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(54) FIBER MADE OF ALLOY RESIN COMPOSITION OF POLYESTER

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(57) ABSTRACT

The present invention concerns a method of preparing a hybrid fiber including polyamide and polyester. Particularly, the method of preparing a hybrid fiber comprises, forming a blend by melting a) 4.99 to 95% by weight of a thermoplastic polyamide resin, b) 4.99 to 95% by weight of a thermoplastic polyester resin, and c) 0.01 to 10% by weight of an epoxy resin at 250 to 300° C., and blend spinning and elongating 10 to 90% by weight of the blend with 90 to 10% by weight of a polyester resin. The hybrid fiber shows highly improved compatibility of the polyamide resin and the thermoplastic polyester resin, and shows excellent strength and elongation.

FIBER MADE OF ALLOY RESIN COMPOSITION OF POLYESTER

TECHNICAL FIELD

[0001] The present invention concerns fibers, yarns, threads and/or textile article made of a composition comprising at least a polyamide resin, a polyester resin and an epoxy resin. The alloy resin composition of the present invention has improved compatibility between polyamide resin and thermoplastic polyester resin, and thus exhibits a good ability to be spun by classical ways of thermoplastic melt spinning. The present invention also concerns a process to produce said fibers.

BACKGROUND ART

[0002] The polyamide fiber is a synthetic fiber based on the polymer with amide bond. The polyamide fiber comprises the aliphatic polyamide such as nylon and the aromatic polyamide such as aramid. The polyamide fiber has the high property of the tenacity, heat-resistance, insulation, and chemical resistance.

[0003] The polyester fiber is a synthetic fiber based on the polymer with ester bond. The PET fiber consisting of polyethylene terephthalate is known as the representative polyester fibers. The polyester fiber has relatively high strength, low hygroscopicity, high chemical resistance and high heat-resistance. In particular it has elasticity due to high Young's modulus.

[0004] In recent, the new fiber material has been studied that has advantages of the poly ester and polyamide. By the way, a number of studies are known that the polyester and polyamide is melted separately and is combined at the spinning process. But, there is still no valid research regarding to the method for preparing the fiber by the melting and blending the polyester resin and polyamide resin because of the low compatibility of them.

[0005] U.S. Pat. No. 4,150,674 disclosed the production of compatible polymeric compositions and fibers from three-component blends of a polyamide, polyester and a terpolymer of lactam. Japanese Patent No. 2005-15705 disclosed that the alloy pellet with 1-50 nm of the mean dispersion diameter of the dispersion polymer is prepared. But this patent did not disclose the use of the compatibilizer.

[0006] Japanese Patent No. 2006-233375 disclosed that the compatibilizing agent is a compound having active hydrogen reactive groups chosen from glycidyl group, oxazoline group and carbodiimide group.

[0007] Despite these patents, the compatibilizing agent for the polyamide resin and the polyester resin is needed to provide the high compatability when melting blend of the polyamide resin and polyester resin is prepared.

[0008] The present inventors have found that a method of preparing a fiber, which includes forming a blend by melting a) 4.99 to 95% by weight of a thermoplastic polyamide resin, b) 4.99 to 95% by weight of a thermoplastic polyester resin and c) 0.01 to 10% by weight of an epoxy resin at 250 to 300° C., and blend spinning and elongating 5 to 95% by weight of the blend with 95 to 5% by weight of a polyester resin, shows highly improved physical properties and compatibility of the fiber. Therefore, the present invention has been completed based on the above facts.

DISCLOSURE OF INVENTION

Technical Problem

[0009] The objective of the present invention is to provide an alloy composition of polyamide resin and polyester resin having improved compatibility and a good ability to be spun with conventional process classically used for thermoplastic polymers; while such a polyamide polyester alloy cannot be spun according to the prior art.

Solution to Problem

[0010] The present invention concerns a method of preparing a fiber including a) forming a blend by melting a) a thermoplastic polyamide resin, b) a thermoplastic polyester resin and c) an epoxy resin at 250 to 300° C., and b) blend spinning and elongating 5 to 95% by weight of the blend and 95 to 5% by weight of a polyester resin.

[0011] According to the preferred embodiment of the present invention, the epoxy resin is one or more members selected from the group consisting of DGEBA (diglycidyl ether of bisphenol A) type epoxy resin, DGEBF (diglycidyl ether of bisphenol F) type epoxy resin, hydrogenated BPA (hydrogenated bisphenol A) type epoxy resin, brominated epoxy resin, cycloaliphatic epoxy resin, rubber modified epoxy resin, aliphatic polyglycidyl type epoxy resin, and glycidyl amine type epoxy resin.

[0012] According to the preferred embodiment of the present invention, epoxy equivalent weight of said epoxy resin is from 2,100 to 6,000 g/eq.

[0013] According to the preferred embodiment of the present invention, the composition comprises from 0.05 to 7% by weight of said epoxy resin.

[0014] According to the preferred embodiment of the present invention, the polyamide resin is one or more members selected from the group consisting of polyamide-6, polyamide-66, polyamide-610, polyamide-11, polyamide-12, polyterephthalamide, polyisophthalamide, polyaramide, and a copolymer thereof.

[0015] According to the preferred embodiment of the present invention, said polyester resin is one or more members selected from the group consisting of polybutylene terephthalate, polybutylene (terephthalate/isophthalate), polybutylene (terephthalate/adipate), polybutylene (terephthalate/sebacate), polybutylene (terephthalate/decanedicarboxylate), polybutylene naphthalate, polyethylene terephthalate, polyethylene (terephthalate/isophthalate), polyethylene (terephthalate/adipate), polyethylene (terephthalate/5-sodiumsulfoisophthalate), polybutylene (terephthalate/5-sodiumsulfoisophthalate), polypropylene terephthalate, polyethylene naphthalate and polycyclohexanedimethylene terephthalate.

[0016] According to the preferred embodiment of the present invention, The present invention concerns synthetic fibers comprising at least a) 4.99 to 95% by weight of a polyamide resin, b) 4.99 to 95% by weight of a polyester resin, and c) 0.01 to 10% by weight of an epoxy resin.

Advantageous Effects of Invention

[0017] An alloy resin composition with remarkably improved compatibility can be obtained by using a specific epoxy resin at an alloy of polyamide resin and polyester resin well known to have no compatibility. The alloy resin with improved compatibility can present excellent properties such as mechanical properties and ability to be spun with classical process used for thermoplastic polymers.

MODE FOR THE INVENTION

[0018] The present invention concerns a method of preparing a fiber including i) forming a blend by melting a) a thermoplastic polyamide resin, b) a thermoplastic polyester resin and c) an epoxy resin at 250 to 300° C., and ii) blend spinning and elongating 5 to 95% by weight of the blend and 95 to 5% by weight of a polyester resin. Hereinafter, respective resins used for preparation of the fiber will be described.

[0019] (a) Polyamide Resin

[0020] In one embodiment, the polyamide resin included in the composition of the present invention may be any thermoplastic polyamide resin. Examples of the polyamide resin may include polyamide-6 obtainable as ring-opening polymerization products of lactams such as ϵ-caprolactam and ω-dodecalactam; polyamide polymers obtainable from such amino acids as aminocaproic acid, 11-aminoundecanoic acid, and 12-aminododecanoic acid; aliphatic, cycloaliphatic or aromatic diamines such as ethylenediamine, tetramethylenediamine, hexamethylenediamine, undecamethylenediamine, dodecamethylenediamine, 2,2,4-trimethylhexamethylenediamine, 2,4,4-trimethylhexamethylenediamine, 5-methylnonahexamethylenediamine, m-xylenediamine, p-xylenediamine, 1,3-bis-aminomethylcyclohexane, 1,4-bisaminomethylcyclohexane, 1-amino-3-aminomethyl-3,5,5-trimethylcyclohexane, bis(4-aminocyclohexane)methane, bis(4-methyl-4-aminocyclohexyl)methane, 2,2-bis(4-aminocyclohexyl)propane, bis(aminopropyl)piperazine, aminoethylpiperidine, etc.; polyamide polymers obtainable from such aliphatic, cycloaliphatic or aromatic dicarboxylic acids as adipic acid, sebacic acid, azelaic acid, dodecanedioic acid, terephthalic acid, isophthalic acid, 2-chloroterephthalic acid, 2-methylterephthalic acid, and 5-methylisophthalic acid; and copolymers of the polyamide resins, and these may be employed singly or in a combination of two or more kinds.

[0021] In some embodiments, examples of the polyamide resin may include polyamide-6, polyamide-66, polyamide-610, polyamide-11, polyamide-12, terephthalic acid or isophthalic acid polyamide, aliphatic or aromatic polyamide, a copolymer thereof, and a mixture thereof; and these may be employed singly or in a combination of two or more kinds. The general structural formulae of some of these resins are represented as follows:

[0022] <Polyamide-6>

[0023] $—[—HN—(CH_2)_5—CO—]—$

[0024] <Polyamide-66>

[0025] $—[—HN—(CH_2)_6—NHCO—(CH_2)_4CO—]—$

[0026] <Polyamide-66/6>

[0027] $—[—HN—(CH_2)_6—NHCO—(CH_2)_4CONH—(CH_2)_5—CO—]—$

[0028] In one embodiment, the relative viscosity of the polyamide resin may range from 2.0 to 3.7 (a solution of 1 g of polymer in 100 ml of 90% formic acid, measured at 25° C.). In another embodiment, the number average molecular weight of the polyamide resin may be about from 5,000 to 70,000.

[0029] Polyamide resin is preferably chosen as one or more members selected from the group consisting of polyamide-6, polyamide-66, polyamide-610, polyamide-11, polyamide-12, polyterephthalamide, polyisophthalamide, polyaramide, and a copolymer thereof.

[0030] The content of the polyamide resin may be between 4.99 and 95% by weight, based on the total weight of the composition.

[0031] (b) Polyester Resin

[0032] In one embodiment, the polyester resin which is included in the composition of the present invention may be a polymer compound having ester bonds in its backbone. Examples of the polyester resin may include a homopolymer or copolymer obtainable by a condensation of dicarboxylic acid (or its ester-formable derivatives) with diol (or its ester-formable derivatives), or a mixture thereof.

[0033] In one embodiment, examples of the dicarboxylic acid may include aromatic dicarboxylic acid such as terephthalic acid, isophthalic acid, phthalic acid, 1,4-, 1,5-, 2,6- or 2,7-naphthalene dicarboxylic acid, bis(p-carboxyphenyl) methane, anthracene dicarboxylic acid, 4,4'-diphenyl ether dicarboxylic acid, 5-sodiumsulfoisophthalic acid, etc.; aliphatic dicarboxylic acid such as adipic acid, sebacic acid, azelaic acid, dodecanedioic acid, etc.; cycloaliphatic dicarboxylic acid such as 1,3-cyclohexane dicarboxylic acid, 1,4-cyclohexane dicarboxylic acid, etc.; and their ester-formable derivatives, but are notlimited thereto. In some embodiments, said dicarboxylic acid may be employed in the form of its ester-formable derivative such as a derivative substituted by alkyl, alkoxy, or halogen, etc. and an ester obtained from a lower alcohol, e.g., dimethyl ester.

[0034] In another embodiment, examples of said diol may include aliphatic glycol having 2~20 carbon atoms such as ethylene glycol, propylene glycol, 1,4-butanediol, neopentyl glycol, 1,5-pentanediol, 1,6-hexanediol, decamethylene glycol, cyclohexanedimethanol, cyclohexanediol, etc.; long chain glycol having molecular weight of from 400 to 6,000 such as polyethylene glycol, poly-1,3-propylene glycol, polytetramethylene glycol, etc.; and their ester-formable derivatives, but are not limited thereto. In some embodiments, said diols may be employed in the form of their ester-formable derivatives such as a derivative substituted by alkyl, alkoxy, or halogen, etc.

[0035] In some embodiment, examples of the homopolymer or copolymer thereof may include polybutylene terephthalate, polybutylene (terephthalate/isophthalate), polybutylene (terephthalate/adipate), polybutylene (terephthalate/sebacate), polybutylene (terephthalate/decanedicarboxylate), polybutylene naphthalate, polyethylene terephthalate, polyethylene (terephthalate/isophthalate), polyethylene (terephthalate/adipate), polyethylene (terephthalate/5-sodiumsulfoisophthalate), polybutylene (terephthalate/5-sodiumsulfoisophthalate), polypropylene terephthalate, polyethylene naphthalate, polycyclohexanedimethylene terephthalate, but are not limited thereto.

[0036] In another embodiment, examples of the polyester resin other than the above compounds may include a polyester resin copolymerized with a copolymerizable monomer, e.g., a hydroxy carboxylic acid such as glycolic acid, hydroxybenzoic acid, hydroxyphenylacetic acid, naphthylglycolic acid, etc.; and a lactone compound such as propiolactone, butyrolactone, caprolactone, valerolactone, etc. In still other embodiments, examples of the polyester resin may include a polyester resin derived from multifunctional ester forming compounds such as trimethylolpropane, trimethyllolethane, pentaerythritol, trimellitic acid, trimesic acid, pyromellitic acid, or a polyester resin having a branched or crosslinked structure in an amount to the extent that the polyester resin maintains the rmoplasticity.

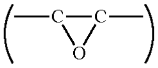
[0037] Polyester resin may be a recycled one as known with usual process to recycle such thermoplastic resins. Recycled polyesters may be issued from bottles, textile industry, films, containers and other fabrics.

[0038] Polyester resin is preferably chosen as one or more members selected from the group consisting of polybutylene terephthalate, polybutylene (terephthalate/isophthalate), polybutylene (terephthalate/adipate), polybutylene (terephthalate/sebacate), polybutylene (terephthalate/decanedicarboxylate), polybutylene naphthalate, polyethylene terephthalate, polyethylene (terephthalate/isophthalate), polyethylene (terephthalate/adipate), polyethylene (terephthalate/5-sodiumsulfoisophthalate), polybutylene (terephthalate/5-sodiumsulfoisophthalate), polypropylene terephthalate, polyethylene naphthalate and polycyclohexanedimethylene terephthalate.

[0039] The content of the polyester resin may be readily varied according to desired physical properties. According to the preferred embodiment of the present invention, the content of the polyester resin is between 4.99 and 95% by weight, based on the total weight of the melt-spinning solution.

[0040] (c) Epoxy Resin

[0041] In one embodiment, a compound having two or more epoxy groups



per one molecule can be used in an epoxy resin. If an epoxy resin is added, through a chemical bonding between polyamide and/or polyester, it is possible to provide an alloy resin with improved compatibility between the polyamide resin and polyester resin.

[0042] In one embodiment, examples of the epoxy resin may include DGEBA (diglycidyl ether of bisphenol A) type epoxy resin, DGEBF (diglycidyl ether of bisphenol F) type epoxy resin, hydrogenated BPA (hydrogenated bisphenol A) type epoxy resin, brominated epoxy resin, cycloaliphatic epoxy resin, rubber modified epoxy resin, aliphatic polyglycidyl type epoxy resin, glycidyl amine type epoxy resin, etc., but are not limited thereto. The epoxy resin may be employed singly, or in a combination of two or more kinds.

[0043] In one embodiment, epoxy resin may be obtained for example, by reacting bisphenol A, bisphenol F, hydrogenated or brominated bisphenol A or bisphenol F, or compounds having two or more hydroxyl groups with epichlorohydrin, or is readily available on the market.

[0044] In one embodiment, the number of functional groups of epoxy resin may be one or more, for example, four or more, depending on the degree of polymerization and form of chemical substance. The epoxy resin may be either in the form of liquid phase or solid phase.

[0045] In some embodiments, the epoxy equivalent weight of epoxy resin may range between 2,100 and 6,000 g/eq., and preferably between 2,500 and 6,000 g/eq.

[0046] In one embodiment, the content of the epoxy resin may be between 0.01 and 10% by weight based on the total weight of the composition. According to another embodiment of the present invention, the content of the epoxy resin is more preferably between 0.05 and 7% by weight, and further preferably between 0.1 and 5% by weight. When the content of the epoxy resin exceeds this range, for example, the productivity may be poor and processing problems may be caused due to the high viscosity of the blend or the poor flowability of the composition. On the other hand, when the content of the epoxy resin is below this range or is not used, the polyamide and the polyester are not miscible with each other, and thus are separated from each other during the formation of the blend, which leads to deterioration of the physical properties of the finally prepared fiber, such as strength and elasticity, as well as a poor spinning property.

[0047] In some embodiments, depending on the final property that is desired, an alloy resin composition may further include other polymer resins, for example, polyethylene, polystyrene, polypropylene, ABS resin, polycarbonate, polyphenylene sulfide, poly phenylene oxide, polyacetal, polysulfone, polyehtersulfone, polyether imide, polyether ketone, polylactic acid resin, polysulfon resin, elastomer resin, or mixtures thereof.

[0048] In another embodiment, within an extent not violative of the purpose of the present invention, additives such as antioxidants; thermal stabilizers; ultraviolet radiation absorbents such as aromatic amines, hindered phenols, phosphorus, and sulphur, dispersing agents, dyes, pigments, surfactants, release agents, lubricants, plasticizers, antimicrobials, stainproofing agents, and/or electrically conductive additives, oilproofing agents, melt viscosity enhancers, flame retardants, or mixtures thereof.

[0049] Polymer fibers are a subset of man-made fibers. The term ‘fiber’ is understood to mean a filament or assembly of chopped, cracked or converted filaments. Meanwhile, the expression “fiber or filament” used herein generally refers to a fiber or filament (for example, a “core-sheath-type” fiber) prepared by melt spinning a melting composition.

[0050] Melt spinning is a method of manufacture for polymeric fibers in which the polymer is melted and pumped through a spinneret (die) with numerous holes, notably from one to thousands. The molten fibers are cooled, solidified, and collected on a take-up wheel. Stretching of the fibers in both the molten and solid states provides for orientation of the polymer chains along the fiber axis.

[0051] The multifilament yarns prepared according to the present invention may have excellent tensile strength and tensile elongation and show an excellent spinning property.

[0052] The multifilament yarns of the present invention are prepared by blending a polyamide resin, a polyester resin and an epoxy resin in a melt phase using a known extruder, for example, subjecting them to a compounding process, using a single-screw extruder or a twin-screw extruder, to prepare a blend or a blended pellet (hereinafter, referred to as a “blend”).

[0053] In the blending process, a composition ratio of the polyamide resin, the polyester resin and the epoxy resin may be adjusted so that the thermoplastic polyamide resin, the thermoplastic polyester resin and the epoxy resin can be present at contents of 4.99 to 95% by weight, 4.99 to 95% by weight and 0.01 to 10% by weight, respectively. In this case, when the weights of the polyamide, polyester and epoxy resins are less than 4.99% by weight, 4.99% by weight and 0.01% by weight, respectively, or exceed 95% by weight, 95% by weight and 10% by weight, respectively, the physical properties of a yarn may be degraded, and yarn breakage may be causing during a spinning process.

[0054] Multifilament yarns are prepared by blending the blend prepared at this composition ratio at 5 to 95% by weight with 95 to 5% by weight of a polyester resin and spinning and elongating the blend using a conventional method.

[0055] In this case, when the weight ratio of the blend to the polyester resin is less than 5% or exceeds 95%, yarn breakage may be caused during a spinning process.

[0056] A general range of the cylinder temperature inside the extruder can be set in consideration of the melting point of the resin. In an illustrative embodiment, when using polyamide-6 resin, the temperature may be set at 250° C., and when using polyamide-66 resin, thetemperature may be set at 280° C. In addition, the alloy resin composition of the present application may be processed in desired forms of fibers by melt spinning according to usual processes well known in the textile industry. The forms or processing methods are not limited thereto.

[0057] Multifilament yarns are prepared by blending 5 to 95% by weight of the blend with 95 to 5% by weight of a polyester resin and spinning and elongating the blend using a conventional method. In this case, when the weight ratio of the blend to the polyester resin is less than 5% or exceeds 95%, yarn breakage may be causing during a spinning process.

[0058] Filaments spun on spinning equipment are solidified while passing through a coagulation bath, and then continuously elongated and wound. In this case, when the melting point is less than 250° C., the extrusion may not be easily performed due to an increase in pack pressure, whereas, when the melting point exceeds 300° C., the polymer may be severely decomposed.

[0059] In the spinning process, the spinning speed may be between 1,000 and 3,500 m/min, and the winding speed may be generally between 1,500 m/min and 6,500 m/min, preferably between 2,000 m/min and 4,500 m/min.

[0060] According to the present invention, the multifilament yarns may be elongated at an elongation ratio of 2.5 to 4.0.

[0061] Melt spun fibers can be extruded from the spinneret in different cross-sectional shapes, such as round, trilobal, pentagonal, octagonal, hollow and others. Trilobal-shaped fibers reflect more light and give an attractive sparkle to textiles.

[0062] The spun fibers may then be drawn and optionally textured, notably for example by using air-jet texturing or mechanical crimp texturing, but other known processes can be used.

[0063] The present invention also concerns yarns made with fibers of the invention. Yarn is a long continuous length of interlocked fibers, suitable for use in the production of textiles, sewing, crocheting, knitting, weaving, embroidery and ropemaking. The continuous yarn may also be obtained by assembling several multifilament yarns. Thread is a type of yarn intended for sewing by hand or machine.

[0064] Yarns according to the present invention may be for example Low Oriented Yarn (LOY), or Partially Oriented Yarn (POY) and/or Fully Drawn Yarn (FDY).

[0065] The yarns, fibres and filaments that can be used in the present invention may have cross sections of any shape, whether round, flat, serrate or fluted, or else in the form of a kidney bean, but also multilobate, in particular trilobate or pentalobate, in the form of an X, or taped, hollow, square, triangular, elliptical and other shapes.

[0066] In general, the yarns, fibers and filaments of the present invention are characterized by their strand linear density, which is generally greater than 1.9 dtx (decitex); i.e. greater than 1.9 g/10 000 meters; but preferably not exceeding 130 dtex, advantageously not exceeding 100 dtex.

[0067] The yarns, threads and/or fibers may be used to produce textile articles such as for example clothes, carpets and floorcoverings, and wallcoverings. Either the fibers, threads and/or yarns prepared from this invention may be manufactured into novel textiles, carpets and other articles of manufacture according to conventional, well known, methods. The textured yarn is most ideally used to produce a carpet using methods of manufacture known to those ordinarily skilled in the art, including tufting, weaving, bonding, needleloom and knitting. Detailed descriptions of these methods may be found in pages 134 to 140 of "Synthetic Fiber Materials", edited by H. Brody, published by Longman 1994, the disclosure of which is specifically incorporated by reference.

[0068] The present invention also concerns articles including the multifilament yarns, as described above. The multifilament yarns according to the present invention may be woven or knitted in the form of fabric or knitted goods.

[0069] Examples described below are to further explain features and advantages of the subject matter of the present disclosure, but not limited to the examples presented below. The subject matter of the present disclosure should not be limited to the specific embodiments and examples described herein. In light of the present disclosure, a skilled artisan may easily perceive that it is possible to modify, substitute, add and combine a part of the constitutions disclosed in the present disclosure other than various exemplary embodiments and examples.

EXAMPLES 1 TO 7 AND COMPARATIVE EXAMPLES 1 TO 6

Thermoplastic Polyamide Resin

[0070] Thermoplastic polyamide-6 resin (Trade Name: Toplamide 1011, commercially available from Hyosung, Inc.)

[0071] <Thermoplastic Polyester Resin>

[0072] Polyethylene terephthalate resin (Product Name: ESLON A-9056, commercially available from Woongjin Chemical Co. Ltd.)

[0073] <Epoxy Resin>

[0074] DGEBA-type epoxy resin (Product Name: YD-019, a commercially available from Kukdo Chemical Co. Ltd., epoxy equivalent weight: 2500 to 3800 g/eq)

Examples 1 to 5

[0075] One of the polyamide resins, one of the polyester resins, and one of the epoxy resins as described above were put into a twin screw mixer at a composition ratio of 79:19:2% by weight and melt-mixed at 280° C. to prepare a primarily blend.

[0076] The blend and the polyester resin were mixed at a composition ratio of 50:50% by weight. Then, a synthetic fiber was prepared by spinning and extending the primarily blend using conventional melt-conjugate spinning equipment at spinning temperatures and elongation ratios described in Table 1 below.

[0077] Among melting-spinning systems, a spin draw spinning process was used. Under conditions in which yarn breakage did not occur and the basic quality of appearance was secured, SDY 75d/24f PET/Nylon6 alloy yarns were prepared.

Example 6

[0078] One of the polyamide resins, one of the polyester resins, and one of the epoxy resins as described above were put into a twin screw mixer at a composition ratio of 79:19:2% by weight and melt-mixed at 280° C. to prepare a primarily blend.

[0079] The blend and the polyester resin were mixed at a composition ratio of 25:75% by weight. Then, a synthetic fiber was prepared by spinning and extending the primarily blend using conventional melt-conjugate spinning equipment at spinning temperatures and elongation ratios described in Table 1 below.

[0080] Among melting-spinning systems, a spin draw spinning process was used. Under conditions in which yarn breakage did not occur and the basic quality of appearance was secured, SDY 75d/24f PET/Nylon6 alloy yarns were prepared.

Example 7

[0081] One of the polyamide resins, one of the polyester resins, and one of the epoxy resins as described above were put into a twin screw mixer at a composition ratio of 79:19:2% by weight and melt-mixed at 280° C. to prepare a primarily blend.

[0082] The blend and the polyester resin were mixed at a composition ratio of 75:25% by weight. Then, a synthetic fiber was prepared by spinning and extending the primarily blend using conventional melt-conjugate spinning equipment at spinning temperatures and elongation ratios described in Table 1 below.

[0083] Among melting-spinning systems, a spin draw spinning process was used. Under conditions in which yarn breakage did not occur and the basic quality of appearance was secured, SDY 75d/24f PET/Nylon6 alloy yarns were prepared.

Comparative Examples 1 to 5

[0084] One of the polyamide resins, one of the polyester resins, and one of the epoxy resins as described above were put into a twin screw mixer at a composition ratio of 89:9:2% by weight, and then melt-mixed at 280° C. to prepare a primarily blend.

[0085] The blend alone was spun and extended using melt-conjugate spinning equipment at spinning temperatures and elongation ratios described in Table 1 below, thereby preparing a synthetic fiber.

[0086] Among melting-spinning systems, a spin draw spinning process was used. Under conditions in which yarn breakage did not occur and the basic quality of appearance was secured, SDY 75d/24f PET/Nylon6 alloy yarns were prepared.

TABLE 1

TestNo.	SpinbeamTemp. (° C.)	Elongation ratio (constant)	GR1 speed/ temp. (mpm/ ° C.)	GR2 speed/ temp. (mpm/° C.)	Winder speed (mpm)
Example 1	276	3.09	1300/88	4020/123	4000
Example 2		3.22	1250/86	4020/123	4000
Example 3		3.22	1250/93	4020/123	4000
Example 4		3.22	1250/88	4020/120	4000
Example 5		3.22	1250/88	4020/126	4000
Comparative Example 1	279	3.09	1300/88	4020/123	4000
Comparative Example 2		3.22	1250/86	4020/123	4000
Comparative Example 3		3.22	1250/93	4020/123	4000
Comparative Example 4		3.22	1250/88	4020/120	4000
Comparative Example 5		3.22	1250/88	64020/123	4000

Comparative Example 6

[0087] One of the polyamide resins and one of the polyester resins as described above were put into a twin screw mixer at a composition ratio of 80:20% by weight, and melt-mixed at 280° C. to prepare a primarily blend.

[0088] Then, the blend and the polyester resin were mixed at a composition ratio of 50:50% by weight and a synthetic fiber was prepared using melt-conjugate spinning equipment.

[0089] In the case of Comparative Example 6, a spinning operation was not performed due to polymer formation on the spinneret upon a spinning process, and thus samples could not be gathered. It seems that poor spinning workability was caused by separation of polyamide when the blend was prepared without employing the compatibilizing agent.

[0090] General properties were evaluated according to the following evaluation method. The results are listed in the following Table 2. Items to be evaluated and an analytic method are as follows:

[0091] 1. Tests of Physical Properties of Yarns

[0092] A) Yarn Deniers

[0093] On the basis of a method (skein method) of measuring the denier of KS K 0416 Filament-yarn, a skein gathered by winding the yarn filament samples around a reel 1 m in circumference 90 times was dried for 30 min at 50° C. in a heating chamber. Then, the yarn denier was measured by weighing the dried yarn filament using a balance with an allowable error of ±0.5 mg.

[0094] B) Breaking Tenacity and Elongation

[0095] Each of samples left for 24 hr at room temperature was tested 10-times under the condition of a sample length of

200 mm and a test speed of 2,000 m/min using Textechno Statimat Me.(Germany). Breaking tenacity and breaking elongation were calculated using the software provided at the test equipment, and the average value was then calculated from each of the results obtained from the 10 cycles of experiments.

TABLE 2

TestNo.	Denier (de)	Tenacity (g/d)	Elongation (%)
Example 1	75.2	2.74	36.2
Example 2	74.7	2.91	31.6
Example 3	74.7	2.91	34.7
Example 4	75.1	2.96	35.5
Example 5	74.7	2.97	30.9
Comparative Example 1	74.6	1.85	15.0
Comparative Example 2	74.6	1.81	17.1
Comparative Example 3	74.5	1.93	16.1
Comparative Example 4	74.6	1.93	16.7
Comparative Example 5	74.6	1.86	17.9

[0096] From Tables 1 and 2, it was seen that a synthetic fiber in which the blend prepared by mixing one of the polyamide resins, one of the polyester resins, and one of the epoxy resins in the composition ratio of 79:19:2% by weight was mixed with the polyester resin at the composition ratio of 50:50% by weight, and a spin draw yarn (SDY) was then prepared (Examples 1 to 5), was remarkably excellent in tenacity and elongation, in comparison with the synthetic fiber which was prepared using the blend alone (Comparative Examples 1 to 5).

[0097] Also, in the case of Comparative Example 6, it seems that that poor spinning workability by separation of polyamide was caused because the blend was prepared without employing the compatibilizing agent.

[0098] From Tables 1 and 2, it was also seen that, when the blend prepared by blending one polyamide resin, one polyester resin and one epoxy resin at a composition ratio of 79% by weight:19% by weight:2% by weight, was blended with a polyester resin at a composition ratio of 25% by weight:75% by weight or 25% by weight:75% by weight to prepare spun drawn yarns (SDY) (Examples 6 and 7), the fibers showed excellent strength and elongation, compared to when the fibers were made of only a conventional blend (Comparative Examples 1 to 5).

1. A method of preparing a fiber, comprising:

forming a first blend by melting: a) a thermoplastic polyamide resin, b) a first thermoplastic polyester resin, and c) an epoxy resin, at 250 to 300° C.; and

blend-spinning and elongating a second blend comprising 5 to 95% by weight of the first blend and 95 to 5% by weight of a second polyester resin to prepare the fiber.

2. The method according to claim **1**, wherein the second blend comprises 25 to 75% by weight of the blend and 75 to 25% by weight of the second polyester resin.

3. The method according to claim **1**, wherein the polyamide resin comprises at least one member selected from the group consisting of polyamide-6, polyamide-66, polyamide-610, polyamide-11, polyamide-12, terephthalic acid-based polyamide, isophthalic acid-based polyaramid, and copolymers thereof.

4. The method according to claim **1**, wherein the second polyester resin comprises at least one member selected from the group consisting of polybutylene terephthalate, polybutylene (terephthalate/isophthalate), polybutylene (terephthalate/adipate), polybutylene (terephthalate/sebacate), polybutylene (terephthalate/decanedicarboxylate), polybutylene naphthalate, polyethylene terephthalate, polyethylene (terephthalate/isophthalate), polyethylene (terephthalate/adipate), polyethylene (terephthalate/5-sodium sulfoisophthalate), polybutylene (terephthalate/5-sodium sulfoisophthalate), polypropylene terephthalate, polyethylene naphthalate, and polycyclohexane dimethylene terephthalate.

5. The method according to claim **1**, wherein the epoxy resin comprises at least one member selected from the group consisting of a diglycidyl ether of bisphenol A type epoxy resin, a diglycidyl ether of bisphenol F type epoxy resin, a hydrogenated bisphenol A type epoxy resin, a brominated epoxy resin, a cycloaliphatic epoxy resin, a rubber-modified epoxy resin, an aliphatic polyglycidyl-type epoxy resin, and a glycidyl amine-type epoxy resin.

6. A fiber prepared by the method according to claim **1**.

7. The method according to claim **1**, wherein the first thermoplastic polyester resin comprises at least one member selected from the group consisting of polybutylene terephthalate, polybutylene (terephthalate/isophthalate), polybutylene (terephthalate/adipate), polybutylene (terephthalate/sebacate), poly-butylene (terephthalate/decanedicarboxylate), polybutylene naphthalate, polyethylene terephthalate, polyethylene (terephthalate/isophthalate), polyethylene (terephthalate/adipate), polyethylene (terephthalate/5-sodium sulfoisophthalate), polybutylene (terephthalate/5-sodium sulfoisophthalate), polypropylene terephthalate, polyethylene naphthalate, and polycyclohexane dimethylene terephthalate.

8. The fiber of claim **6**, wherein the fiber comprises 4.99 to 95% by weight of the polyamide resin, 4.99 to 95% by weight of the polyester resins, and 0.01 to 10% by weight of the epoxy resin.

9. The method of claim **9**, wherein the second blend comprises 4.99 to 95% by weight of the polyamide resin, 4.99 to 95% by weight of the polyester resin, and 0.01 to 10% by weight of the epoxy resin.

10. The method according to claim **1**, wherein first thermoplastic polyester resin and the second polyester resin each comprise at least one member selected from the group consisting of polybutylene terephthalate, polybutylene (terephthalate/isophthalate), polybutylene (terephthalate/adipate), polybutylene (terephthalate/sebacate), poly-butylene (terephthalate/decanedicarboxylate), polybutylene naphthalate, polyethylene terephthalate, polyethylene (terephthalate/isophthalate), polyethylene (terephthalate/adipate), polyethylene (terephthalate/5-sodium sulfoisophthalate), polybutylene (terephthalate/5-sodium sulfoisophthalate), polypropylene terephthalate, polyethylene naphthalate, and polycyclohexane dimethylene terephthalate.

11. The method of claim **10**, wherein the thermoplastic polyamide resin comprises polyamide-6, the first thermoplastic polyester resin and the second polyester resin each comprise polyethylene terephthalate, and the epoxy resin comprises a diglycidyl ether of bisphenol A-type epoxy resin.

12. A method of making a fiber, comprising blend-spinning and elongating a resin blend comprising:

95 to 5% by weight of a thermoplastic polyester resin comprising at least one member selected from the group

consisting of polybutylene terephthalate, polybutylene (terephthalate/isophthalate), polybutylene (terephthalate/adipate), polybutylene (terephthalate/sebacate), poly-butylene (terephthalate/decanedicarboxylate), polybutylene naphthalate, polyethylene terephthalate, polyethylene (terephthalate/isophthalate), polyethylene (terephthalate/adipate), polyethylene (terephthalate/5-sodium sulfoisophthalate), polybutylene (terephthalate/5-sodium sulfoisophthalate), polypropylene terephthalate, polyethylene naphthalate, and polycyclohexane dimethylene terephthalate, and

5 to 95% by weight of a first resin blend formed by melt phase blending of:

a) 4.99 to 95% by weight of a thermoplastic polyamide resin comprising at least one member selected from the group consisting of polyamide-6, polyamide-66, polyamide-610, polyamide-11, polyamide-12, terephthalic acid-based polyamide, isophthalic acid-based polyaramid, and copolymers thereof,

b) 4.99 to 95% by weight of the thermoplastic polyester resin, and

c) 0.01 to 10% by weight of an epoxy resin comprising at least one member selected from the group consisting of a diglycidyl ether of bisphenol A-type epoxy resin, a diglycidyl ether of bisphenol F-type epoxy resin, a hydrogenated bisphenol A-type epoxy resin, a brominated epoxy resin, a cycloaliphatic epoxy resin, a rubber-modified epoxy resin, an aliphatic polyglycidyl-type epoxy resin, and a glycidyl amine-type epoxy resin.

13. The method of claim **12**, wherein the thermoplastic polyamide resin comprises polyamide-6, the thermoplastic polyester resin comprises polyethylene terephthalate, and the epoxy resin comprises a diglycidyl ether of bisphenol A-type epoxy resin.

14. A fiber made by the method of claim **12**.

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