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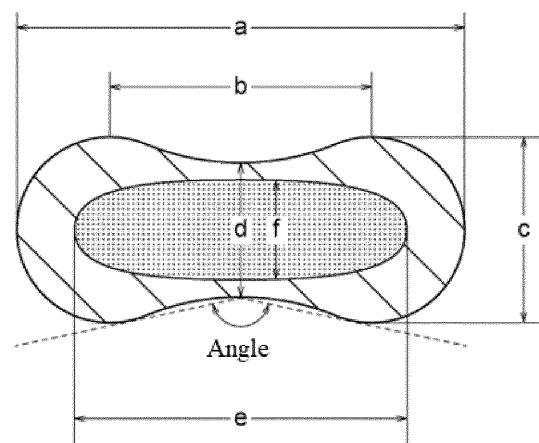
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(54) **BRISTLE MATERIAL FOR COSMETIC BRUSH, AND COSMETIC BRUSH USING SAID BRISTLE MATERIAL**

(57) An object of the present invention is to provide a makeup brush bristle material and a makeup brush bristle material assembly, both made of synthetic resin, as well as a makeup brush using such bristle material or bristle material assembly, all suitable for applying both powder cosmetics and liquid cosmetics, or more specifically, offering good uptake and release properties with respect to powder or liquid cosmetics. As a solution, a makeup brush bristle material is provided that comprises S-twisted or Z-twisted core-sheath complex monofilaments whose core part is constituted by synthetic resin A and sheath part is constituted by synthetic resin B that differs in type from synthetic resin A, characterized in that the cross-section of the core-sheath complex monofilaments in the direction orthogonal to the axis of fiber has a cocoon shape.

[FIG. 1]



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Description**Technical Field**

5 **[0001]** The present invention relates to a makeup brush bristle material, a makeup brush bristle material assembly, and a makeup brush.

Background Art

10 **[0002]** Traditionally, squirrel hair, horsehair, goat hair and other natural animal hairs have been used as bristle materials for makeup brushes. Natural animal hairs, which reportedly have favorable properties of taking up and releasing liquid or powder cosmetics, and are also flexible, soft to the touch, and pleasant to the feel during use, have many regular users. In particular, makeup brushes using squirrel hair and goat hair are highly regarded by consumers as the animal hair makeup brushes of finest quality. Despite their many advantages, however, natural animal hairs are limited in supply
15 because they are natural resources, and the sentiments for the protection of animals and global ecosystems, etc., are gradually reducing their availability. In recent years, therefore, bristle materials made of synthetic fibers are proposed for use in makeup brushes to substitute for natural animal hairs.

20 **[0003]** For example, Patent Literature 1 proposes a brush bristle material for makeup brushes or other brushes, whose primary component is polypropylene terephthalate and which exhibits a specific bending recovery rate. It is specifically disclosed that a brush bristle material made solely of polypropylene terephthalate, even when its tip is tapered, offers superior durability to a brush bristle material made solely of polybutylene terephthalate, and is also more flexible and softer than conventional brush bristle materials (refer to Patent Literature 1).

25 **[0004]** Patent Literature 2 proposes a brush bristle material, constituted by a synthetic resin monofilament having a tapered part formed at one end thereof. It is specifically disclosed that shaping the cross-section of the tapered part as a circle, and the cross-section of the main body part other than the tapered part as an eight-petal flower, makes the bristle material suitable for use in makeup brushes as it offers both excellent performance in terms of liquid cosmetic application, and pleasant feel comparable to natural animal hair during use (refer to Patent Literature 2).

Background Art Literature

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Patent Literature**[0005]**

35 Patent Literature 1: Japanese Patent Laid-open No. 2003-245133
 Patent Literature 2: Japanese Patent Laid-open No. 2009-201794

Summary of the Invention**Problems to Be Solved by the Invention**

40 **[0006]** Natural animal hairs are subtly crimped, so when they are bundled, the tip of the application part becomes flared, which is particularly suitable for blushes, eyeshadow, and other powder cosmetics applied in a blending manner. On the other hand, brush bristle materials made of synthetic fibers remain straight, instead of flaring, at the tip of the application part when bundled because the synthetic fibers themselves are straight; accordingly, they are known to be
45 suitable for applying eyeliner, lipstick and other solid, paste, or liquid cosmetics, but not suitable for applying powder cosmetics.

50 **[0007]** Accordingly, an object of the present invention is to provide a makeup brush bristle material and a makeup brush bristle material assembly, both made of synthetic resin, as well as a makeup brush using such bristle material or bristle material assembly, all suitable for applying both powder cosmetics and liquid cosmetics, or more specifically, offering good uptake and release properties with respect to powder or liquid cosmetics.

Means for Solving the Problems

55 **[0008]** After studying in earnest to achieve the aforementioned object, the inventor of the present invention discovered that a makeup brush bristle material comprising S-twisted or Z-twisted core-sheath complex monofilaments having a specific cross-section shape, when designed as a two-layer structure consisting of a core part and a sheath part, each made of a different material, would provide a makeup brush bristle material providing a good balance of softness and

resilience while offering exceptional uptake and release properties with respect to powder or liquid cosmetics, and finally achieved the aforementioned object.

[0009] To be specific, the key points of the present invention are as follows:

1. A makeup brush bristle material comprising S-twisted or Z-twisted core-sheath complex monofilaments whose core part is constituted by synthetic resin A and sheath part is constituted by synthetic resin B that differs in type from synthetic resin A, characterized in that the cross-section of the core-sheath complex monofilaments in the direction orthogonal to the axis of fiber has a cocoon shape.
2. The makeup brush bristle material according to 1, characterized in that the core-sheath complex monofilament has a narrow tip part having a tapered shape.
3. The makeup brush bristle material according to 2, characterized in that the narrow tip part having a tapered shape is branched.
4. The makeup brush bristle material according to any one of 1 to 3, characterized in that the synthetic resin A and the synthetic resin B are each a polyester-based resin.
5. The makeup brush bristle material according to 4, characterized in that the synthetic resin A and the synthetic resin B are each one type selected from polytrimethylene terephthalate, polyethylene terephthalate, and polybutylene terephthalate.
6. A makeup brush bristle material assembly comprising a mixed assembly of S-twisted and Z-twisted core-sheath complex monofilaments whose core part is constituted by synthetic resin A and sheath part is constituted by synthetic resin B that differs in type from synthetic resin A, characterized in that the cross-sections of the core-sheath complex monofilaments in the direction orthogonal to the axis of fiber each have a similar cocoon shape.
7. A makeup brush characterized in that it uses, at least partially, the makeup brush bristle material according to any one of 1 to 5 or the makeup brush bristle material assembly according to 6.

Effects of the Invention

[0010] The makeup brush bristle material proposed by the present invention has three unique three-dimensional shapes including twists, a specific cross-section shape, and a core-sheath structure. The two-layer structure consisting of a core part and a sheath part, each made of a different material, allows the two different materials to exhibit their individual properties. The ability to adjust the softness, elasticity, and feel according to the combination of these different materials allows the makeup brush bristle material to be one suitable for powder cosmetics or for liquid cosmetics. In other words, the makeup brush bristle material proposed by the present invention, which has a two-layer structure consisting of a core part and a sheath part representing a combination of two different materials, provides a good balance of softness and resilience while offering the levels of both softness and elasticity that create an excellent feel on the skin, and this makes the makeup brush bristle material proposed by the present invention equally excellent or even superior to makeup brushes using natural animal hair. Additionally, when combined, the three unique three-dimensional shapes demonstrate effects greater than the sum of their individual effects, and achieve uptake and release properties with respect to powder or liquid cosmetics that are superior to natural animal hair. Furthermore, by having a narrow tip part having a tapered shape, the makeup brush bristle material offers feel, elasticity, and softness comparable to natural animal hair.

Brief Description of the Drawings

[0011]

- [FIG. 1] A schematic cross-sectional view of a cocoon-shaped core-sheath complex monofilament pertaining to a makeup brush bristle material according to the present invention.
- [FIG. 2] A schematic cross-sectional view showing an example of a cocoon shape according to the present invention.
- [FIG. 3] (A) to (C) are schematic views of cross-section shapes not included in the present invention.
- [FIG. 4] A graph showing the evaluation results of the Examples under "Use Performance Evaluation of Makeup Brushes 4."

Mode for Carrying Out the Invention

[0012] The present invention relates to a makeup brush bristle material, a makeup brush bristle material assembly, and a makeup brush, each comprising S-twisted or Z-twisted core-sheath complex monofilaments whose core part is constituted by synthetic resin A and sheath part is constituted by synthetic resin B that differs in type from synthetic resin A, wherein the cross-section of the core-sheath complex monofilaments in the direction orthogonal to the axis of fiber

has a cocoon shape.

[0013] The present invention is explained in detail below.

[0014] The makeup brush bristle material proposed by the present invention is constituted by S-twisted or Z-twisted core-sheath complex monofilaments. In other words, it has a helical structure representing either an "S-twisted bristle material (twisted to the right)" or "Z-twisted bristle material (twisted to the left)" and, unlike straight fibers or wavy fibers, flares three-dimensionally in the direction crossing at right angles with the axis of helix.

[0015] The volume occupied by a single bristle material having such helical structure based on twist, is greater than the volume occupied by a bristle material of planar zigzag structure formed by the conventionally known gear-crimp method, and a makeup brush bristle material assembly or makeup brush comprising the makeup brush bristle materials proposed by the present invention becomes fluffy and highly voluminous because it contains many void parts inside as the bristle materials are prevented from overlapping or adhering to each other, even in a stationary state. Additionally, combining S-twist and Z-twist allows for further increase in the void parts inside and the three-dimensional feel can be enhanced as a result, which is desirable.

[0016] The number of twists in each of the makeup brush bristle materials proposed by the present invention is set preferably in a range of 30 T/m (twists/meter) or greater but no greater than 100 T/m (twists/meter), or more preferably in a range of 40 T/m (twists/meter) or greater but no greater than 90 T/m (twists/meter), for both S-twist and Z-twist, so that, when they are made into a makeup brush bristle material assembly or makeup brush, void parts in which to retain powder or liquid cosmetics are formed between adjacent bristle materials. So long as the number of twists is within the aforementioned ranges, a helical structure can be given to the fibers in their length direction based on a wavelength width over 10 mm but not exceeding 35 mm.

[0017] Normally, adding a three-dimensional feel to a monofilament requires it to be hard-twisted in order to make the wavelength width shorter; with the makeup brush bristle material proposed by the present invention, on the other hand, the number of twists is reduced (loose twisting) to make the wavelength width longer. By reducing the number of twists as described above, a brush bristle material with a greater three-dimensional feel can be obtained, and also several of such monofilaments can be twisted together and then combed to open the fibers with ease, which provides an added benefit of higher manufacturing efficiency. Also, hard-twisting tends to make the bristle material less elastic and rough to the skin.

[0018] On the other hand, a wavelength width over 35 mm makes the twisting loose and the bristle material closer to being straight, leading to less three-dimensional flare of the bristle materials and reduced void parts between the bristle materials, the result of which is a tendency of the trapped or retained amount of powder or liquid cosmetics to drop. Meanwhile, when the wavelength width is smaller than 10 mm, the bristle materials tend to tangle together and the manufacturing efficiency drops as a result. The wavelength width of the makeup brush bristle material proposed by the present invention is preferably 11 mm or greater but no greater than 25 mm, or more preferably 12 mm or greater but no greater than 20 mm.

[0019] The makeup brush bristle material proposed by the present invention comprises S-twisted or Z-twisted core-sheath complex monofilaments whose cross-section in the direction orthogonal to the axis of fiber has a cocoon shape.

[0020] The cross-section shape of the makeup brush bristle material proposed by the present invention is explained according to FIGS. 1 to 3. FIGS. 1 and 2 are both schematic views of cross-section shapes representing the makeup brush bristle material proposed by the present invention. FIGS. 3 (A) to (C) are schematic views of cross-section shapes not included in the present invention.

[0021] The cocoon shape of the cross-section of the core-sheath complex monofilament under the present invention refers to a rice bale shape resembling a cocoon spun by a silkworm-oblong with a gradual constriction at the center portion (mid body portion)-as shown in FIG. 1, and does not include cross-section shapes with no constriction at the center portion (mid body portion) like the one shown in FIG. 3 (A). Also, while the cocoon shape of the cross-section of the core-sheath complex monofilament under the present invention includes shapes having a large constriction at the center portion (mid body portion) like the one shown in FIG. 2, it does not include shapes having a sharp-angled, groove-like constriction(s) like the ones shown in FIGS. 3 (B) and (C).

[0022] The cocoon shape of the cross-section of the core-sheath complex monofilament under the present invention is characterized in that, as shown in FIGS. 1 and 2, the angle formed by the two tangential lines (dotted lines) originating from the center part of constriction and extending along the gradual constriction is greater than 90 degrees but smaller than 180 degrees. With the cocoon shape of the cross-section of the core-sheath complex monofilament under the present invention, this angle is preferably 100 degrees or greater, or more preferably 120 degrees or greater, or yet more preferably 130 degrees or greater. In embodiments not included in the present invention, specifically one shown in FIG. 3 (B), a sharp-angled, vertical groove is constituted where the angle formed by the two tangential lines (dotted lines) originating from the center part of constriction and extending along the constriction is smaller than 90 degrees.

[0023] Under the present invention, the cross-section of the core part in the direction orthogonal to the axis of fiber has an oval shape.

[0024] The inventor of the present invention had previously confirmed that the uptake property (catching property) of

a makeup brush bristle material with respect to powder or liquid cosmetics would improve when a vertical groove is present in the length direction of fiber. However, the inventor of the present invention discovered for the first time that, if this vertical groove has a sharp angle (within 90 degrees), any powder or liquid cosmetic taken up by the makeup brush bristle material would be retained in this vertical groove and the release property (releasing property) would drop.

In other words, the inventor of the makeup brush bristle material proposed by the present invention discovered that it would demonstrate excellent uptake and release properties, especially release property (releasing property), with respect to powder or liquid cosmetics when the cross-section of its core-sheath complex monofilament as proposed by the present invention is shaped as a cocoon having a gradual streamlined shape, or specifically a constriction whose angle as described above is greater than 90 degrees but smaller than 180 degrees, and finally completed the present invention.

[0025] The cross-section shape of the makeup brush bristle material proposed by the present invention is explained in greater detail according to FIG. 1. The hatched area in FIG. 1 represents the sheath part of the makeup brush bristle material proposed by the present invention, while the dotted area represents the core part of the makeup brush bristle material proposed by the present invention.

[0026] In FIG. 1, a represents the long diameter of the sheath part of the present invention (hereinafter referred to as "long diameter of sheath part a"), b represents the depression width of the sheath part (hereinafter referred to as "depression width of sheath part b"), c represents the short diameter of the sheath part (hereinafter referred to as "short diameter of sheath part c"), d represents the depression diameter of the sheath part (hereinafter referred to as "depression diameter of sheath part d"), e represents the long diameter of the core part of the present invention (hereinafter referred to as "long diameter of core part e"), and f represents the short diameter of the core part (hereinafter referred to as "short diameter of core part f").

[0027] With the makeup brush bristle material proposed by the present invention, the long diameter of sheath part a is in a range of 100 μm or greater but no greater than 200 μm , within which a range of 105 μm or greater but no greater than 170 μm is preferred, and a range of 110 μm or greater but no greater than 160 μm is more preferred. The depression width of sheath part b is in a range of 40% or greater but no greater than 75% of the long diameter of sheath part a, the short diameter of sheath part c is in a range of 10 μm or greater but no greater than 100 μm , and the depression diameter of sheath part d is 40% or greater but no greater than 95% of the short diameter of sheath part c. Preferably the aspect ratio of long diameter of sheath part a and depression diameter of sheath part d (a/d) is in a range of 1 or greater but no greater than 3. Meanwhile, preferably the ratio of depression diameter of sheath part d and short diameter of sheath part c (d/c) is in a range of 0.4 or greater but smaller than 1.0.

[0028] Also, with the makeup brush bristle material proposed by the present invention, the ratio of long diameter of core part e and long diameter of sheath part a (e/a) is preferably in a range of 0.5 or greater but no greater than 0.9, or more preferably in a range of 0.6 or greater but no greater than 0.8. Meanwhile, the ratio of short diameter of core part f and short diameter of sheath part c (f/c) is preferably in a range of 0.5 or greater but no greater than 0.9, or more preferably in a range of 0.6 or greater but no greater than 0.8.

[0029] When its long diameter of sheath part a, depression width of sheath part b, short diameter of sheath part c, depression diameter of sheath part d, long diameter of core part e, and short diameter of core part f are within the aforementioned ranges, the makeup brush bristle material proposed by the present invention demonstrates excellent performance in terms of uptake and release properties with respect to powder or liquid cosmetics.

[0030] The makeup brush bristle material proposed by the present invention has a twist structure based on S-twist or Z-twist, a cocoon-shaped cross-section, as well as a two-layer structure consisting of a core part and a sheath part, each made of a different material, and by combining these three unique three-dimensional shapes, it demonstrates synergistic effects-effects that achieve a good balance of softness and resilience while offering levels of both softness and elasticity that create an excellent feel on the skin. Additionally, in terms of uptake and release properties with respect to powder or liquid cosmetics, and particularly release property (releasing property) with respect to powder or liquid cosmetics, it demonstrates exceptional initial release property.

[0031] The makeup brush bristle material proposed by the present invention comprises core-sheath complex monofilaments whose core part is constituted by synthetic resin A and sheath part is constituted by synthetic resin B that differs in type from synthetic resin A.

[0032] Here, under the present invention, "differs in type" means the type of the synthetic resin constituting synthetic resin A differs, even by a small degree, from that of the synthetic resin constituting synthetic resin B. In Example 1 among Examples described below, for example, the core part is constituted by polybutylene terephthalate, while the sheath part is constituted by polytrimethylene terephthalate. Such embodiment where polybutylene terephthalate, or synthetic resin A constituting the core part, differs in type from polytrimethylene terephthalate, or synthetic resin B constituting the sheath part, is specified, under the present invention, as one whose "core part is constituted by synthetic resin A and sheath part is constituted by synthetic resin B that differs in type from synthetic resin A."

[0033] Similarly, in Example 2, the core part is constituted by polybutylene terephthalate, while the sheath part is constituted by polytrimethylene terephthalate and polybutylene terephthalate, and this is also a specific example representing an embodiment where synthetic resin A constituting the core part differs in type from synthetic resin B constituting

the sheath part.

[0034] For these synthetic resin A and synthetic resin B, one or two or more types may be selected from polyamide-based resins, polyolefin-based resins, polyester-based resins and other synthetic resins, and used alone or in combination; however, it is important that synthetic resin A and synthetic resin B differ in type. Among these, polyester-based resins are ideal choices for synthetic resin A and synthetic resin B as they possess appropriate rigidity and durability as makeup brush bristle materials and also exhibit excellent extrudability, twistability, taperability, etc. Among them, preferably synthetic resin A and synthetic resin B are each one type selected from polytrimethylene terephthalate, polyethylene terephthalate, polybutylene terephthalate, polylactic acid, and other polyester-based resins. In particular, more preferably synthetic resin A and synthetic resin B are each one type selected from polytrimethylene terephthalate (PTT), polyethylene terephthalate (PET), and polybutylene terephthalate (PBT), as these have appropriate flexibility and elasticity. The core-sheath complex monofilament under the present invention may contain heat-proofing agent, weather-proofing agent, plasticizer, colorant, and other commonly used additives to the extent that the object of the present invention is not hindered.

[0035] The makeup brush proposed by the present invention is characterized in that it uses, at least partially, the makeup brush bristle material proposed by the present invention or makeup brush bristle material assembly proposed by the present invention. To be more specific, preferably 10% by weight or more, or more preferably 20% by weight or more, or yet more preferably 25% by weight or more, or most preferably 30% by weight or more, of all makeup brush bristle materials of the makeup brush proposed by the present invention is accounted for by the makeup brush bristle material proposed by the present invention or makeup brush bristle material assembly proposed by the present invention.

[0036] The makeup brush proposed by the present invention can demonstrate performance superior to makeup brushes using natural animal hair in terms of uptake and release properties with respect to powder or liquid cosmetics, and it can also function more like makeup brushes using natural animal hair by having the levels of both softness and elasticity that create excellent feel on the skin, when 10% by weight or more but no more than 100% by weight of all makeup brush bristle materials is accounted for by the makeup brush bristle material proposed by the present invention or makeup brush bristle material assembly proposed by the present invention. In particular, the makeup brush proposed by the present invention can demonstrate the effects of the present invention fully when 30% by weight or more of all makeup brush bristle materials is accounted for by the makeup brush bristle material proposed by the present invention or makeup brush bristle material assembly proposed by the present invention.

[0037] The makeup brush proposed by the present invention, for the balance thereof not using the makeup brush bristle material proposed by the present invention or makeup brush bristle material assembly proposed by the present invention, can use makeup brush bristle materials constituted by nylon fibers, polyester fibers, and other synthetic fibers.

[0038] Also, with the makeup brush proposed by the present invention, preferably the tip of the core-sheath complex monofilament is processed so that it has a narrow tip part having a tapered shape. Furthermore, it is more preferable that this narrow tip part having a tapered shape is processed so that it branches. Processing the tip part this way improves feel on the skin when a cosmetic is applied, thus achieving excellent feel close to natural animal hair.

<Method for Manufacturing Makeup Brush Bristle Material>

[0039] Next, an example of how the makeup brush bristle material proposed by the present invention is manufactured, is explained.

[0040] As for the core-sheath complex monofilament that constitutes the makeup brush bristle material, synthetic resins in pellet or powder form, representing synthetic resin A for core part and synthetic resin B for sheath part that varies in type from synthetic resin A, are prepared and supplied to a composite melt spinning machine, together with additives as necessary, to be coextruded from a core-sheath complex nozzle corresponding to the cross-section shape of the bristle material proposed by the present invention, and then solidified under cooling and drawn under heating, and spun as a core-sheath complex monofilament, to manufacture a core-sheath complex monofilament whose cross-section has a cocoon shape.

[0041] Such core-sheath complex monofilaments are twisted by the number of times mentioned above, after which the core-sheath complex monofilaments that have been twisted together are heated at a temperature equal to or below the melting points of the synthetic resins and thus thermally set. The thermal setting period, which varies depending on the temperature, is approx. 5 minutes with dry heat at 185°C, for example. This way, the twisted structure is fixed and the shape stabilizes against any effects of the use environment. Then, the thermally-set core-sheath complex monofilaments are cut to a prescribed length, such as a length of 25 mm or more, for example, or preferably a length in a range of 50 mm or more but no more than 100 mm.

[0042] The cut core-sheath complex monofilaments may have a tapered narrow tip part formed at the tip, if necessary. To do this, a hydrolysis-promoting catalyst is added to a strong alkali solution (such as an aqueous sodium hydroxide solution), and after the mixture has been held under a certain temperature condition, the cut core-sheath complex monofilaments are immersed in it from the tip to near the center part. After having been immersed for a prescribed period

of time, the core-sheath complex monofilaments are pulled up, and their tips have become narrowed in a tapered shape, forming a pointed narrow tip part. When obtained by this method, the core-sheath complex monofilaments have a virtually immaculate tapered narrow tip part. Also, by setting an appropriate immersion period, the constricted portion of the cocoon shape representing the cross-section of the core-sheath complex monofilaments will dissolve, and a makeup brush bristle material with a narrow tip part whose tip is split into two sharp-pointed branches can be obtained. This method is ideal because a makeup brush bristle material with a branched narrow tip part can be formed with ease. The length of this narrow part should be set in a range of 1 to 30 mm according to the purpose of use or application, while the length of the branched portion should be set in a range of 0.1 to 20 mm.

[0043] Next, this bundle of core-sheath complex monofilaments is washed in water and dried. Then, the bundle of core-sheath complex monofilaments is combed and twisted together, into a single makeup brush bristle material.

[0044] The makeup brush bristle material thus obtained has a specific cross-section shape and a helical structure because the cross-section of the monofilaments in the direction orthogonal to the axis of fiber has a cocoon shape and also because thermally-set traces of twist are left behind. Additionally, when this is alkaline-treated, a makeup brush bristle material with a branched narrow tip part can be obtained.

[0045] Furthermore, dyeing treatment may be given, as necessary. For the dye, any dispersive dye may be used; however, one with a weather fastness of level 5 or above is preferred because it will cause less discoloration or fading when the makeup brush is used. Also, while any known dye carrier agent may be combined with the dye, preferably highpressure dyeing is performed that requires no dye carrier agent. Also, carbon black or any of various types of pigments, etc., may be added to the manufacturing material for monofilaments. This not only saves dye when dyeing, but it may even render dyeing unnecessary depending on the application, which is desirable.

<Makeup Brush Bristle Material Assembly>

[0046] The makeup brush bristle material assembly proposed by the present invention is a mixed assembly of S-twisted and Z-twisted makeup brush bristle materials. Using a makeup brush bristle material assembly in which S-twisted and Z-twisted makeup brush bristle materials are mixed to produce a makeup brush allows the bristle materials at the tips of their application parts to perform flowing movement in random directions so that powder or liquid cosmetics can be trapped or retained by a uniform amount, which is desirable. A makeup brush can have its application parts twisted in a certain direction and permanently bent depending on the usage or use habit of its user; when S-twisted and Z-twisted materials are mixed, however, such permanent bending does not occur easily and the durability of the makeup brush improves further, which is ideal.

[0047] Preferably the makeup brush bristle material assembly proposed by the present invention consists of S-twisted makeup brush bristle materials and Z-twisted makeup brush bristle materials mixed at a ratio of 4:6 to 6:4. When a makeup brush bristle material assembly with a 4:6 to 6:4 mix ratio is used as an application part of a makeup brush, the application part as formed will have more void parts inside and thus create a three-dimensional feel, functioning even more like an applicator that uses natural animal hair and allowing powder or liquid cosmetics to be applied uniformly. Furthermore, preferably S-twisted makeup brush bristle materials and Z-twisted makeup brush bristle materials are mixed roughly uniformly. This "mixed roughly uniformly" refers to a state where S-twisted makeup brush bristle materials and Z-twisted makeup brush bristle materials are dispersed without grouping together with their own kinds and being unevenly distributed. For example, it is a state where S-twisted makeup brush bristle materials and Z-twisted makeup brush bristle materials are placed roughly alternately across nearly the entire application part of the makeup brush, with a Z-twisted makeup brush bristle material placed next to an S-twisted makeup brush bristle material, and an S-twisted makeup brush bristle material placed next to the Z-twisted makeup brush bristle material. When S-twisted makeup brush bristle materials and Z-twisted makeup brush bristle materials are mixed roughly uniformly, the adjacent makeup brush bristle materials are prevented from contacting each other in a closely packed manner, which allows void parts to be formed easily between the makeup brush bristle materials and a fluffy, highly voluminous makeup brush can be formed as a result.

[0048] Also, preferably the application part of the makeup brush constituted by S-twisted makeup brush bristle materials and Z-twisted makeup brush bristle materials mixed roughly uniformly, has a bristle density of 0.3 g/cm³ to 0.5 g/cm³. When the bristle density in the application part of the makeup brush is within the aforementioned range, the application part will have a three-dimensional feel, with its tip flaring and growing voluminous, to function more like an applicator that uses natural animal hair, and become suitable for applying powder or liquid cosmetics.

<Method for Manufacturing Makeup Brush>

[0049] An example of how the makeup brush is manufactured, which uses the makeup brush bristle material or makeup brush bristle material assembly proposed by the present invention as obtained by the aforementioned manufacturing method, etc., is explained.

[0050] Makeup brush bristle materials, including the makeup brush bristle material or makeup brush bristle material assembly proposed by the present invention accounting for at least a part, or preferably 10% by weight or more, or more preferably 20% by weight or more, or yet more preferably 25% by weight or more, or most preferably 30% by weight or more, of all makeup brush bristle materials, are introduced into a brush-ear forming jar and, under vibration, an ear part with a raised center is formed according to the interior shape of the jar, after which the formed ear part is inserted into a cylindrical ferrule provided at the tip of a makeup brush handle part, to obtain a makeup brush.

[0051] The makeup brush proposed by the present invention is ideal for uniformly applying powder or liquid cosmetics, and can be utilized as various types of makeup brushes, such as liquid brush, lip brush, nailcare brush, foundation brush, powder brush, shadow brush, blush brush, highlighting brush, concealer brush, etc. Among them, the makeup brush proposed by the present invention is particularly suitable for so-called blending-a technique to apply a powder cosmetic by spreading it thinly on the skin surface-thus demonstrating excellent performance when used as a face brush, blush brush, highlighting brush, eyeshadow brush, or other shadow brush that often requires such application technique.

Examples

[0052] The present invention is explained below using examples; however, it should be noted that the scope of art of the present invention is not limited by these examples.

<Manufacturing Examples of Makeup Brush Bristle Materials and Makeup Brushes According to Present Invention>

Example 1 (Makeup Brush 1)

[0053] 60 core-sheath complex fibers having a cocoon cross-section shape (core component: polybutylene terephthalate, sheath component: polytrimethylene terephthalate, fineness: 80 decitex), including those twisted in the direction of letter S (S-twist) and others twisted in the direction of letter Z (Z-twist) for 80 T/m (twists/meter) using a twisting machine, were treated with dry heat at 185°C for 5 minutes to set the twists, to obtain an S-twisted and Z-twisted makeup brush bristle material assembly with a wavelength width of 11 mm.

[0054] Next, the S-twist and Z-twist in the makeup brush bristle material assembly were mixed at a ratio of 1:1 and held together, to create a fiber bundle of 4 cm in diameter, which was then wrapped with paper for protection. This fiber bundle was cut to a length of 8 cm, into a roller of 4 cm in diameter and 8 cm in length. Further, an aqueous solution consisting of 100 g/L of sodium hydroxide and 6 g/L of quaternary amine (product name: DYK-1125, manufactured by Ipposha Oil Industries Co., Ltd.) was prepared, conducting tapering treatment, and the fiber bundle was dyed therein and then combed, with a comb running through the twists, after which the fiber bundle was placed in a concave jar with the bristle tips facing down, and vibrated to align the bristle shape, to create Makeup Brush 1.

Example 2 (Makeup Brush 2)

[0055] Makeup Brush 2 was created in the same manner as described in the aforementioned manufacturing example of Example 1, except that 60 core-sheath complex fibers having a cocoon cross-section shape (core component: polybutylene terephthalate, sheath component: polytrimethylene terephthalate + polybutylene terephthalate, fineness: 80 decitex), including those twisted in the direction of letter S (S-twisted) and others twisted in the direction of letter Z (Z-twisted) for 80 T/m (twists/meter) using a twisting machine, were used.

Example 3 (Makeup Brush 3)

[0056] Makeup Brush 3 was created in the same manner as described in the aforementioned manufacturing example of Example 1, except that 60 core-sheath complex fibers having a cocoon cross-section shape (core component: polyethylene terephthalate elastomer, sheath component: polytrimethylene terephthalate, fineness: 80 decitex), including those twisted in the direction of letter S (S-twisted) and others twisted in the direction of letter Z (Z-twisted) for 80 T/m (twists/meter) using a twisting machine, were used.

Example 4 (Makeup Brush 4)

[0057] Makeup Brush 4 was created in the same manner, except that the fibers manufactured in Example 1 above were mixed with untwisted fibers based on the fibers in Example 1 at a ratio of 1:1.

Example 5 (Makeup Brush 5)

[0058] Makeup Brush 5 was created in the same manner, except that the fibers manufactured in Example 2 above were mixed with untwisted fibers based on the fibers in Example 2 at a ratio of 1:1.

Example 6 (Makeup Brush 6)

[0059] Makeup Brush 6 was created in the same manner, except that the fibers manufactured in Example 3 above were mixed with untwisted fibers based on the fibers in Example 3 at a ratio of 1:1.

Comparative Example 1 (Comparative Example Makeup Brush 1)

[0060] Comparative Example Makeup Brush 1 was created in the same manner as described in Example 1, except that 60 core-sheath complex fibers having a circular cross-section shape (core component: polyethylene terephthalate elastomer, sheath component: polytrimethylene terephthalate, fineness: 100 decitex), including those twisted in the direction of letter S (S-twisted) and others twisted in the direction of letter Z (Z-twisted) for 80 T/m (twists/meter) using a twisting machine, were used.

Comparative Example 2 (Comparative Example Makeup Brush 2)

[0061] Comparative Example Makeup Brush 2 was created in the same manner as described in Example 1, except that 60 core-sheath complex fibers having a circular cross-section shape (core component: polyethylene terephthalate elastomer, sheath component: polytrimethylene terephthalate, fineness: 80 decitex), including those twisted in the direction of letter S (S-twisted) and others twisted in the direction of letter Z (Z-twisted) for 80 T/m (twists/meter) using a twisting machine, were used.

Comparative Example 3 (Comparative Example Makeup Brush 3)

[0062] Comparative Example Makeup Brush 3 was created in the same manner as described in Example 1, except that 60 core-sheath complex fibers having a circular cross-section shape (core component: polyethylene terephthalate elastomer, sheath component: polybutylene terephthalate, fineness: 80 decitex), including those twisted in the direction of letter S (S-twisted) and others twisted in the direction of letter Z (Z-twisted) for 80 T/m (twists/meter) using a twisting machine, were used.

Comparative Example 4 (Comparative Example Makeup Brush 4)

[0063] Comparative Example Makeup Brush 4 was created in the same manner as described in Example 1, except that 60 core-sheath complex fibers having a circular cross-section shape (core component: polyethylene terephthalate elastomer, sheath component: polybutylene terephthalate + polytrimethylene terephthalate, fineness: 80 decitex), including those twisted in the direction of letter S (S-twisted) and others twisted in the direction of letter Z (Z-twisted) for 80 T/m (twists/meter) using a twisting machine, were used.

Comparative Examples 5 to 7 (Comparative Example Makeup Brushes 5 to 7)

[0064] Comparative Example Makeup Brushes 5 to 7 were created in the same manner, except that the fibers in Comparative Examples 2 to 4 whose fineness was adjusted to 60 decitex were used.

<Use Performance Evaluation of Makeup Brushes 1: Evaluation of Powder Uptake Property>

[0065] A test was conducted to evaluate the powder uptake property (catching property) of the makeup brush proposed by the present invention. Under the present invention, "powder uptake property (catching property)" indicates ease of attachment of powder cosmetics to the makeup brush.

(Test Samples)

[0066] Makeup Brushes 1 to 6 and Comparative Example Makeup Brushes 1 to 7 manufactured in the aforementioned manufacturing examples, as well as, to serve as the evaluation standard, a commercially available goat hair (Sokouhou) makeup brush regarded highly by consumers as an animal hair makeup brush of finest quality, were evaluated for powder

uptake property (catching property) with respect to a powder cosmetic (Integrate Mineral Glow Pressed Powder, manufactured by Shiseido Co., Ltd.), using a surface property tester (product name: TRILAB Handy Rub Tester Type TL701, manufactured by Trinity-Lab Inc.).

5 (Test Method)

[0067] A circular container (diameter: 5.5 cm) filled with the powder cosmetic was attached roughly vertically to the contactor of the aforementioned surface property tester using a double-sided tape. Each test sample was installed on a rotating table so that the ear part of the makeup brush, being the test sample, would contact the surface of the powder cosmetic roughly at right angles, and was fixed horizontally to the test table.

[0068] The ear part of the makeup brush was swept 10 times over the surface of the powder cosmetic (speed: 6 rpm, radius of rotation: 100 mm, angle of rotation: 90 degrees), to let the ear part of the makeup brush pick up the powder cosmetic.

[0069] The powder uptake property of each test sample was evaluated by measuring the weight of the makeup brush before the test and also after the end of the test, and taking the weight difference as the amount of powder taken up in 10 sweeps (hereinafter referred to as "taken-up amount").

[0070] It should be noted that, if a given makeup brush was unused, the makeup brush was swept 10 times on the surface of the powder cosmetic according to the aforementioned test method to take up the powder cosmetic, and then swept over a tissue paper to release the powder cosmetic until nothing attached to the tissue paper, and used as a test sample.

[0071] The test was conducted twice, and the average value of each test sample was compared against the taken-up amount of the animal hair makeup brush, and evaluated according to the following criteria, and a summary of the results is shown in Table 1 below.

25 [Evaluation Criteria]

[0072]

1: 1 time or more the taken-up amount of the animal hair makeup brush

2: 0.8 times or more but less than 1 time the taken-up amount of the animal hair makeup brush

3: Less than 0.8 times the taken-up amount of the animal hair makeup brush

[0073] It is confirmed that, as shown in Table 1 below, Makeup Brushes 1 to 6 constituted by makeup brush bristle materials conforming to the present invention took up approx. 1.1 to 1.6 times more powder than the commercially available goat hair makeup brush. It is also confirmed that they took up approx. 1.2 to 2.2 times more powder than Comparative Example Makeup Brushes 1 to 7 made of core-sheath complex monofilaments having a circular cross-section shape.

[0074] These evaluation results clearly show that the makeup brush bristle material proposed by the present invention demonstrates synergistic effects from a combination of three unique three-dimensional shapes including twists, a specific cross-section shape, and a core-sheath structure, and that it can be made into a makeup brush offering excellent powder uptake property (catching property).

<Use Performance Evaluation of Makeup Brushes 2: Evaluation of Color Development and Spreading Property>

45 (Test Samples)

[0075] The evaluation was conducted with a powder cosmetic (Integrate Mineral Glow Pressed Powder, manufactured by Shiseido Co., Ltd.) using the same test samples in "Use Performance Evaluation of Makeup Brushes 1" above, namely Makeup Brushes 1 to 6 and Comparative Example Makeup Brushes 1 to 7, as well as, to serve as the evaluation standard, a commercially available goat hair (Sokouhou) makeup brush regarded highly by consumers as an animal hair makeup brush of finest quality.

(Test Method)

[0076] The makeup brush, being the test sample, was circled 3 times on the surface of the powder cosmetic to let the ear part of the makeup brush pick up the powder cosmetic, and then circled 10 times on a tissue paper. 10 panelists (adult females) evaluated the color development and spreading of the cosmetic on the tissue paper according to the following evaluation criteria, with the most selected rating used as the evaluation result, and a summary of the results

is shown in Table 1 below. It should be noted that, under the following evaluation criteria, A and B indicate that the makeup brush presents no practical problems, while C and D indicate that the makeup brush presents practical problems.

[Evaluation Criteria]

[0077]

- A: Color development is on par with the animal hair makeup brush, and the applied cosmetic spreads evenly.
- B: Color development is on par with the animal hair makeup brush, and the applied cosmetic spreads evenly, albeit over a smaller range than A.
- C: Color development is weaker than with the animal hair makeup brush, and spreading is equivalent to B.
- D: Color development is weaker than with the animal hair makeup brush, and the spreading range is smaller than B.

[0078] It is confirmed that, as shown in Table 1 below, Makeup Brushes 1 to 6 constituted by makeup brush bristle materials conforming to the present invention provide makeup brushes that present no practical problems in terms of color development and spreading property. On the other hand, Comparative Example Makeup Brushes 1 to 7 constituted by core-sheath complex monofilaments having a circular cross-section shape clearly are makeup brushes that present practical problems in terms of color development and spreading property.

<Use Performance Evaluation of Makeup Brushes 3: Evaluation of Feel on Skin>

(Test Samples)

[0079] The evaluation was conducted using the same test samples in "Use Performance Evaluation of Makeup Brushes 1" above, namely Makeup Brushes 1 to 6 and Comparative Example Makeup Brushes 1 to 7, as well as, to serve as the evaluation standard, a commercially available goat hair (Sokouhou) makeup brush regarded highly by consumers as an animal hair makeup brush of finest quality.

(Test Method)

[0080] 10 panelists (adult females) used the makeup brush, being the test sample, on their skin and evaluated the feel according to the following evaluation criteria, with the most selected rating used as the evaluation result, and a summary of the results is shown in Table 1 below. It should be noted that, under the following evaluation criteria, 1 and 2 indicate that the makeup brush presents no practical problems, while 3 indicates that the makeup brush presents practical problems.

[Evaluation Criteria]

[0081]

- 1: The brush moves flexibly on the skin surface and creates a fine feel with the entire brush following the skin surface.
- 2: The brush has a slightly less desirable feel than 1 but presents no practical problems.
- 3: The brush lacks appropriate tension and flexibility, and it feels like the bristle bundle is moving randomly, creating a poor feel.

[0082] It is confirmed that, as shown in Table 1 below, Makeup Brushes 1 to 6 constituted by makeup brush bristle materials conforming to the present invention have an excellent or fine feel, providing makeup brushes that present no practical problems. On the other hand, Comparative Example Makeup Brushes 1 to 7 constituted by core-sheath complex monofilaments having a circular cross-section shape clearly are makeup brushes that present practical problems due to a poor feel.

<Use Performance Evaluation of Makeup Brushes 4: Evaluation of Elasticity and Softness>

(Test Samples)

[0083] The evaluation was conducted with a surface property tester (product name: TRILAB Handy Rub Tester Type TL701, manufactured by Trinity-Lab Inc.) using the same test samples in "Use Performance Evaluation of Makeup Brushes 1" above, namely Makeup Brushes 1 to 6 and Comparative Example Makeup Brushes 1 to 7, as well as, to

serve as the evaluation standard, a commercially available goat hair (Sokouhou) makeup brush regarded highly by consumers as an animal hair makeup brush of finest quality.

(Test Method)

[0084] Each test sample was installed on a rotating table so that the ear part of the makeup brush, being the test sample, would contact the surface of the contactor of the aforementioned surface property tester roughly at right angles, and was fixed horizontally to the test table.

[0085] The ear part of the makeup brush was moved in the horizontal direction relative to the surface of the contactor of the surface property tester (speed: 6 rpm, angle of rotation: 90 degrees), to measure the maximum values of the resulting forces applied in the vertical direction and horizontal direction.

[0086] The measured value in the vertical direction, which represents a force of recovery of the bristle bundle of the makeup brush, was evaluated as an indicator of the elasticity of the makeup brush, while the measured value in the horizontal direction, which represents a force that pushes in the contactor, was evaluated as an indicator of the softness of the makeup brush.

[0087] The measurement was conducted three times and a summary of the average values is shown in Table 1 below as well as in FIG. 4.

[0088] As shown in Table 1 below and in FIG. 4, Makeup Brushes 1 to 6 constituted by makeup brush bristle materials conforming to the present invention clearly are makeup brushes offering both elasticity and softness, compared to Comparative Example Makeup Brushes 1 to 7 constituted by core-sheath complex monofilaments having a circular cross-section shape.

[0089] The evaluation results of "Use Performance Evaluations of Makeup Brushes 1 to 4" above are summarized, and shown in Table 1. In Table 1, "PBT" stands for polybutylene terephthalate, "PTT" stands for polytrimethylene terephthalate, and "PET" stands for polyethylene terephthalate.

[Table 1]

	Core-sheath complex monofilament		Evaluation 1			Evaluation 2		Evaluation 3	Evaluation 4	
	Core part	Sheath part	Taken-up amount (g)	Comparison against animal hair	Evaluation				Elasticity	Softness
Example 1	PBT	PTT	0.0263	1.46	1	A	1	1	0.609	0.279
Example 2	PBT	PTT+PBT	0.0209	1.16	1	A	1	1	0.632	0.254
Example 3	PET	PTT	0.0283	1.57	1	B	2	2	0.547	0.189
Example 4	PBT	PTT	0.0220	1.22	1	A	1	1	0.558	0.230
Example 5	PBT	PTT+PBT	0.0200	1.11	1	A	2	2	0.677	0.258
Example 6	PET	PTT	0.0240	1.33	1	B	2	2	0.587	0.214
Comparative Example 1	PET	PTT	0.0131	0.73	3	D	3	3	0.299	0.289
Comparative Example 2	PET (highly elastic)	PTT	0.0127	0.71	3	C	3	3	0.428	0.213
Comparative Example 3	PET (highly elastic)	PBT	0.0170	0.94	2	C	3	3	0.508	0.322
Comparative Example 4	PET (highly elastic)	PTT+PBT	0.0152	0.84	2	C	3	3	0.441	0.279
Comparative Example 5	PET (highly elastic)	PTT	0.0160	0.89	2	C	3	3	0.390	0.196
Comparative Example 6	PET (highly elastic)	PBT	0.0170	0.94	2	C	3	3	0.431	0.240
Comparative Example 7	PET (highly elastic)	PTT+PBT	0.0160	0.89	2	C	3	3	0.349	0.222
Animal hair	Goat hair (Sokouhou)		0.0180	-	-	-	1	1	0.560	0.280

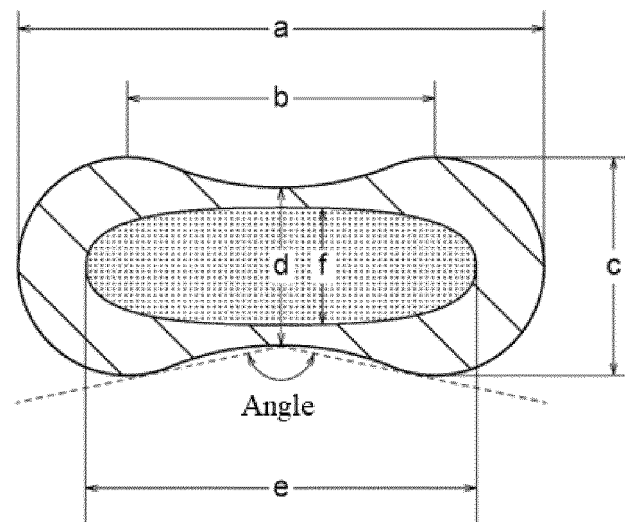
Industrial Field of Application

[0090] The makeup brush bristle material proposed by the present invention has three unique three-dimensional shapes including twists, i.e., S-twists and Z-twists, a specific cocoon-shaped cross-section, and a core-sheath structure. Adopting a two-layer structure consisting of a core part and a sheath part, each made of a different material, it provides a good balance of softness and resilience while offering the levels of both softness and elasticity that create excellent feel on the skin, and this makes it equally excellent or even superior to makeup brushes using natural animal hair. Additionally, when combined, the three unique three-dimensional shapes demonstrate effects greater than the sum of their individual effects and achieve uptake and release properties with respect to powder or liquid cosmetics that are superior to natural animal hair. Furthermore, by having a narrow tip part having a tapered shape, the makeup brush bristle material proposed by the present invention offers a feel, elasticity, and softness comparable to natural animal hair.

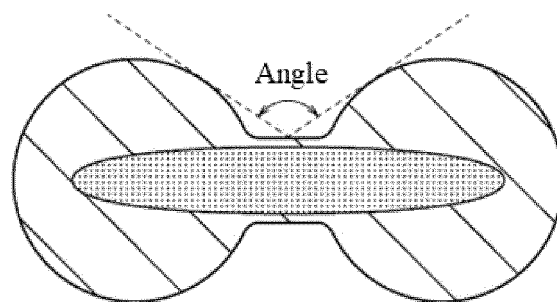
Claims

1. A makeup brush bristle material comprising S-twisted or Z-twisted core-sheath complex monofilaments whose core part is constituted by synthetic resin A and sheath part is constituted by synthetic resin B that differs in type from synthetic resin A, **characterized in that** a cross-section of the core-sheath complex monofilaments in a direction orthogonal to an axis of fiber has a cocoon shape.
2. The makeup brush bristle material according to claim 1, **characterized in that** the core-sheath complex monofilament has a narrow tip part having a tapered shape.
3. The makeup brush bristle material according to claim 2, **characterized in that** the narrow tip part having a tapered shape is branched.
4. The makeup brush bristle material according to any one of claims 1 to 3, **characterized in that** the synthetic resin A and the synthetic resin B are each a polyester-based resin.
5. The makeup brush bristle material according to claim 4, **characterized in that** the synthetic resin A and the synthetic resin B are each one type selected from polytrimethylene terephthalate, polyethylene terephthalate, and polybutylene terephthalate.
6. A makeup brush bristle material assembly comprising a mixed assembly of S-twisted and Z-twisted core-sheath complex monofilaments whose core part is constituted by synthetic resin A and sheath part is constituted by synthetic resin B that differs in type from synthetic resin A, **characterized in that** cross-sections of the core-sheath complex monofilaments in a direction orthogonal to an axis of fiber each have a similar cocoon shape.
7. A makeup brush **characterized by** using, at least partially, the makeup brush bristle material according to any one of claims 1 to 5 or the makeup brush bristle material assembly according to claim 6.

[FIG. 1]

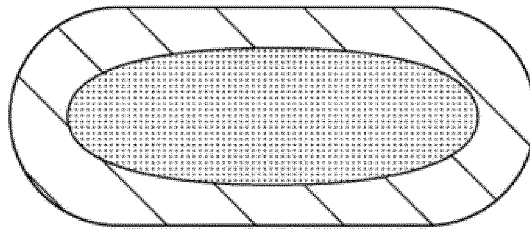


[FIG. 2]

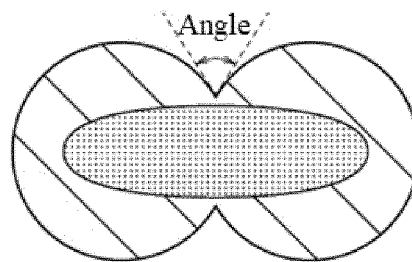


[FIG. 3]

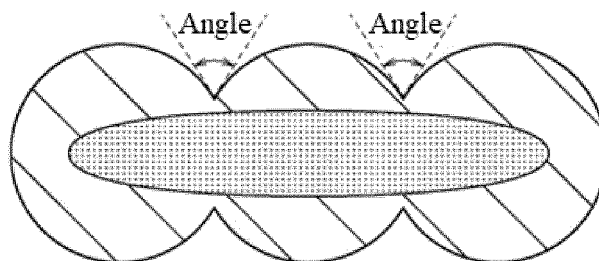
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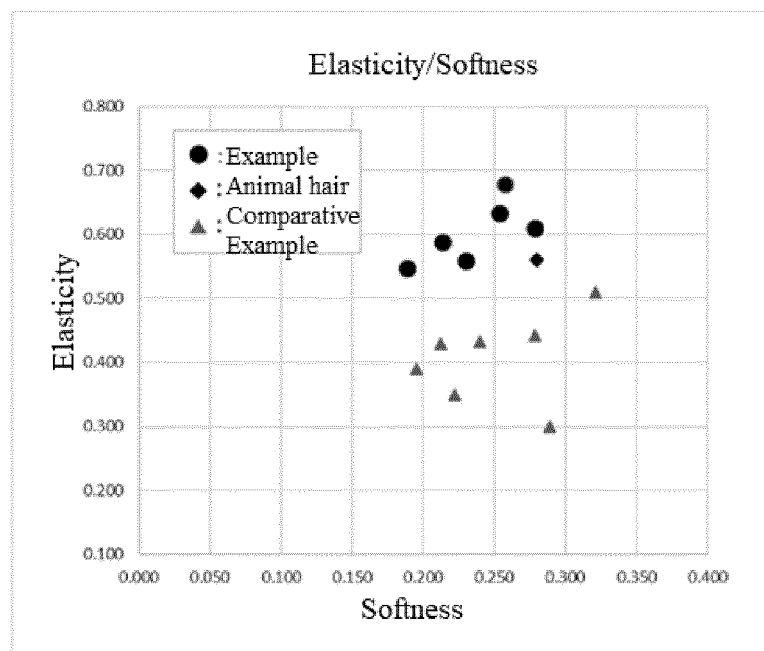


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INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2021/025894

A. CLASSIFICATION OF SUBJECT MATTER

A45D 34/04 (2006.01) i; A46D 1/00 (2006.01) i; A46D 1/05 (2006.01) i; D01F 8/04 (2006.01) i; D01F 8/14 (2006.01) i

FI: A46D1/00 101; D01F8/04 Z; D01F8/14 B; A46D1/05; A45D34/04 510B

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)

A45D34/04; A46D1/00; A46D1/05; D01F8/04; D01F8/14

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.
Y	WO 2019/111868 A1 (TAIKI CO., LTD.) 13 June 2019 (2019-06-13) paragraphs [0001], [0010]-[0033], fig. 1-7	1-7
Y	JP 57-133220 A (ASAHI KASEI INDUSTRY CO., LTD.) 17 August 1982 (1982-08-17) specification, pp. 1-6	1-7
A	JP 2010-194149 A (TORAY MONOFILAMENT CO., LTD.) 09 September 2010 (2010-09-09) entire text, all drawings	1-7
A	WO 2019/124440 A1 (MITSUBISHI PENCIL CO., LTD.) 27 June 2019 (2019-06-27) entire text, all drawings	1-7



Further documents are listed in the continuation of Box C.



See patent family annex.

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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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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
27 July 2021 (27.07.2021)Date of mailing of the international search report
03 August 2021 (03.08.2021)Name and mailing address of the ISA/
Japan Patent Office
3-4-3, Kasumigaseki, Chiyoda-ku,
Tokyo 100-8915, Japan

Authorized officer

Telephone No.

Form PCT/ISA/210 (second sheet) (January 2015)

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.

PCT/JP2021/025894

Patent Documents referred in the Report	Publication Date	Patent Family	Publication Date
WO 2019/111868 A1	13 Jun. 2019	KR 10-2020-0083579 A CN 111447858 A	
JP 57-133220 A	17 Aug. 1982	(Family: none)	
JP 2010-194149 A	09 Sep. 2010	(Family: none)	
WO 2019/124440 A1	27 Jun. 2019	(Family: none)	

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 2003245133 A [0005]
- JP 2009201794 A [0005]