Example 1, except that the polymer in Example 1 was changed to a polyester (A7) that contains a copolymerized phosphorus compound 2. The results are shown in Table 2. Besides, the phosphorus compound 2 was (2-carboxyethyl)methylphosphinic acid, and a content of phosphorus element contained in a sheath was 0.5% by mass.

[Example 18]

[0147] Regarding a polymer used in a core, a fabric and a fabric body were produced and evaluated in the same manner as in Example 1, except that the polymer in Example 1 was changed to a polyester elastomer (A4). The results are shown in Table 2.

[Example 19]

[0148] Regarding a polymer used in a core, a fabric and a fabric body were produced and evaluated in the same manner as in Example 1, except that the polymer in Example 1 was changed to a polyester elastomer (A5). The results are shown in Table 2.

[Comparative example 1] to [Comparative example 6]

[0149] A fabric and a fabric body were produced and evaluated in the same manner as in Example 1, except that a ratio of a core and a sheath, a content of a flame retardant, and a content of phosphorus element were changed as shown in Table 2. The results are shown in Table 3.

Table 1

	Unit	Example 1	Example 2	Example 3	Example 4	Example 5	Example 6	Example 7
Monofilament								
Fiber form	-	Core-sheath composite	Core-sheath composite	Core-sheath composite	Core-sheath composite	Core-sheath composite	Core-sheath composite	Core-sheath composite
Base polymer in core	-	Polyester elastomer (A1)	Polyester elastomer (A1)	Polyester elastomer (A1)	Polyester elastomer (A1)	Polyester elastomer (A1)	Polyester elastomer (A1)	Polyester elastomer (A1)
Base polymer in sheath	-	Polyester (A3)	Polyester (A3)	Polyester (A3)	Polyester (A3)	Polyester (A3)	Polyester (A3)	Polyester (A3)
Fraction of core	% by volume	70	60	90	70	70	70	70
Fraction of sheath	% by volume	30	40	10	30	30	30	30
Flame retardant contained in core		1. Organic phosphate	1. Organic phosphate	1. Organic phosphate	1. Organic phosphate	1. Organic phosphate	1. Organic phosphate	1. Organic phosphate
Content of flame retardant contained in core	% by mass	20	20	20	5	30	40	20
Flame retardant contained in sheath	-	Phosphorus compound 1	Phosphorus compound 1	Phosphorus compound 1	Phosphorus compound 1	Phosphorus compound 1	Phosphorus compound 1	Phosphorus compound 1
Content of phosphorus element based on entire sheath	% by mass	0.7	0.7	0.7	0.7	0.7	0.7	0.1
Total fineness	dtex	760	760	760	760	760	760	760
Dry heat shrinkage	%	23.0	21.1	26.7	26.5	21.2	19.2	22.9
Spinnability								
	Unit	Example 1	Example 2	Example 3	Example 4	Example 5	Example 6	Example 7
Filter clogging	-	A	A	A	A	A	B	A
Scum generation	-	A	A	A	A	A	A	A
Yarn breakage	-	A	A	A	A	A	B	A
Number of occurrences of bump yarn	-	A	A	A	A	A	B	A

(continued)

Spinnability								
	Unit	Example 1	Example 2	Example 3	Example 4	Example 5	Example 6	Example 7
Comprehensive evaluation	-	A	A	A	A	A	B	A
Other yarn (multifilament)	-	False-twisted PET (167T/2-48)	False-twisted PET (167T/2-48)	False-twisted PET (167T/2-48)	False-twisted PET (167T/2-48)	False-twisted PET (167T/2-48)	False-twisted PET (167T/2-48)	False-twisted PET (167T/2-48)
Fabric body								
Type of fabric body		Knitted fabric	Knitted fabric	Knitted fabric	Knitted fabric	Knitted fabric	Knitted fabric	Knitted fabric
Content of monofilament based on fabric	% by mass	70	70	70	70	70	70	70
Knitting density of fabric								
Well	Yarn/25.4 mm	29	29	30	30	29	28	29
Coarse	Yarn/25.4 mm	36	36	35	35	36	36	36
Air permeability of fabric	cm ³ /cm ² lsec	103	118	100	103	115	120	105
Amount of deflection of fabric body when load of 400N is applied	mm	32	25	38	36	26	20	29
Flammability of fabric								
Horizontal method	mm/min	0	0	0	0	0	0	0
UL94V	Grade	V-0	V-0	V-0	V-0	V-0	V-0	V-2
	Unit	Example 1	Example 2	Example 3	Example 4	Example 5	Example 6	Example 7
Comprehensive evaluation on fabric body	-	A	A	A	A	A	B	B

(continued)

	Unit	Example 8	Example 9	Example 10	Example 11	Example 12	Example 13	Example 14
Monofilament								
Fiber form	-	Core-sheath composite	Core-sheath composite	Core-sheath composite	Core-sheath composite	Core-sheath composite	Core-sheath composite	Core-sheath composite
Base polymer in core	-	Polyester elastomer (A1)	Polyester elastomer (A1)	Polyester elastomer (A1)	Polyester elastomer (A1)	Polyester elastomer (A1)	Polyester elastomer (A1)	Polyester elastomer (A1)
Base polymer in sheath	-	Polyester (A3)	Polyester (A3)	Polyester (A3)	Polyester (A3)	Polyester (A3)	Polyester (A3)	Polyester (A3)
Fraction of core	% by volume	70	70	70	70	70	70	70
Fraction of sheath	% by volume	30	30	30	30	30	30	30
Flame retardant contained in core	-	1. Organic phosphate	1. Organic phosphate	1. Organic phosphate	1. phosphate 2. Triazine-containing compound	3. Phosphinic acid	Aluminum hydroxide Al (OH) ₃	1. Organic phosphate
Content of flame retardant contained in core	% by mass	20	20	20	22	20	20	20
Flame retardant contained in sheath	-	Phosphorus compound 1	Phosphorus compound 1	Phosphorus compound 1	Phosphorus compound 1	Phosphorus compound 1	Phosphorus compound 1	Phosphoric acid Al
Content of phosphorus element based on entire sheath	% by mass	0.3	1.1	1.5	0.7	0.7	0.7	0.7
Total fineness	dtex	760	760	760	760	760	760	760
Dry heat shrinkage	%	22.8	22.5	22.3	22.8	23.5	19.4	21.3
Spinnability								
	Unit	Example 8	Example 9	Example 10	Example 11	Example 12	Example 13	Example 14
Filter clogging	-	A	A	B	A	A	A	B
Scum generation	-	A	A	A	A	A	A	A
Yarn breakage	-	A	A	B	A	A	A	B

(continued)

Spinnability								
	Unit	Example 8	Example 9	Example 10	Example 11	Example 12	Example 13	Example 14
Number of occurrences of bump yarn	-	A	A	B	A	A	A	B
Comprehensive evaluation	-	A	A	B	A	A	A	B
Other yarn (multifilament)	-	False-twisted PET (167T/2-48)	False-twisted PET (167T/2-48)	False-twisted PET (167T/2-48)	False-twisted PET (167T/2-48)	False-twisted PET (167T/2-48)	False-twisted PET (167T/2-48)	False-twisted PET (167T/2-48)
Fabric body								
Type of fabric body	-	Knitted fabric	Knitted fabric	Knitted fabric	Knitted fabric	Knitted fabric	Knitted fabric	Knitted fabric
Content of monofilament based on fabric	% by mass	70	70	70	70	70	70	70
Knitting density of fabric								
Well	Yarn/ 25.4 mm	29	29	29	29	29	28	29
Coarse	Yarn/ 25.4 mm	36	36	36	36	36	36	36
Air permeability of fabric	cm ³ /cm ² /sec	105	103	105	103	102	122	110
Amount of deflection of fabric body when load of 400N is applied	mm	30	31	28	32	36	20	24
	Unit	Example 8	Example 9	Example 10	Example 11	Example 12	Example 13	Example 14
Flammability of fabric								
Horizontal method	mm/min	0	0	0	0	0	0	0
UL94V	Grade	V-0	V-0	V-0	V-0	V-0	V-2	V-1
Comprehensive evaluation on fabric body	-	A	A	B	A	A	B	B

Table 2

	Unit	Example 15	Example 16	Example 17	Example 18	Example 19
5	Monofilament					
	Fiber form	-	Core-sheath composite	Core-sheath composite	Core-sheath composite	Core-sheath composite
10	Base polymer in core	-	Polyester elastomer (A1)+(A2)	Polyester elastomer (A1)	Polyester elastomer (A4)	Polyester elastomer (A5)
15	Base polymer in sheath	-	Polyester (A3)	Polyester (A6)	Polyester (A7)	Polyester (A3)
	Fraction of core	% by volume	70	70	70	70
	Fraction of sheath	% by volume	30	30	30	30
20	Flame retardant contained in core	-	1. Organic phosphate	1. Organic phosphate	1. Organic phosphate	1. Organic phosphate
	Content of flame retardant contained in core	% by mass	20	20	20	20
25	Flame retardant contained in sheath	-	Phosphorus compound 1	-	Phosphorus compound 2	Phosphorus compound 1
30	Content of phosphorus element based on entire sheath	% by mass	0.7	-	0.5	0.7
	Total fineness	dtex	760	760	760	760
	Dry heat shrinkage	%	24.5	20.0	23.0	26.0
35	Spinnability					
	Filter clogging	-	A	A	A	A
	Scum generation	-	A	A	A	A
40		Unit	Example 15	Example 16	Example 17	Example 18
	Yarn breakage	-	A	A	A	A
45	Number of occurrences of bump yarn	-	A	A	A	A
	Comprehensive evaluation	-	A	A	A	A
50	Other yarn (multifilament)	-	False-twisted PET (167T/2-48)	False-twisted PET (167T/2-48)	False-twisted PET (167T/2-48)	False-twisted PET (167T/2-48)
	Fabric body					
55	Type of fabric body	-	Knitted fabric	Knitted fabric	Knitted fabric	Knitted fabric

EP 4 273 312 A1

(continued)

Fabric body						
5	Content of monofilament based on fabric	% by mass	70	70	70	70
Knitting density of fabric						
10	Well	Yarn/25.4 mm	29	30	29	29
	Coarse	Yarn/25.4 mm	36	36	40	36
15	Air permeability of fabric	cm ³ /cm ² /sec lsec	100	105	100	100
20	Amount of deflection of fabric body when load of 400N is applied	mm	35	25	32	40
					45	
Flammability of fabric						
	Horizontal method	mm/min	0	0	0	0
	UL94V	Grade	V-0	V-2	V-0	V-0
25	Comprehensive evaluation on fabric body	-	A	B	A	A
					B	

55

(continued)

Spinnability								
Comprehensive evaluation	-	A	B	A	B	A	B	
Other yarn (multifilament)	-	False-twisted PET (167T/2-48)	-	False-twisted PET (167T/2-48)	False-twisted PET (167T/2-48)	False-twisted PET (167T/2-48)	False-twisted PET (167T/2-48)	
Fabric body								
Type of fabric body	-	Knitted fabric	Knitted fabric	Knitted fabric	Knitted fabric	Knitted fabric	Knitted fabric	
Content of monofilament based on fabric	% by mass	70	70	40	70	70	70	
Knitting density of fabric								
Well	Yarn/25.4 mm	28	30	29	29	29	28	
Coarse	Yarn/25.4 mm	36	36	40	36	36	36	
Air permeability of fabric	cm ³ /cm ² /sec /sec	120	95	90	103	105	100	
Amount of deflection of fabric body when load of 400N is applied	mm	18	42	15	15	36	55	
Flammability of fabric								
Horizontal method	mm/min	0	80	0	0	10	20	
	Unit	Comparative example 1	Comparative example 2	Comparative example 3	Comparative example 4	Comparative example 5	Comparative example 6	
UL94V	Grade	V-0	V-2	V-0	V-2	V-2	V-2	
Comprehensive evaluation on fabric body	-	C	C	C	C	C	C	

EXPLANATION OF NUMERALS

[0150]

- 5 1. Fabric
 1a. Opening
 2. Frame member
 2a. First frame member
 2b. Second frame member
 10 3. Fabric body

Claims

- 15 **1.** A fabric, comprising 50% by mass or more of monofilament,
 wherein the monofilament is a core-sheath composite fiber having a core and a sheath,
 wherein the core is
 20 contained in 60 to 90% by volume with respect to the core-sheath composite fiber, and
 contains a first flame retardant and a polyester elastomer, and
 wherein the sheath is
 25 contained in 10 to 40% by volume with respect to the core-sheath composite fiber, and
 consists of polyester excluding the polyester elastomer of the core.
- 2.** The fabric of claim 1,
 30 wherein the fabric is a knitted fabric,
 wherein the knitted fabric has a knitting density of 10 to 50 yarns/25.4 mm in at least one of a warp direction
 and a weft direction, and
 wherein a fineness of the monofilament is 300 to 3000 dtex.
- 35 **3.** The fabric of claim 1 or 2,
 wherein the first flame retardant contains
 at least one selected from the group consisting of an organic phosphate compound, a metal phosphinate, and
 a triazine skeleton-containing compound,
 40 which is contained in an amount of 1 to 30% by mass based on the core.
- 4.** The fabric of any one of claims 1 to 3,
 wherein the sheath contains a second flame retardant,
 45 wherein the second flame retardant contains
 at least one of an aryl phosphinic acid compound and an alkyl phosphinic acid compound,
 which is contained in an amount of 0.3 to 1.1% by mass in terms of phosphorus element, based on the sheath.
- 50 **5.** A fabric body having the fabric of any one of claims 1 to 4 and a frame member.
- 6.** The fabric body of claim 5, wherein the fabric is non-sewn and non-bonded.
- 7.** A seat using the fabric body of claim 5 or 6.

55

FIG. 1

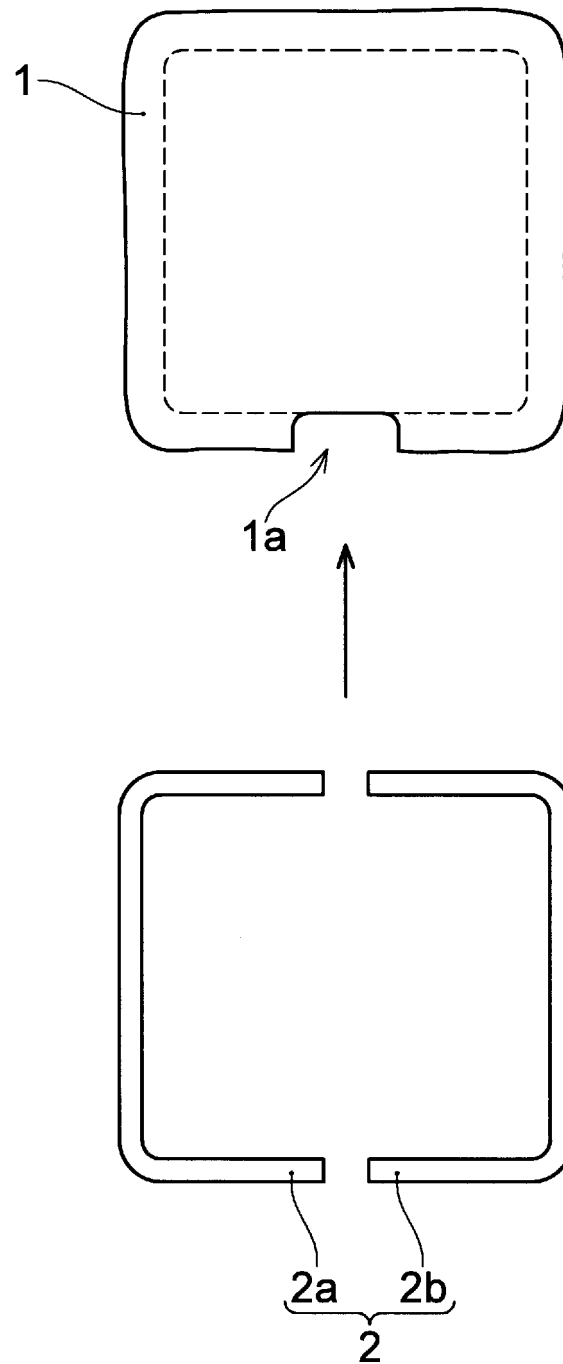
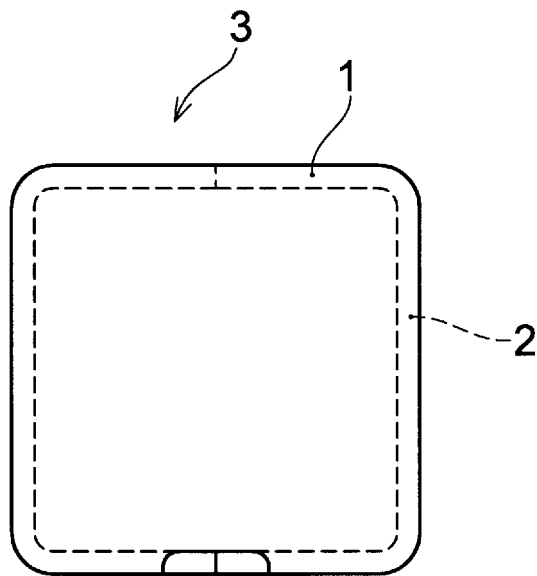


FIG. 2



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2022/003188

A. CLASSIFICATION OF SUBJECT MATTER

D04B 1/16(2006.01)i; **A47C 7/00**(2006.01)i; **D01F 8/14**(2006.01)i
FI: D04B1/16; A47C7/00 Z; D01F8/14 B

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

D01F8/00-8/18; D04B1/00-1/28; D04B21/00-21/20; A47C7/00

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Published examined utility model applications of Japan 1922-1996
Published unexamined utility model applications of Japan 1971-2022
Registered utility model specifications of Japan 1996-2022
Published registered utility model applications of Japan 1994-2022

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	JP 2000-248450 A (TOYO BOSEKI) 12 September 2000 (2000-09-12) claims 1-2, 4, paragraphs [0012], [0014], example 3	1-7
X	JP 2001-303395 A (TOYO BOSEKI) 31 October 2001 (2001-10-31) claims 6, 9, paragraphs [0012], [0020], example 1	1-7
A	JP 2011-21287 A (TEIJIN FIBERS LTD) 03 February 2011 (2011-02-03) claim 1, paragraph [0030]	1-7
A	JP 3-279429 A (TORAY IND INC) 10 December 1991 (1991-12-10) claim 1, p. 3, upper right column, line 5	1-7
A	JP 11-222729 A (TOYO BOSEKI) 17 August 1999 (1999-08-17) claim 1, paragraph [0018]	1-7

☐ Further documents are listed in the continuation of Box C.☒ See patent family annex.

* Special categories of cited documents:

“A” document defining the general state of the art which is not considered to be of particular relevance

“E” earlier application or patent but published on or after the international filing date

“L” document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

“O” document referring to an oral disclosure, use, exhibition or other means

“P” document published prior to the international filing date but later than the priority date claimed

“T” later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

“X” document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

“Y” document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

“&” document member of the same patent family

Date of the actual completion of the international search

14 March 2022

Date of mailing of the international search report

29 March 2022

Name and mailing address of the ISA/JP

Japan Patent Office (ISA/JP)
3-4-3 Kasumigaseki, Chiyoda-ku, Tokyo 100-8915
Japan

Authorized officer

Telephone No.

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.

PCT/JP2022/003188

5

10

15

20

25

30

35

40

45

50

55

Patent document cited in search report	Publication date (day/month/year)	Patent family member(s)	Publication date (day/month/year)
JP 2000-248450 A	12 September 2000	(Family: none)	
JP 2001-303395 A	31 October 2001	(Family: none)	
JP 2011-21287 A	03 February 2011	(Family: none)	
JP 3-279429 A	10 December 1991	(Family: none)	
JP 11-222729 A	17 August 1999	(Family: none)	

Form PCT/ISA/210 (patent family annex) (January 2015)

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- JP 2019143283 A [0003]