

DESCRIPTION

TITLE OF INVENTION

ARTIFICIAL HAIR FIBER, AND HAIR ACCESSORY

TECHNICAL FIELD

[0001]

The present invention relates to an artificial hair fiber and a hair accessory.

BACKGROUND

[0002]

Artificial hair fibers (fibers used in artificial hair) can be used in a hair accessory. There have been investigations into obtaining an artificial hair fiber which has an appearance, etc., equivalent to human hair (for example, Patent Document 1 listed below).

CITATION LIST

PATENT LITERATURE

[0003]

Patent Document 1: JP 2001-131824 A

SUMMARY OF INVENTION

TECHNICAL PROBLEM

[0004]

After interweaving artificial hair fibers to obtain an interwoven structure, the appearance of the interwoven structure can be arranged by arranging the orientations of the fibers by bringing the interwoven structure into contact with hot water. In that case, although it is possible to use hot water with a high temperature of 95°C, etc., when the temperature of the hot water decreases over time, it can be difficult to arrange the appearance of the interwoven structure by continuing to use the hot water. Due thereto, it is desirable that the appearance of the interwoven structure can be sufficiently arranged even when the temperature of the hot water decreases over time and, for example, hot water of 75°C is used.

[0005]

One aspect of the present invention has an objective of providing an artificial hair fiber which enables the appearance of an interwoven structure of the artificial hair

fibers to be sufficiently arranged when the interwoven structure is brought into contact with hot water of 75°C. Another aspect of the present invention has an objective of providing a hair accessory that includes such an artificial hair fiber.

SOLUTION TO PROBLEM

[0006]

The present invention, in several aspects thereof, relates to [1] to [4], etc., described below.

[1] An artificial hair fiber having a $\tan \delta$ peak of 88°C or less in a dynamic viscoelastic measurement with a frequency of 1 Hz in water.

[2] The artificial hair fiber described in [1], wherein the temperature of the $\tan \delta$ peak is 50-88°C.

[3] The artificial hair fiber described in [1] or [2], wherein the artificial hair fiber contains a vinyl chloride-based polymer.

[4] A hair accessory including the artificial hair fiber described in any one of [1] to [3].

EFFECTS OF INVENTION

[0007]

According to one aspect of the present invention, it is possible to provide an artificial hair fiber which enables the appearance of an interwoven structure of the artificial hair fibers to be sufficiently arranged when the interwoven structure is brought into contact with hot water of 75°C. According to another aspect of the present invention, it is possible to provide a hair accessory that includes such an artificial hair fiber.

DESCRIPTION OF EMBODIMENTS

[0008]

Hereinafter, an embodiment of the present invention will be described in detail.

[0009]

“A or more” in a numerical value range indicates a range of A and more than A. “A or less” in a numerical value range indicates a range of A and less than A. For numerical value ranges described in stages herein, an upper limit value or a lower limit value of a numerical value range of one stage may be arbitrarily combined with an upper limit value or a lower limit value of a numerical value range of another stage. For numerical value ranges described herein, an upper limit value or a lower limit value of a numerical range may be substituted by a value shown in an example. “A or B” indicates that either A or B may be included and also that both may be included. In the absence of any particular restrictions, materials provided as examples herein may be used alone or in combinations of two or more. In the

absence of any particular restrictions, when there are a plurality of substances corresponding to components in a composition, the content of each component in the composition indicates the total amount of the plurality of substances that are present in the composition. The term “step” refers not only to an independent step but also includes a case in which a desired action of a step is achieved even if it is not possible to clearly distinguish from another step. “(Meth)acrylic acid” indicates at least one of acrylic acid and a methacrylic acid corresponding thereto. The same also applies with respect to other similar expressions such as “(meth)acrylate”, etc.

[0010]

An artificial hair fiber according to the present embodiment has a $\tan \delta$ peak (loss tangent peak) of 88°C or less in a dynamic viscoelastic measurement with a frequency of 1 Hz in water. The artificial hair fiber according to the present embodiment can be used as artificial hair (for example, an artificial hair substrate fiber) and can also be used in order to obtain artificial hair. The artificial hair fiber according to the present embodiment may be a fiber that has undergone a stretching treatment or may be an unstretched fiber.

[0011]

An interwoven structure (interwoven body; woven body) according to the present embodiment is an interwoven structure of artificial hair fibers according to the present embodiment and can be obtained by interweaving artificial hair fibers according to the present embodiment. Examples of the interwoven structure according to the present embodiment include, without any particular limitation, a two-fiber weave, a three-fiber weave, a four-fiber weave, a five-fiber weave, a six-fiber weave, and an eight-fiber weave, etc.

[0012]

The present inventors discovered that by using, as an indicator, a $\tan \delta$ peak temperature of an artificial hair fiber obtained by means of a dynamic viscoelasticity measurement in water, it is possible to adjust the appearance of an interwoven structure of the artificial hair fibers when the interwoven structure is brought into contact with hot water. According to the artificial hair fiber according to the present embodiment, when an interwoven structure of the artificial hair fibers (for example a fiber bundle of the artificial hair fibers) is brought into contact with hot water of 75°C, it is possible to sufficiently arrange the appearance of the interwoven structure, for example, it is possible to sufficiently arrange (obtain excellent shape cohesion in) the appearance of the interwoven structure by arranging the orientation of the fibers by bringing protruding fibers into contact with hot water. For example, according to the artificial hair fiber of the present embodiment, in the evaluation described in the examples later, by using hot water of 75°C, it is possible to obtain a state in which fibers protruding from a three-fiber weave before a treatment are aligned along the interweaving direction of the three-fiber weave after the treatment (state in which the orientations of the fibers are arranged by the treatment).

[0013]

Regarding the reason that the appearance of the interwoven structure can be sufficiently arranged when brought into contact with hot water of 75°C, the present inventors infer the following. That is, the $\tan \delta$ peak temperature of the artificial hair fiber obtained by means of a dynamic viscoelasticity measurement in water is correlated with the ease at which the artificial hair fiber softens when brought into contact with hot water. When such a $\tan \delta$ peak temperature is low, the fiber easily softens in hot water and the orientation of the fiber is easily adjusted. Due thereto, the appearance of the interwoven structure can be sufficiently arranged when brought into contact with hot water of 75°C. However, reasons that it is possible to sufficiently arrange the appearance of the interwoven structure are not limited to the foregoing.

[0014]

With the artificial hair fiber according to the present embodiment, the appearance of the interwoven structure should be sufficiently arranged when hot water of 75°C is used. Further, the appearance of the interwoven structure may be arranged by using hot water of a different temperature in accordance with an application. According to one aspect of the artificial hair fiber according to the present invention, it is possible to sufficiently arrange the appearance of an interwoven structure of the artificial hair fibers when the interwoven structure is brought into contact with hot water of 95°C.

[0015]

From the perspective of sufficiently arranging the appearance of the interwoven structure when brought into contact with hot water of 75°C, the artificial hair fiber according to the present embodiment has a $\tan \delta$ peak (hereinafter sometimes referred to as a “peak P”) of 88°C or less in a dynamic viscoelastic measurement with a frequency of 1 Hz in water. When a plurality of $\tan \delta$ peaks are confirmed in a temperature range of 88°C or less, it is possible to use, as a temperature of a peak P, a peak temperature having the largest $\tan \delta$. The peak P may be a peak derived from a monomeric unit of vinyl chloride in a vinyl chloride-based polymer. The temperature of the peak P can be measured under conditions described in the examples, and a dynamic viscoelastic measurement can be carried out in a measurement temperature range of 25-96°C at a temperature increase rate of 1°C/min. The temperature of the peak P can be adjusted by the types of components contained in the artificial hair fiber and the contents thereof, etc. For example, it is possible to adjust the temperature of the peak P by the type, content, etc., of a plasticizer.

[0016]

From the perspective that it is easy to arrange the appearance of the interwoven structure when brought into contact with hot water (for example, hot water of 75°C), the temperature (peak temperature) of the peak P may be 87°C or less, 86°C or less, 85°C or less, 83°C or less, 80°C or less, 78°C or less, 77°C or less, 75°C or less, 70°C or less, 65°C or less, 60°C or less, 55°C or less, or 54°C or less. From the perspective that it is easy to obtain an artificial hair fiber having an excellent tactile sensation, the temperature of the peak P may be 40°C or more, 45°C or more, 50°C or more, 54°C or more, 55°C or more, 60°C or more, 65°C or more,

70°C or more, 75°C or more, 77°C or more, 78°C or more, 80°C or more, 83°C or more, 85°C or more, or 86°C or more. From the foregoing perspectives, the temperature of the peak P may be 40-88°C, 40-80°C, 40-70°C, 40-60°C, 50-88°C, 50-80°C, 50-70°C, 50-60°C, 60-88°C, 60-80°C, 70-88°C, or 70-80°C.

[0017]

The artificial hair fiber according to the present embodiment may contain a polymer. The polymer may be a resin material. Examples of the polymer include vinyl chloride-based polymers, polyester-based polymers, polyamide-based polymers, polyolefin-based polymers, vinyl acetate-based polymers (ethylene-vinyl acetate copolymers (EVA), etc.), acrylonitrile-based polymers (acrylonitrile-butadiene rubber (NBR), acrylonitrile-butadiene-styrene (ABS) polymers, acrylonitrile-styrene (AS) copolymers, etc.), thermoplastic polyurethane (TPU), polyester-based thermoplastic elastomers (TPEE), methyl methacrylate-butadiene-styrene (MBS) polymers, and polymethyl methacrylate (PMMA), etc. In a case in which a polymer that may correspond to a polymer other than a vinyl chloride-based polymer has a vinyl chloride monomeric unit, said polymer is defined as corresponding to a vinyl chloride-based polymer. One polymer may be used alone or two or more polymers may be used in combination. For example, a vinyl chloride-based polymer and an acrylonitrile-styrene (AS) copolymer may be used in combination.

[0018]

From the perspective that it is easy to arrange the appearance of an interwoven structure when brought into contact with hot water (for example, hot water of 75°C), the artificial hair fiber according to the present invention may contain a vinyl chloride-based polymer. A vinyl chloride-based polymer is a polymer having vinyl chloride as a monomeric unit (polymer having a vinyl chloride monomeric unit). The vinyl chloride-based polymer can be obtained by bulk polymerization, solution polymerization, suspension polymerization, or emulsion polymerization, etc.

[0019]

Examples of a vinyl chloride-based polymer include a vinyl chloride homopolymer (polyvinyl chloride) and a copolymer of vinyl chloride and another monomer. A mixture of the foregoing may also be used. Examples of a copolymer of vinyl chloride and another monomer include: a copolymer of vinyl chloride and a vinyl ester (vinyl chloride-vinyl acetate copolymer, vinyl chloride-vinyl propionate copolymer, etc.); a copolymer of vinyl chloride and a (meth)acrylic acid compound ((meth)acrylic acid, (meth)acrylic acid ester, etc.) (vinyl chloride-butyl acrylate copolymer, vinyl chloride-2-ethylhexyl acrylate copolymer, etc.); a copolymer of vinyl chloride and a polyfunctional monomer described later; a copolymer of vinyl chloride and an olefin (vinyl chloride-ethylene copolymer, vinyl chloride-propylene copolymer, etc.); and a vinyl chloride-acrylonitrile copolymer, etc. The vinyl chloride-based polymer does not have to have a (meth)acrylic acid compound monomeric unit.

[0020]

The vinyl chloride-based polymer may include a cross-linked vinyl chloride-based

resin, and from the perspective that it is easy to arrange the appearance of the interwoven structure when brought into contact with hot water (for example, hot water of 75°C), may include a non-cross-linked vinyl chloride-based resin. The term “cross-linked” in “cross-linked vinyl chloride-based resin” means having a branch point in a polymeric chain (for example, a branch point at which a carbon chain of a side chain branches from a carbon chain of a main chain) and indicates a non-linear chain. The term “non-cross-linked” in “non-cross-linked vinyl chloride-based resin” means not having a branch point in the polymeric chain (for example, a branch point at which a carbon chain of a side chain branches from a carbon chain of the main chain) and indicates a linear chain.

[0021]

The cross-linked vinyl chloride-based resin can be obtained by adding, during polymerization of the vinyl chloride, a polyfunctional monomer and polymerizing. Examples of a polyfunctional monomer include di(meth)acrylate compounds such as polyethylene glycol di(meth)acrylate and modified bisphenol A di(meth)acrylate, etc. The cross-linked vinyl chloride-based resin may be a mixture of: a gel component having a cross-linked structure and having, as a main component, a vinyl chloride monomeric unit; and polyvinyl chloride component (component including a vinyl chloride monomeric unit). The gel component tends to be insoluble in tetrahydrofuran, and the polyvinyl chloride component tends to be soluble in tetrahydrofuran.

[0022]

From the perspective that it is easy to arrange the appearance of the interwoven structure when brought into contact with hot water (for example, hot water of 75°C), the content of the non-cross-linked vinyl chloride-based resin in the vinyl chloride-based polymer may be 50 mass% or more, over 50 mass%, 70 mass% or more, 90 mass% or more, 95 mass% or more, 98 mass% or more, or 99 mass% or more based on the total mass of the vinyl chloride-based polymer. There may also be an aspect in which the vinyl chloride-based polymer substantially consists only of a non-cross-linked vinyl chloride-based resin (substantially 100 mass% of the vinyl chloride-based polymer is a non-cross-linked vinyl chloride-based resin).

[0023]

From the perspective that it is easy to arrange the appearance of the interwoven structure when brought into contact with hot water (for example, hot water of 75°C), the polymer may include a non-cross-linked vinyl chloride-based resin having a viscosity-average degree of polymerization described below. The viscosity-average degree of polymerization may be 100 or more, 300 or more, 400 or more, 500 or more, 600 or more, 700 or more, 800 or more, 900 or more, or 1000 or more. The viscosity-average degree of polymerization may be 3000 or less, 2500 or less, 2000 or less, 1500 or less, 1200 or less, or 1000 or less. From the foregoing perspectives, the viscosity-average degree of polymerization may be 100-3000, 100-2000, 100-1500, 500-3000, 500-2000, 500-1500, 800-3000, 800-2000, or 800-1500. The viscosity-average degree of polymerization can be calculated according to JIS K 6721 by measuring, using an Ubbelohde viscometer in a constant temperature tank

at 30°C, the specific viscosity of a solution obtained by dissolving 200 mg of a non-cross-linked vinyl chloride-based resin in 50 mL of nitrobenzene.

[0024]

From the perspective that it is easy to arrange the appearance of the interwoven structure when brought into contact with hot water (for example, hot water of 75°C), the content of the vinyl chloride-based resin in the polymer may be 50 mass% or more, over 50 mass%, 70 mass% or more, 90 mass% or more, 95 mass% or more, 98 mass% or more, or 99 mass% or more based on the total mass of the polymer. There may also be an aspect in which the polymer substantially consists only of a vinyl chloride-based polymer (substantially 100 mass% of the polymer is a vinyl chloride-based polymer).

[0025]

The polymer may include a mixture of a vinyl chloride-based polymer and a component capable of forming a polymer alloy with the vinyl chloride-based polymer. Examples of a component capable of forming a polymer alloy with the vinyl chloride-based polymer include an ethylene-vinyl acetate (EVA) copolymer, acrylonitrile-butadiene rubber (NBR), a thermoplastic polyurethane (TPU), a polyester-based thermoplastic elastomer (TPEE), a methyl methacrylate-butadiene-styrene (MBS) polymer, an acrylonitrile-butadiene-styrene (ABS) polymer, an acrylonitrile-styrene (AS) copolymer, and polymethyl methacrylate (PMMA), etc.

[0026]

Examples of a polyester-based polymer include polyethylene terephthalate, polybutylene terephthalate, polyethylene-2,6-naphthalate, polymethylene terephthalate, and glycol-modified polyethylene terephthalate, etc.

[0027]

Examples of a polyamide-based polymer include nylon 6, nylon 66, nylon 11, nylon 12, nylon 6/10, and nylon 6/12, etc.

[0028]

Examples of a polyolefin-based polymer include polyethylene and polypropylene, etc.

[0029]

A content A as a content of the polymer or a content of the vinyl chloride-based polymer, based on the total mass of the artificial hair fiber, may be in the ranges described below. From the perspective that it is easy to obtain an artificial hair fiber having an excellent tactile sensation, the content A may be 50 mass% or more, over 50 mass%, 55 mass% or more, 60 mass% or more, 65 mass% or more, 70 mass% or more, 72 mass% or more, 75 mass% or more, 78 mass% or more, 80 mass% or more, 82 mass% or more, 85 mass% or more, or 88 mass% or more. From the perspective that it is easy to arrange the appearance of the interwoven structure

when brought into contact with hot water (for example, hot water of 75°C), the content A may be 90 mass% or less, 89 mass% or less, 88 mass% or less, 85 mass% or less, 82 mass% or less, 80 mass% or less, 78 mass% or less, or 75 mass% or less. From the foregoing perspectives, the content A may be 50-90 mass%, 50-85 mass%, 50-80 mass%, 50-75 mass%, 70-90 mass%, 70-85 mass%, 70-80 mass%, 70-75 mass%, 80-90 mass%, 80-85 mass%, or 85-90 mass%.

[0030]

The artificial hair fiber according to the present embodiment may contain a plasticizer. Examples of a plasticizer include an epoxy-based plasticizer, a phthalic acid-based plasticizer, an isophthalic acid-based plasticizer, a terephthalic acid-based plasticizer, an adipic acid-based plasticizer (excluding plasticizers corresponding to a polyester-based plasticizer), a polyester-based plasticizer, a phosphoric acid-based plasticizer, a trimellitic acid-based plasticizer, and a benzoic acid-based plasticizer, etc. Specific examples of a plasticizer include epoxydized soybean oil, epoxidized linseed oil, diisononyl phthalate (DINP), diheptyl phthalate (DHP), di-2-ethylhexyl phthalate (DOP), di-n-octyl phthalate (n-DOP), diisodecyl phthalate (DIDP), phthalic acid-propylene glycol-based polyesters, benzyl butyl phthalate (BBP), di-2-ethylhexyl isophthalate (DOIP), di-2-ethylhexyl terephthalate (DOTP), diisononyl adipate (DINA), di-2-ethylhexyl adipate (DOA), diisodecyl adipate, benzyloctyl adipate (BOA), adipic acid-propylene glycol-based polyesters, adipic acid-butylene glycol-based polyesters, tricresyl phosphate (TCP), diphenyl cresyl phosphate (DPCP), tri-2-ethylhexyl trimellitate (TOTM), and oxydiethylene=dibenzoate, etc. One plasticizer may be used alone or two or more plasticizers may be combined and used. For example, epoxydized soybean oil and another plasticizer may be used in combination.

[0031]

From the perspective that it is easy to arrange the appearance of the interwoven structure when brought into contact with hot water (for example, hot water of 75°C), the plasticizer may include at least one selected from the group consisting of epoxy-based plasticizers, phthalic acid-based plasticizers, terephthalic acid-based plasticizers, adipic acid-based plasticizers, and polyester-based plasticizers, and may include at least one selected from the group consisting of epoxydized soybean oil, diisononyl phthalate, di-2-ethylhexyl terephthalate, and diisononyl adipate.

[0032]

The content of the plasticizer, based on the total mass of the artificial hair fiber, may be in the ranges described below. From the perspective that it is easy to arrange the appearance of the interwoven structure when brought into contact with hot water (for example, hot water of 75°C), the content of the plasticizer may be 2.0 mass% or more, 3.0 mass% or more, 4.0 mass% or more, 5.0 mass% or more, 6.0 mass% or more, 7.0 mass% or more, 8.0 mass% or more, 9.0 mass% or more, 10.0 mass% or more, 12.0 mass% or more, 15.0 mass% or more, 18.0 mass% or more, or 20.0 mass% or more. From the perspective that it is easy to obtain an artificial hair fiber having an excellent tactile sensation, the content of the plasticizer may be 30.0 mass% or less, 25.0 mass% or less, 20.0 mass% or less, 18.0 mass% or less, 15.0

mass% or less, 12.0 mass% or less, 10.0 mass% or less, 9.0 mass% or less, 8.0 mass% or less, 7.0 mass% or less, 6.0 mass% or less, or 5.0 mass% or less. From the foregoing perspectives, the content of the plasticizer may be 2.0-30.0 mass%, 2.0-20.0 mass%, 2.0-10.0 mass%, 2.0-6.0 mass%, 4.0-30.0 mass%, 4.0-20.0 mass%, 4.0-10.0 mass%, 4.0-6.0 mass%, 5.0-30.0 mass%, 5.0-20.0 mass%, 5.0-10.0 mass%, 10.0-30.0 mass%, or 15.0-30.0 mass%.

[0033]

The content of the plasticizer with respect to 100 parts by mass of the polymer or 100 parts by mass of the vinyl chloride-based polymer may be in the ranges described below. From the perspective that it is easy to arrange the appearance of the interwoven structure when brought into contact with hot water (for example, hot water of 75°C), the content of the plasticizer may be 2.0 parts by mass or more, 3.0 parts by mass or more, 4.0 parts by mass or more, 5.0 parts by mass or more, 6.0 parts by mass or more, 7.0 parts by mass or more, 8.0 parts by mass or more, 9.0 parts by mass or more, 10.0 parts by mass or more, 12.0 parts by mass or more, 15.0 parts by mass or more, 18.0 parts by mass or more, 20.0 parts by mass or more, 22.0 parts by mass or more, 25.0 mass% or more, 28.0 parts by mass or more, or 30.0 parts by mass or more. From the perspective that it is easy to obtain an artificial hair fiber having an excellent tactile sensation, the content of the plasticizer may be 50.0 parts by mass or less, 45.0 parts by mass or less, 40.0 parts by mass or less, 35.0 parts by mass or less, 30.0 parts by mass or less, 28.0 parts by mass or less, 25.0 parts by mass or less, 22.0 parts by mass or less, 20.0 parts by mass or less, 18.0 parts by mass or less, 15.0 parts by mass or less, 12.0 parts by mass or less, 10.0 parts by mass or less, 9.0 parts by mass or less, 8.0 parts by mass or less, 7.0 parts by mass or less, 6.0 parts by mass or less, or 5.0 parts by mass or less. From the foregoing perspectives, the content of the plasticizer may be 2.0-50.0 parts by mass, 2.0-30.0 parts by mass, 2.0-10.0 parts by mass, 2.0-8.0 parts by mass, 4.0-50.0 parts by mass, 4.0-30.0 parts by mass, 4.0-10.0 parts by mass, 4.0-8.0 parts by mass, 6.0-50.0 parts by mass, 6.0-30.0 parts by mass, 6.0-10.0 parts by mass, 10.0-50.0 parts by mass, or 20.0-50.0 parts by mass.

[0034]

The artificial hair fiber according to the present embodiment may contain a component that does not correspond to the above components (polymer, plasticizer, etc.). Examples of such a component include a thermal stabilizer, a lubricant, an anti-static agent, a flame retardant, a flame retardant promoter, an ultraviolet absorber, a photostabilizer, a fluorescence agent, and an anti-oxidant, etc.

[0035]

Examples of a thermal stabilizer include a Ca-Zn-based thermal stabilizer, a hydrotalcite-based stabilizer, a tin-based thermal stabilizer, and a β -diketone-based thermal stabilizer, etc.

[0036]

Examples of a Ca-Zn-based thermal stabilizer include zinc stearate, calcium

stearate, zinc 12-hydroxystearate, and calcium 12-hydroxystearate, etc.

[0037]

Examples of a hydrotalcite-based stabilizer include: a complex salt compound including magnesium and/or an alkali metal and aluminum or zinc; a complex salt compound including magnesium and aluminum; and a compound obtained by dehydrating the water of crystallization of said complex salt compounds, etc.

[0038]

Examples of a tin-based thermal stabilizer include: mercapto tin-based stabilizers such as dimethyltin mercapto, dimethyltin mercaptide, dibutyltin mercapto, dioctyltin mercapto, dioctyltin mercapto polymers, and dioctyltin mercapto acetate, etc.; maleate tin-based stabilizers such as dimethyltin maleate, dibutyltin maleate, dioctyltin maleate, and dioctyltin maleate polymers, etc.; and laurate tin-based stabilizers such as dimethyltin laurate, dibutyltin laurate, and dioctyltin laurate, etc.

[0039]

Examples of a β -diketone-based thermal stabilizer include stearyl benzoyl methane and dibenzoyl methane, etc.

[0040]

Examples of a lubricant include metal soap-based lubricants, higher fatty acid-based lubricants, ester-based lubricants, and higher alcohol-based lubricants, etc.

[0041]

For the metal soap-based lubricant, examples of a metal soap include stearates, laurates, palmitates, and oleates, etc., of Na, Mg, Al, Ca, and Ba, etc.

[0042]

Examples of a higher fatty acid-based lubricant include: saturated fatty acids such as stearic acid, palmitic acid, myristic acid, lauric acid, and capric acid etc.; unsaturated fatty acids such as oleic acid, etc.; and mixtures thereof, etc.

[0043]

Examples of an ester-based lubricant include: ester-based lubricants including an alcohol and a fatty acid; pentaerythritol-based lubricants such as monoesters, diesters, triesters, and tetraesters of pentaerythritol or dipentaerythritol and a higher fatty acid or mixtures thereof, etc.; and montanic acid wax-based lubricant such as esters of montanic acid and a higher alcohol (stearyl alcohol, palmityl alcohol, myristyl alcohol, lauryl alcohol, and oleyl alcohol, etc.).

[0044]

Examples of a higher alcohol-based lubricant include stearyl alcohol, palmityl

alcohol, myristyl alcohol, lauryl alcohol, and oleyl alcohol, etc.

[0045]

After undergoing a stretching treatment, the artificial hair fiber according to the present embodiment may have a single fiber fineness in the ranges described below. The single fiber fineness may be 20 decitex or more, 30 decitex or more, 40 decitex or more, or 50 decitex or more. The single fiber fineness may be 100 decitex or less, 90 decitex or less, 80 decitex or less, or 70 decitex or less. From the foregoing perspectives, the single fiber fineness may be 20-100 decitex.

[0046]

A method for producing the artificial hair fiber according to the present embodiment may include a spinning step for spinning a composition containing a component (polymer, plasticizer, etc.) to be contained in the artificial hair fiber. In the spinning step, it is possible to melt-spin (melt-deform) a composition containing a component (polymer, plasticizer, etc.) to be contained in the artificial hair fiber.

[0047]

The method for producing the artificial hair fiber according to the present embodiment may include, prior to the spinning step, a kneading step for melt-kneading a composition containing a component (polymer, plasticizer, etc.) to be contained in the artificial hair fiber. Various kinds of general kneading machines can be used as a device for performing melt-kneading. Examples of kneading machines include single screw extruders, twin screw extruders, rolls, Banbury mixers, and kneaders, etc.

[0048]

The method for producing the artificial hair fiber according to the present embodiment may include, after the spinning step, a stretching step for performing a stretching treatment on a thread (unstretched thread) obtained in the spinning step.

[0049]

From the perspective that it is easy for fiber strength to be manifested, the draw ratio in the stretching step may be 1.5 times or more or 2.0 times or more. From the perspective that there are unlikely to be occurrences of thread breakage during the stretching treatment, the draw ratio may be 5.0 times or less or 4.0 times or less. From the foregoing perspectives, the draw ratio may be 1.5-5.0 times.

[0050]

The stretching treatment may be carried out by using a two-step method in which after first being wound up on a bobbin, an unstretched thread is stretched in a step that is non-continuous with a spinning step. The stretching treatment may also be carried out by using a direct spinning-stretching method in which the unstretched thread is stretched in a step that is continuous with the spinning step without being wound up on a bobbin. The stretching treatment may be carried out by using a

single-stage stretching method in which stretching is performed once to achieve a target draw ratio. The stretching treatment may also be performed by using a multi-stage stretching method in which stretching is performed two times or more to achieve the target draw ratio.

[0051]

The temperature during the stretching treatment may be 80-120°C. When the temperature is 80°C or more, it is easy to sufficiently ensure fiber strength and there are unlikely to be occurrences of thread breakage. When the temperature is 120°C or less, it is easy to obtain good thread tactile sensation.

[0052]

The method for producing the artificial hair fiber according to the present embodiment may include, after the stretching step, a heat treatment step for heat treating (annealing) a thread (stretched thread) obtained in the stretching step. By performing a heat treatment step, it is possible to reduce the heat shrinkage rate of the stretched thread.

[0053]

The heat treatment temperature may be 100°C or more or 120°C or more. The heat treatment temperature may be 200°C or less or 150°C or less. From the foregoing perspectives, the heat treatment temperature may be 100-200°C. The heat treatment may be carried out in a successive manner immediately after the stretching treatment and may also be carried out some time after first winding up the stretched thread.

[0054]

The method for producing the artificial hair fiber according to the present embodiment may include a gear processing step for performing a gear processing treatment (diluent processing treatment) on the artificial hair fiber. The gear processing treatment is a treatment in which the fiber is crimped by being passed between two interlocking high temperature gears. The gear processing step may be carried out after the spinning step and may be carried out after the heat treatment step described above. There are no particular limitations regarding gear material, gear wave form, number of gear edges, etc., in the gear processing treatment.

[0055]

The method for producing the artificial hair fiber according to the present embodiment may include a hot water processing step for bringing the artificial hair fiber into contact with (for example, immersing in) hot water. The hot water processing step may be carried out after the spinning step, may be carried out after the heat treatment step described above, and may be carried out after the gear processing step described above. The temperature of the hot water may be 70-100°C, 75-100°C, 70-95°C, 75-95°C, 70°C or more and less than 95°C, 75°C or more and less than 95°C, 70-90°C, 75-90°C, 70-80°C, or 75-80°C.

[0056]

A hair accessory according to the present embodiment includes the artificial hair fiber of the present embodiment. The hair accessory according to the present embodiment is an article that can be detachably worn on the head. There may be an aspect in which the hair accessory according to the present embodiment includes the artificial hair fiber according to the present application (for example, a fiber bundle of the artificial hair fiber), and there may be an aspect in which the hair accessory according to the present embodiment includes the artificial hair fiber according to the present application and a member that is different from the artificial hair fiber. Examples of the hair accessory include a toupee, a wig, a hairpiece, a braid, an extension, and attachable hair, etc.

EXAMPLES

[0057]

Hereinafter, the present invention is explained in detail using examples, but the present invention is not limited to the examples below.

[0058]

<Fabrication of artificial hair fiber>

A vinyl chloride-based resin composition was obtained by mixing a polymer (product name: TH 1000, manufactured by Taiyo Vinyl Corporation; non-cross-linked vinyl chloride-based resin, vinyl chloride homopolymer, viscosity-average degree of polymerization: 1000), a plasticizer (product name: Epoxidized Soybean Oil/ESBO/ESBOD, manufactured by Chang Chun Petrochemical Co., Ltd.; epoxidized soybean oil), and an additive (thermal stabilizer, etc.) in a blender. Pellets were fabricated by compounding the vinyl chloride-based resin composition using an extruder with a diameter of 65 mm at a cylinder temperature of 130-170°C. The pellets were melt-spun with an extruder having a diameter of 40 mm to obtain fibers A. The cylinder temperature during the melt-spinning was 150-190°C. Fibers B having an average fineness of 140 decitex were obtained by heat treating the fibers A for 0.5-1.5 seconds using a heating cylinder disposed directly below a nozzle. 56-decitex artificial hair fibers were obtained by stretching the fibers B to 300% in a 100°C air atmosphere and then subjecting to heat shrinkage in a 120°C air atmosphere until the overall length of the fibers shrank to 80% of the length before the treatment. The contents of the polymer and the plasticizer based on the total mass of the artificial hair fiber are shown in Table 1. The content of the additive is the remainder when the contents of the polymer and the plasticizer are subtracted from the total mass of the artificial hair fiber.

[0059]

<Fabrication of fiber bundle>

The artificial hair fibers described above underwent a crimping process using a gear machine (NEW YAKI BRAID CRIMPING M/C-2.5 mm/SUNG JIN INDUSTRIAL CO.,

LTD.) under conditions of a gear pitch of 2.5 mm, preheating at 80°C, a gear roll temperature of 80°C, and a gear roll rotation speed of 1 m/min. Thereafter, the fibers were bundled to obtain a fiber bundle A having a length of 400 mm and a mass of 5.1 g.

[0060]

The artificial hair fibers described above underwent a crimping process using a gear machine (NEW YAKI BRAID CRIMPING M/C-2.5 mm/SUNG JIN INDUSTRIAL CO., LTD.) under conditions of a gear pitch of 2.5 mm, preheating at 90°C, a gear roll temperature of 90°C, and a gear roll rotation speed of 1 m/min. Thereafter, the fibers were bundled to obtain a fiber bundle B having a length of 600 mm and a mass of 120 g.

[0061]

<Tan δ peak temperature measurement>

Four artificial hair fibers were extracted from the fiber bundle A described above. Then, the four fibers were aligned and fixed in a tool in a state in which adjacent fibers were in contact with one another and thereafter the fibers were immersed in a container containing water. Next, a measuring device (product name: RSA-G2, manufactured by TA Instruments) was used to measure the dynamic viscoelasticity of the fibers in water and a peak temperature of the tan δ peak was obtained. The measurement conditions when using a water measuring unit of the measuring device were a temperature increase rate of 1°C/min., a chucking distance of 10 mm, a frequency of 1 Hz, a skew of 0.1%, a tensile mode, and a measurement temperature range of 25-96°C. The temperature of the water in the container was increased at a temperature increase rate of 1°C/min. in the measurement temperature range of 25-96°C. The peak temperature measurement results are shown in Table 1. In Examples 1-4 and Comparative Examples 1 and 2, there was one peak confirmed in the temperature range 25-96°C.

[0062]

<Appearance evaluation>

A three-fiber weave interwoven structure was fabricated using abovementioned fiber bundle A with a length of 400 mm and a mass of 5.1 g, and then the interwoven structure was immersed in water (hot water) of 95°C or 75°C for approximately 15 seconds. Next, after removing the interwoven structure from the water, the surface of the interwoven structure was wiped gently three times to wipe away the water. In addition, after drying naturally by leaving to stand at room temperature (25°C) for 24 hours or more, the appearance of the interwoven structure was observed visually. A case in which the three-fiber weave state was good was assessed as "A" and a case in which the three-fiber was poor was assessed as "B". A state in which fibers protruding from a three-fiber weave before a treatment are aligned along the interweaving direction of the three-fiber weave after the treatment (state in which the orientations of the fibers are arranged by the treatment) was assessed as being a good state. The results are shown in Table 1.

[0063]

<Tactile sensation>

The fiber bundle B described above was assessed as being one of two ranks, namely, “having a firm texture” and “lacking a firm texture”, by a handling feeling (firm texture felt when the fiber bundle B was touched by the palm so as to be compressed) of ten hair fiber treatment technicians (having at least five years practical experience). A case of being evaluated by nine people or more of having a firm texture was assessed as “A”, and a case of being evaluated by eight people or less of having a firm texture was assessed as “B”. The results are shown in Table 1.

[0064]

TABLE 1

		Comp Ex		Example			
		1	2	1	2	3	4
Content	Polymer	92.1	90.9	88.1	84.4	78.2	72.2
[mass%]	Plasticizer	0	1.4	4.4	8.4	15.1	21.7
Peak temperature [°C]		93	90	86	77	65	54
Appearance	95°C treatment	A	A	A	A	A	A
evaluation	75°C treatment	B	B	A	A	A	A
Tactile sensation		A	A	A	A	A	B

CLAIMS

1. An artificial hair fiber having a $\tan \delta$ peak of 88°C or less in a dynamic viscoelastic measurement with a frequency of 1 Hz in water.
2. The artificial hair fiber according to claim 1, wherein the temperature of the $\tan \delta$ peak is 50-88°C.
3. The artificial hair fiber according to claim 1, wherein the artificial hair fiber contains a vinyl chloride-based polymer.
4. A hair accessory comprising the artificial hair fiber according to any one of claims 1 to 3.