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(54) **LOW-AIR-PERMEABILITY FABRIC AND TEXTILE PRODUCT**

(57) The invention addresses the problem of providing a low-breathability woven fabric and a textile product that are excellent not only in downproofness but also in stretchability. As a means for resolution, a low-breathability woven fabric having a breathability of 1.0 cc/sec/cm^2 or less is configured to include a stretch fiber.

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Description

Technical Field

[0001] The present invention relates to a low-breathability woven fabric and a textile product that are excellent not only in downproofness but also in stretchability.

Background Art

[0002] Conventionally, in the fields of outerwear and comforter fabrics, low-breathability woven fabrics with excellent effects in reducing the blowout of cotton and down (downproofness) have been proposed (see, e.g., PTLs 1 and 2) .

[0003] Meanwhile, recently, in order to improve the wearing comfort of woven fabrics, it is required to add stretchability to woven fabrics.

[0004] However, downproofness and stretchability are conflicting properties, and it has been difficult to have both of them.

Citation List

Patent Literature

[0005]

PTL 1: JP-A-2005-048298
PTL 2: JP-A-2012-057265

Summary of Invention

Technical Problem

[0006] The invention has been accomplished against the above background. An object thereof is to provide a low-breathability woven fabric and a textile product that are excellent not only in downproofness but also in stretchability.

Solution to Problem

[0007] The present inventors have conducted extensive research to solve the above problems and, as a result, found that by skillfully devising yarns that constitute a woven fabric, etc., a low-breathability woven fabric that is excellent not only in downproofness but also in stretchability can be obtained. As a result of further extensive research, they have accomplished the invention.

[0008] Thus, the invention provides "a low-breathability woven fabric having a breathability of 1.0 $cm^3/cm^2 \cdot s$ or less, characterized in that the low-breathability woven fabric includes a stretch fiber".

[0009] At this time, it is preferable that the woven fabric has an elongation of 17.5% or more in the warp direction or the weft direction. In addition, it is preferable that in the woven fabric, the amount of down leakage in accordance with GB T 12705.1-2009 Textile, Methods of Testing the Down-Proof Properties of Fabrics, Part 1: Rubbing Test, is 50 pieces or less. In addition, it is preferable that the woven fabric has a warp cover factor within a range of 800 to 1,500 and a weft cover factor within a range of 700 to 1,200. Note that the warp cover factor (warp CF) and the weft cover factor (weft CF) are defined by the following formulas:

$$\text{warp CF} = (DWp/1.1)^{1/2} \times MWp$$

$$\text{weft CF} = (DWf/1.1)^{1/2} \times MWf$$

[DWp is the warp total fineness (dtex), MWp is the warp weaving density (yarns/2.54 cm), DWf is the weft total fineness (dtex), and MWf is the weft weaving density (yarns/2.54 cm)].

[0010] In addition, it is preferable that the stretch fiber is a polyurethane fiber, a conjugate fiber made of two components joined in a side-by-side manner or an eccentric sheath-core manner, a false-twist crimped yarn, or a polytrimethylene terephthalate fiber. In addition, it is preferable that the woven fabric has a plain structure or a ripstop taffeta structure. In addition, it is preferable that the woven fabric is given water repellent processing. In addition, it is preferable that the woven fabric is not given a waterproof coating or not laminated. In addition, it is preferable that the woven fabric is not calendered. In addition, it is preferable that the woven fabric has a tear strength of 7 N or more in the warp direction or the weft direction. Note that the tear strength is measured in accordance with JIS L 1096-2010 8.17, D Method. In addition, it is preferable that the woven fabric has a slip resistance of 3 mm or less. Note that the slip resistance is measured in accordance with JIS L 1096-2010 8.23, B Method (load: 117.7 N). In addition, it is preferable that in the woven fabric, the Rotating Box IDFL 20-1 (Modified FTMS 191-5530) is 5 (0-5 particles).

[0011] In addition, the invention provides a textile product including the low-breathability woven fabric described above and being selected from the group consisting of downwear, down jackets, comforters, sleeping bags, and sportswear.

Advantageous Effects of Invention

[0012] According to the invention, a low-breathability woven fabric and a textile product that are excellent not only in downproofness but also in stretchability are obtained. Description of Embodiments

[0013] First, it is important that the low-breathability woven fabric of the invention has a breathability of 1.0 $cm^3/cm^2 \cdot s$ or less (more preferably 0.01 to 1.0 $cm^3/cm^2 \cdot s$, and particularly preferably 0.1 to 0.5 $cm^3/cm^2 \cdot s$). A breathability of more than 1.0 $cm^3/cm^2 \cdot s$ may cause a decrease in downproofness and thus is un-

desirable. Incidentally, the breathability is measured in accordance with JIS L1096-2010 8.26.1, A Method (Frazier method).

[0014] The low-breathability woven fabric of the invention includes a stretch fiber. At this time, as such stretch fibers, a one-component fiber made of polytrimethylene terephthalate, a conjugate fiber made of two components joined in a side-by-side manner or an eccentric sheath-core manner (conjugate filament yarn), an elastic fiber (polyurethane-based fiber, polyether ester-based fiber, moisture-absorbing elastomer fiber, etc.), an undrawn polyester fiber, a false-twist crimped yarn, and the like are preferable.

[0015] Here, it is preferable that the woven fabric of the invention is composed only of the stretch fiber. For example, it is preferable that the woven fabric is composed only of an elastic fiber and a false-twist crimped yarn, or that the woven fabric is composed only of a conjugate fiber made of two components joined in a side-by-side manner or an eccentric sheath-core manner and a false-twist crimped yarn.

[0016] The conjugate fiber is preferably a conjugate fiber in which at least one of the components is polytrimethylene terephthalate, polybutylene terephthalate, or polyethylene terephthalate. Specific examples of combinations of two components include polytrimethylene terephthalate and polytrimethylene terephthalate, polytrimethylene terephthalate and polyethylene terephthalate, polyethylene terephthalate and polyethylene terephthalate, and polyethylene terephthalate and polybutylene terephthalate.

[0017] Here, polytrimethylene terephthalate refers to a fiber made of a polyester whose main repeating unit is a trimethylene terephthalate unit, in which the trimethylene terephthalate unit is 50 mol% or more, preferably 70 mol% or more, still more preferably 80 mol% or more, and particularly preferably 90 mol% or more. Therefore, the term encompasses polytrimethylene terephthalate containing, as third components, another acid component and/or another glycol component in a total amount within a range of 50 mol% or less, preferably 30 mol% or less, still more preferably 20 mol% or less, and particularly preferably 10 mol% or less.

[0018] Polytrimethylene terephthalate is produced by condensing terephthalic acid or a functional derivative thereof and trimethylene glycol or a functional derivative thereof in the presence of a catalyst under appropriate reaction conditions.

[0019] As third components to be added, aliphatic dicarboxylic acids (oxalic acid, adipic acid, etc.), alicyclic dicarboxylic acids (cyclohexanedicarboxylic acid, etc.), aromatic dicarboxylic acids (isophthalic acid, sodium sulfoisophthalic acid, etc.), aliphatic glycols (ethylene glycol, 1,2-trimethylene glycol, tetramethylene glycol, etc.), alicyclic glycols (cyclohexane glycol, etc.), aromatic dioxy compounds (hydroquinone bisphenol A, etc.), aromatic-containing aliphatic glycols (1,4-bis(β-hydroxyethoxy)benzene, etc.), aliphatic oxycarboxylic acids (p-oxybenzoic acid, etc.), and the like can be mentioned.

[0020] The polyethylene terephthalate may be a copolymer of three components, or may also be a material-recycled or chemically recycled polymer. Further, it may also be obtained using a catalyst containing a specific phosphorus compound or titanium compound as described in JP-A-2004-270097 or JP-A-2004-211268.

[0021] The polytrimethylene terephthalate, polyethylene terephthalate, polybutylene terephthalate, and the like described above may contain one or more kinds of micropore-forming agents, cationic dye dyeable agents, coloring inhibitors, heat stabilizers, fluorescent brighteners, delusterants, colorants, moisture absorbents, and inorganic fine particles.

[0022] The conjugate fiber can be produced, for example, by the method described in JP-A-2009-46800.

[0023] In the invention, the stretch fiber may be present in the woven fabric as a single yarn, or may also be present in the woven fabric as a composite yarn (air-mingled yarn, plied yarn, etc.) with other yarns (e.g., non-crimped yarn, etc.).

[0024] In the stretch fiber and other yarns described above, in order to obtain excellent downproofness, the single fiber fineness is preferably within a range of 0.00002 to 3.0 dtex (more preferably 0.1 to 2.0 dtex, and particularly preferably 0.3 to 1.0 dtex). It is most preferable that all the fibers constituting the woven fabric have single fiber finenesses within the above range.

[0025] In addition, in the fibers constituting the woven fabric, with respect to the single-fiber cross-sectional shape, in addition to a round cross-section, the cross-section may also be elliptical, triangular, quadrangular, cross-shaped, flat, flat with constrictions, H-shaped, W-shaped, or the like, for example.

[0026] In addition, in the fibers constituting the woven fabric, with respect to the total fineness and the number of filaments, in order to obtain excellent downproofness, it is preferable that the total fineness is within a range of 20 to 220 dtex (more preferably 20 to 50 dtex), and the number of filaments is within a range of 1 to 300 (more preferably 50 to 300).

[0027] Fibers constituting the woven fabric other than the stretch fiber (other yarns) are not particularly limited, but polyester-based fibers made of polyesters are preferable. Examples of such polyesters include polyesters in which the main acid component is terephthalic acid, and the main glycol component is at least one glycol selected from the group consisting of C_{2-6} alkylene glycols, that is, ethylene glycol, trimethylene glycol, tetramethylene glycol, pentamethylene glycol, and hexamethylene glycol, particularly preferably ethylene glycol.

[0028] Such a polyester may have a small amount (usually 30 mol % or less) of a copolymerized component as necessary. At this time, as bifunctional carboxylic acids used other than terephthalic acid, for example, aromatic, aliphatic, and alicyclic bifunctional carboxylic acids such as isophthalic acid, naphthalenedicarboxylic acid, diphenyldicarboxylic acid, diphenoxyethanedicarboxylic

acid, β-hydroxyethoxybenzoic acid, p-oxybenzoic acid, 5-sodium sulfoisophthalic acid, adipic acid, sebacic acid, and 1,4-cyclohexanedicarboxylic acid can be mentioned. In addition, as diol compounds other than the above glycols, for example, aliphatic, alicyclic, and aromatic diol compounds such as cyclohexane-1,4-dimethanol, neopentyl glycol, bisphenol A, and bisphenol S, polyoxyalkylene glycols, and the like can be mentioned.

[0029] The polyester can be synthesized by any method. For example, in the case of polyethylene terephthalate, its production is possible through a first-stage reaction in which terephthalic acid and ethylene glycol are directly subjected to an esterification reaction, a lower alkyl ester of terephthalic acid, such as dimethyl terephthalate, and ethylene glycol are subjected to a transesterification reaction, or terephthalic acid and ethylene oxide are allowed to react, thereby producing a glycol ester of terephthalic acid and/or an oligomer thereof, and a second-stage reaction in which the product of the first-stage reaction is heated under reduced pressure to cause a polycondensation reaction until the desired degree of polymerization is reached. In addition, the polyester may also be a material-recycled or chemically recycled polyester. Further, it may also be an aliphatic polyester such as polylactic acid or stereocomplex polylactic acid.

[0030] The polyester may also contain, as necessary, one or more kinds of delusterants (titanium dioxide), micropore-forming agents (organic sulfonic acid metal salts), coloring inhibitors, heat stabilizers, flame retardants (diantimony trioxide), fluorescent brighteners, coloring pigments, antistatic agents (sulfonic acid metal salts), moisture absorbents (polyoxyalkylene glycols), antibacterial agents, and other inorganic particles. In particular, when the polyester contains 0.2 wt% or more (more preferably 0.2 to 2.5 wt%) of a delusterant relative to the polyester weight, this imparts UV shielding effects and anti-see-through properties to the low-breathability woven fabric, and thus is preferable.

[0031] The low-breathability woven fabric of the invention can be woven using the stretch fiber and other yarns as necessary, which are formed into a composite yarn before weaving as necessary, using an ordinary weaving machine (e.g., water jet loom, etc.). At this time, the weave structure of the woven fabric is not limited, and preferred examples thereof include a plain structure, a twill structure, and a satin structure. In addition, a double weave is also possible. Among them, in order to obtain excellent downproofness, a plain structure or a ripstop taffeta structure, which has the largest number of weave points, is preferable. As long as the object of the invention is not impaired, the woven fabric may also be additionally subjected to dyeing and finishing, water absorption processing, water repellent processing, napping, or UV shielding in the usual manner, or to other various kinds of function-imparting processing using an antibacterial agent, a deodorant, an insect repellant, a phosphorescent agent, a retroreflective agent, a minus ion generator, etc. Incidentally, in the case where the cloth contains a conjugate fiber, the latent crimp of the conjugate fiber becomes apparent (coiled) due to the thermal history during dyeing or like.

[0032] In addition, in order to obtain excellent stretchability, it is preferable that the woven fabric is not given a waterproof coating (a resin finish to improve waterproofness, NOT water repellent processing) or not laminated. In particular, it is preferable that neither a waterproof coating nor lamination is applied. However, it is preferable that water repellent processing is applied.

[0033] At this time, in the water repellent processing, the kind of water repellent is not particularly limited. For example, fluorine-based compounds are applicable, and examples also include eco-friendly water repellents such as hydrocarbon-based compounds and silicone-based compounds. It is preferable that an antistatic agent, a melamine resin, and a catalyst are mixed as necessary to give a processing agent having a water repellent concentration of about 3 to 15 wt%, and the surface of a cloth is treated using the processing agent at a pick-up rate of about 50 to 90%. Examples of methods for treating the cloth surface with a processing agent include a padding method and a spraying method. Among them, in order for the processing agent to penetrate the inside of the cloth, a padding method is preferable. The pick-up rate is the weight percentage (%) of the processing agent relative to the cloth (before processing agent application) weight.

[0034] In addition, it is possible to perform dyeing, alkaline weight reduction, or napping in the usual manner in at least either the pre-process or post-process of the water repellent processing step. Further, a UV shielding agent, an antibacterial agent, a deodorant, an insect repellent, a phosphorescent agent, a retroreflective agent, a negative ion generator, and the like may be additionally applied. Incidentally, in the case where the cloth contains a conjugate fiber, the latent crimp of the conjugate fiber becomes apparent (coiled) due to the thermal history during dyeing or like.

[0035] In addition, in the low-breathability woven fabric of the invention, in order to obtain excellent downproofness, it is preferable that the warp cover factor is within a range of 800 to 1,500, and a weft cover factor is within a range of 700 to 1,200. Note that the warp cover factor (warp CF) and the weft cover factor (weft CF) are defined by the following formulas:

$$\text{warp CF} = (DWp/1.1)^{1/2} \times MWp$$

$$\text{weft CF} = (DWf/1.1)^{1/2} \times MWf$$

[DWp is the warp total fineness (dtex), MWp is the warp weaving density (yarns/2.54 cm), DWf is the weft total fineness (dtex), and MWf is the weft weaving density (yarns/2.54 cm).

[0036] In addition, the density of the woven fabric is preferably such that the warp density is 180 yarns/2.54 cm or more (preferably 190 to 400 yarns/2.54 cm), and the weft density is 100 yarns/2.54 cm or more (preferably 110 to 300 yarns/2.54 cm).

[0037] In addition, in terms of lightweightness, it is preferable that the woven fabric has a weight per unit of 100 g/m^2 or less (more preferably 10 to 95 g/m^2).

[0038] The low-breathability woven fabric thus obtained is excellent not only in downproofness but also in stretchability. At this time, it is preferable that the woven fabric has an elongation of 17.5% or more (more preferably 20 to 30%) in the warp direction and/or the weft direction.

[0039] In addition, it is preferable that the woven fabric has a tear strength of 7 N or more in the warp direction or the weft direction (preferably in the warp direction and the weft direction). Note that the tear strength is measured in accordance with JIS L 1096-2010 8.17, D Method.

[0040] In addition, it is preferable that the woven fabric has a slip resistance of 3 mm or less. Note that the slip resistance is measured in accordance with JIS L 1096-2010 8.23, B Method (load: 117.7 N).

[0041] In addition, it is preferable that in the woven fabric, the amount of down leakage in accordance with GB T 12705.1-2009 Textile, Methods of Testing the Down-Proof Properties of Fabrics, Part 1: Rubbing Test, is 50 pieces or less. In addition, it is preferable that in the woven fabric, the Rotating Box IDFL 20-1 (Modified FTMS 191-5530) is 5 (0-5 particles).

[0042] Next, the textile product of the invention is a textile product including the low-breathability woven fabric described above and being selected from the group consisting of downwear, down jackets, comforters, sleeping bags, and sportswear.

[0043] The textile product uses the low-breathability woven fabric described above, and thus is excellent not only in downproofness but also in stretchability.

[0044] Incidentally, the low-breathability woven fabric may be used for various textile products such as soccer shirts, golf shirts, tennis shirts, basket shirts, table tennis shirts, badminton shirts, running shirts, soccer pants, tennis pants, basketball pants, table tennis pants, badminton pants, running pants, golf pants, undershirts for various sports, innerwear for various sports, sweaters, T-shirts, jerseys, sweatshirts, windbreakers, medical garments (gowns, etc.), dust-proof garments, and the like.

EXAMPLES

[0045] Next, examples of the invention and comparative examples will be described in detail, but the invention is not limited thereto. Incidentally, measurement items were measured by the following methods.

(1) Cover Factor

[0046] The cover factor CF of a woven fabric was calculated by the following formulas.

$$\text{Warp CF} = (DWp/1.1)^{1/2} \times MWp$$

$$\text{Weft CF} = (DWf/1.1)^{1/2} \times MWf$$

[DWp is the warp total fineness (dtex), MWp is the warp weaving density (yarns/2.54 cm), DWf is the weft total fineness (dtex), and MWf is the weft weaving density (yarns/2.54 cm).]

(2) Elongation of Woven Fabric

[0047] The elongation of a woven fabric was measured in accordance with JIS L1096-2010 8.16, B Method.

(3) Tear Strength of Woven Fabric

[0048] Tear strength (N) was measured in accordance with JIS L1096-2010 8.17, D Method.

(4) Slip Resistance of Woven Fabric

[0049] The slip resistance (mm) of a woven fabric was measured in accordance with JIS L 1096-2010 8.23, B Method, load: 117.7 N (mm).

(5) Down Leakage through Woven Fabric 1

[0050] Measurement was performed in accordance with GB T 12705.1-2009 Textile, Methods of Testing the Down-Proof Properties of Fabrics, Part 1: Rubbing Test.

(6) Down Leakage through Woven Fabric 2

[0051] (0-5 Particles) was measured in accordance with Rotating Box IDFL 20-1 (Modified FTMS191-5530).

(7) Weight per Unit of Woven Fabric

[0052] Weight per unit (g/m^2) was measured in accordance with JIS L1096-2010 8.3.

(8) Water Repellency of Woven Fabric

[0053] Water repellency (grade) was measured in accordance with JIS L1092-2009 7.2, Test for Resistance to Surface Wetting (Spray Test) .

(9) Breathability of Woven Fabric

[0054] Breathability ($cm^3/cm^2 \cdot s$) was measured in accordance with JIS L1096-2010 8.26.1, A Method (Frazier Method). Incidentally, the number of samples was 5, and the average was determined.

[Example 1]

[0055] Using a semi-dull polyethylene terephthalate multifilament false-twist crimped yarn (total fineness: 22 dtex/72 fil, single fiber fineness: 0.31 dtex) as the warp and a commingled yarn obtained by interlacing a semi-dull polyethylene terephthalate multifilament false-twist crimped yarn (total fineness: 22 dtex/72 fil, single fiber fineness: 0.31 dtex) and a polyurethane fiber (total fineness: 22 dtex/1 fil, elastic fiber) drawn to 2.6 times the original length as the weft, a plain woven fabric was woven using a water jet loom weaving machine. The woven fabric was then dyed with a disperse dye at 130°C × 30 minutes, and subjected to the following water repellent processing. In the water repellent processing, the following processing agent was used, and the liquid was squeezed out at a pick-up rate of 80%, followed by drying at 130°C for 3 minutes and then a heat treatment at 170°C for 45 seconds.

<Processing Agent Composition>

[0056]

- Fluorine-free water repellent: 5.0 wt%
  (Neoseed NR-7080 manufactured by Nichika Chemical Co., Ltd., hydrocarbon-based compound)
- Melamine resin: 0.3 wt%
  (SUMITEX Resin M-3 manufactured by Sumitomo Chemical Co., Ltd.)
- Catalyst: 0.3 wt%
  (SUMITEX Accelerator ACX manufactured by Sumitomo Chemical Co., Ltd.)
- Water: 94.4 wt%

[0057] In the woven fabric thus obtained, the weight per unit was 68 g/m^2, the warp density was 282 yarns/2.54 cm, the weft density was 206 yarns/2.54 cm, the cover factors were warp: 1,261, weft: 1,084, and total: 2,345, the warp elongation was 1%, the weft elongation was 23%, the water repellency grade was 4, the breathability was 0.5 cm^3/cm^2·s, the tear strength was 7 N or more both in warp and weft, the slip resistance was 3 mm or less, the amount of down leakage in accordance with GB T 12705.1-2009 Textile, Methods of Testing the Down-Proof Properties of Fabrics, Part 1: Rubbing Test, was 50 pieces or less, and the Rotating Box IDFL 20-1 (Modified FTMS 191-5530) was 5 (0-5 Particles). That is, it was a low-breathability woven fabric excellent not only in downproofness but also in stretchability.

[Example 2]

[0058] Using a semi-dull polyamide multifilament false-twist crimped yarn (total fineness: 22 dtex/48 fil, single fiber fineness: 0.46 dtex) as the warp and a commingled yarn obtained by interlacing a semi-dull polyamide multifilament false-twist crimped yarn (total fineness: 22 dtex/48 fil, single fiber fineness: 0.46 dtex) and a polyurethane fiber (total fineness: 22 dtex/1 fil, elastic fiber) drawn to 2.6 times the original length as the weft, a plain woven fabric was woven using a water jet loom weaving machine. The woven fabric was then dyed with an acid dye at 98°C × 30 minutes, followed by water repellent processing in the same manner as in Example 1.

[0059] In the woven fabric thus obtained, the weight per unit was 59 g/m^2, the warp density was 283 yarns/2.54 cm, the weft density was 193 yarns/2.54 cm, the cover factors were warp: 1,266, weft: 1,003, and total: 2,269, the warp elongation was 2%, the weft elongation was 26%, the water repellency grade was 4, the breathability was 0.6 cm^3/cm^2·s, the tear strength was 10 N or more both in warp and weft, the slip resistance was 3 mm or less, the amount of down leakage in accordance with GB T 12705.1-2009 Textile, Methods of Testing the Down-Proof Properties of Fabrics, Part 1: Rubbing Test, was 50 pieces or less, and the Rotating Box IDFL 20-1 (Modified FTMS 191-5530) was 5 (0-5 Particles). That is, it was a low-breathability woven fabric excellent not only in downproofness but also in stretchability.

[Example 3]

[0060] Using a semi-dull polyethylene terephthalate multifilament false-twist crimped yarn (total fineness: 39 dtex/144 fil, single fiber fineness: 0.27 dtex) as the warp and a side-by-side conjugate fiber made of polyethylene terephthalate and polytrimethylene terephthalate (total fineness: 56 dtex/32 fil, single fiber fineness: 1.75 dtex) as the weft, a plain woven fabric was woven using a water jet loom weaving machine.

[0061] The woven fabric was then dyed with a disperse dye at 130°C × 30 minutes, followed by water repellent processing in the same manner as in Example 1 and calendering.

[0062] In the woven fabric thus obtained, the weight per unit was 82 g/m^2, the warp density was 230 yarns/2.54 cm, the weft density was 125 yarns/2.54 cm, the cover factors were warp: 1,361, weft: 884, and total: 2,245, the warp elongation was 1%, the weft elongation was 21%, the water repellency grade was 4, the breathability was 0.3 cm^3/cm^2·s, the tear strength was 10 N or more both in warp and weft, the slip resistance was 3 mm or less, the amount of down leakage in accordance with GB T 12705.1-2009 Textile, Methods of Testing the Down-Proof Properties of Fabrics, Part 1: Rubbing Test, was 50 pieces or less, and the Rotating Box IDFL 20-1 (Modified FTMS 191-5530) was 5 (0-5 Particles). That is, it was a low-breathability woven fabric excellent not only in downproofness but also in stretchability.

[Example 4]

[0063] Using a semi-dull polyethylene terephthalate multifilament false-twist crimped yarn (total fineness: 56 dtex/72 fil, single fiber fineness: 0.78 dtex) as the warp

and a side-by-side conjugate fiber made of polyethylene terephthalate and polytrimethylene terephthalate (total fineness: 56 dtex/32 fil, single fiber fineness: 1.75 dtex) as the weft, a plain woven fabric was woven using a water jet loom weaving machine. The woven fabric was then dyed with a disperse dye at 130°C × 30 minutes, followed by water repellent processing in the same manner as in Example 1 and calendering.

[0064] In the woven fabric thus obtained, the weight per unit was 94 g/m^2, the warp density was 200 yarns/2.54 cm, the weft density was 129 yarns/2.54 cm, the cover factors were warp: 1,414, weft: 912, and total: 2,326, the warp elongation was 2%, the weft elongation was 20%, the water repellency grade was 4, the breathability was 0.5 cm^3/cm^2·s, the tear strength was 10 N or more both in warp and weft, the slip resistance was 3 mm or less, the amount of down leakage in accordance with GB T 12705.1-2009 Textile, Methods of Testing the Down-Proof Properties of Fabrics, Part 1: Rubbing Test, was 50 pieces or less, and the Rotating Box IDFL 20-1 (Modified FTMS 191-5530) was 5 (0-5 Particles). That is, it was a low-breathability woven fabric excellent not only in downproofness but also in stretchability.

[Example 5]

[0065] Using a bright polyethylene terephthalate multifilament false-twist crimped yarn (total fineness: 56 dtex/144 fil, single fiber fineness: 0.39 dtex) as the warp and a side-by-side conjugate fiber made of polyethylene terephthalate and polytrimethylene terephthalate (total fineness: 56 dtex/48 fil, single fiber fineness: 1.17 dtex) as the weft, a plain woven fabric was woven using a water jet loom weaving machine. The woven fabric was then dyed with a disperse dye at 130°C × 30 minutes, followed by water repellent processing in the same manner as in Example 1.

[0066] In the woven fabric thus obtained, the weight per unit was 96 g/m^2, the warp density was 204 yarns/2.54 cm, the weft density was 132 yarns/2.54 cm, the cover factors were warp: 1,442, weft: 933, and total: 2,375, the warp elongation was 0.2%, the weft elongation was 21%, the water repellency grade was 4, the breathability was 0.9 cm^3/cm^2·s, the tear strength was 10 N or more both in warp and weft, the slip resistance was 3 mm or less, the amount of down leakage in accordance with GB T 12705.1-2009 Textile, Methods of Testing the Down-Proof Properties of Fabrics, Part 1: Rubbing Test, was 50 pieces or less, and the Rotating Box IDFL 20-1 (Modified FTMS 191-5530) was 5 (0-5 Particles). That is, it was a low-breathability woven fabric excellent not only in downproofness but also in stretchability.

[Example 6]

[0067] Using a semi-dull polyethylene terephthalate multifilament false-twist crimped yarn (total fineness: 22 dtex/72 fil) as the warp and a semi-dull polyethylene terephthalate multifilament false-twist crimped yarn (total fineness: 22 dtex/72 fil) as the weft, a plain woven fabric was woven using a water jet loom weaving machine. The woven fabric was then dyed with a disperse dye at 130°C × 30 minutes, followed by water repellent processing in the same manner as in Example 1 and calendering.

[0068] In the woven fabric thus obtained, the weight per unit was 61 g/m^2, the warp density was 242 yarns/2.54 cm, the weft density was 214 yarns/2.54 cm, the cover factors were warp: 1,082, weft: 957, and total: 2,039, the warp elongation was 1%, the weft elongation was 3%, the water repellency grade was 4, the breathability was 0.3 cm^3/cm^2·s, the tear strength was 10 N or more both in warp and weft, the slip resistance was 3 mm or less, the amount of down leakage in accordance with GB T 12705.1-2009 Textile, Methods of Testing the Down-Proof Properties of Fabrics, Part 1: Rubbing Test, was 50 pieces or less, and the Rotating Box IDFL 20-1 (Modified FTMS 191-5530) was 5 (0-5 Particles). That is, it was a low-breathability woven fabric excellent in downproofness, but slightly inferior in stretchability.

[Comparative Example 1]

[0069] Using a semi-dull polyethylene terephthalate multifilament false-twist crimped yarn (total fineness: 56 dtex/72 fil) as the warp and a side-by-side conjugate fiber made of polyethylene terephthalate and polytrimethylene terephthalate (total fineness: 56 dtex/32 fil) as the weft, a plain woven fabric was woven using a water jet loom weaving machine. The woven fabric was then dyed with a disperse dye at 130°C × 30 minutes, followed by water repellent processing in the same manner as in Example 1 and calendering.

[0070] In the woven fabric thus obtained, the weight per unit was 86 g/m^2, the warp density was 149 yarns/2.54 cm, the weft density was 95 yarns/2.54 cm, the cover factors were warp: 1,053, weft: 672, and total: 1,725, the warp elongation was 1%, the weft elongation was 21%, the water repellency grade was 4, the breathability was 1.6 cm^3/cm^2·s, the tear strength was 7 N or more both in warp and weft, the slip resistance was 3 mm or less, the amount of down leakage in accordance with GB T 12705.1-2009 Textile, Methods of Testing the Down-Proof Properties of Fabrics, Part 1: Rubbing Test, was 74 pieces, and the Rotating Box IDFL 20-1 (Modified FTMS 191-5530) was 3 (0-5 Particles). That is, it was a woven fabric excellent in stretchability, but inferior in downproofness.

Industrial Applicability

[0071] According to the invention, a low-breathability woven fabric with reduced blowout of cotton and down and a textile product, which are excellent not only in downproofness but also in stretchability, are provided, and the industrial value thereof is extremely high.

Claims

1. A low-breathability woven fabric having a breathability of 1.0 $cm^3/cm^2 \cdot s$ or less, **characterized in that** the low-breathability woven fabric includes a stretch fiber.

2. The low-breathability woven fabric according to claim 1, wherein the woven fabric has an elongation of 17.5% or more in the warp direction or the weft direction.

3. The low-breathability woven fabric according to claim 1 or 2, wherein in the woven fabric, the amount of down leakage in accordance with GB T 12705.1-2009 Textile, Methods of Testing the Down-Proof Properties of Fabrics, Part 1: Rubbing Test, is 50 pieces or less.

4. The low-breathability woven fabric according to any one of claims 1 to 3, wherein the stretch fiber is a polyurethane fiber, a conjugate fiber made of two components joined in a side-by-side manner or an eccentric sheath-core manner, a false-twist crimped yarn, or a polytrimethylene terephthalate fiber.

5. The low-breathability woven fabric according to any one of claims 1 to 4, wherein the woven fabric has a warp cover factor within a range of 800 to 1,500 and a weft cover factor within a range of 700 to 1,200,

   the warp cover factor (warp CF) and the weft cover factor (weft CF) being defined by the following formulas:

$$\text{warp CF} = (DWp/1.1)^{1/2} \times MWp$$

$$\text{weft CF} = (DWf/1.1)^{1/2} \times MWf$$

   [DWp is the warp total fineness (dtex), MWp is the warp weaving density (yarns/2.54 cm), DWf is the weft total fineness (dtex), and MWf is the weft weaving density (yarns/2.54 cm) J.

6. The low-breathability woven fabric according to any one of claims 1 to 5, wherein the woven fabric has a plain structure or a ripstop taffeta structure.

7. The low-breathability woven fabric according to any of claims 1 to 6, wherein the woven fabric is given water repellent processing.

8. The low-breathability woven fabric according to any one of claims 1 to 7, wherein the woven fabric is not given a waterproof coating or not laminated.

9. The low-breathability woven fabric according to any one of claims 1 to 8, wherein the woven fabric is not calendered.

10. The low-breathability woven fabric according to any one of claims 1 to 9, wherein the woven fabric has a tear strength of 7 N or more in the warp direction or the weft direction,
    the tear strength being measured in accordance with JIS L 1096-2010 8.17, D Method.

11. The low-breathability woven fabric according to any one of claims 1 to 10, wherein the woven fabric has a slip resistance of 3 mm or less,
    the slip resistance being measured in accordance with JIS L 1096-2010 8.23, B Method (load: 117.7 N).

12. The low-breathability woven fabric according to any one of claims 1 to 11, wherein in the woven fabric, the Rotating Box IDFL 20-1 (Modified FTMS 191-5530) is 5 (0-5 particles).

13. A textile product comprising the low-breathability woven fabric according to any one of claims 1 to 12 and being selected from the group consisting of downwear, down jackets, comforters, sleeping bags, and sportswear.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2021/021270

A. CLASSIFICATION OF SUBJECT MATTER
D03D 15/56(2021.01)i; A41D 3/00(2006.01)i
FI: D03D15/08; A41D3/00 A; A41D3/00 B; A41D3/00 Z
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)
D03D1/00-27/18

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	1971-2021
Registered utility model specifications of Japan	1996-2021
Published registered utility model applications of Japan	1994-2021

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 2019-214798 A (TORAY INDUSTRIES, INC.) 19 December 2019 (2019-12-19) claims, paragraphs [0028], [0076], examples	1, 4, 6-9, 13
Y	claims, paragraphs [0028], [0076], examples	2, 4-13
X	JP 2006-336162 A (TORAY INDUSTRIES, INC.) 14 December 2006 (2006-12-14) claims, paragraphs [0030], [0031], [0062], examples	1-2, 4, 6-9
Y	claims, paragraphs [0030], [0031], [0062], examples	2-13
X	JP 2006-348411 A (TORAY INDUSTRIES, INC.) 28 December 2006 (2006-12-28) claims, paragraphs [0043], [0053], examples	1, 3-9, 12-13
Y	claims, paragraphs [0043], [0053], examples	2-13
X	JP 1-298278 A (KANEBO KABUSHIKI KAISHA) 01 December 1989 (1989-12-01) comparative examples	1-6, 8-9
A		2-5, 7, 10-13

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

* Special categories of cited documents:
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"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
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"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	Date of mailing of the international search report
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Name and mailing address of the ISA/	Authorized officer
Japan Patent Office 3-4-3, Kasumigaseki, Chiyoda-ku, Tokyo 100-8915, Japan	Telephone No.

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2021/021270

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	JP 11-200174 A (ASAHI KASEI INDUSTRY CO., LTD.) 27 July 1999 (1999-07-27) claims, paragraph [0004], examples	1, 3-6, 8-9, 12-13
Y	claims, paragraph [0004], examples	2-13
X	JP 11-81141 A (ASAHI KASEI INDUSTRY CO., LTD.) 26 March 1999 (1999-03-26) claims, paragraphs [0001], [0004], examples	1, 4, 6-10, 13
Y	claims, paragraphs [0001], [0004], examples	2-13
X	JP 2019-35165 A (TOYOBO STC CO., LTD.) 07 March 2019 (2019-03-07) claims, paragraphs [0001], [0059], [0067], examples	1, 3-8, 10-13
Y	claims, paragraphs [0001], [0059], [0067], examples	2-13
X	JP 2018-12899 A (TOYOBO STC CO., LTD.) 25 January 2018 (2018-01-25) claims, paragraph [0043], examples	1, 3-4, 6-8, 11-13
Y	claims, paragraph [0043], examples	2-13
P, X	JP 2020-105647 A (TORAY INDUSTRIES, INC.) 09 July 2020 (2020-07-09) claims, paragraph [0038], examples	1-3, 6, 8-9, 12-13
P, Y	claims, paragraph [0038], examples	5-13
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INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/JP2021/021270

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JP 2019-214798 A	19 Dec. 2019	(Family: none)	
JP 2006-336162 A	14 Dec. 2006	(Family: none)	
JP 2006-348411 A	28 Dec. 2006	(Family: none)	
JP 1-298278 A	01 Dec. 1989	(Family: none)	
JP 11-200174 A	27 Jul. 1999	(Family: none)	
JP 11-81141 A	26 Mar. 1999	(Family: none)	
JP 2019-35165 A	07 Mar. 2019	US 2019/0055682 A1 claims, paragraphs [0001], [0078], [0087], examples	
JP 2018-12899 A	25 Jan. 2018	(Family: none)	
JP 2020-105647 A	09 Jul. 2020	(Family: none)	

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REFERENCES CITED IN THE DESCRIPTION

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- JP 2005048298 A **[0005]**
- JP 2012057265 A **[0005]**
- JP 2004270097 A **[0020]**
- JP 2004211268 A **[0020]**
- JP 2009046800 A **[0022]**