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(54) STAIN-RESISTANT FIBERS, TEXTILES AND CARPETS

SCHMUTZABWEISENDE FASERN, TEXTILIEN UND TEPPICHE

FIBRES, TEXTILES ET TAPIS RÉSISTANTS AUX TACHES

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Description**FIELD OF THE INVENTION**

[0001] The present invention broadly relates to low color fibers, textiles and carpets comprising a semi-aromatic polyamide that feature surprisingly anti-staining properties. The invention relates also in particular to the use of a semi-aromatic polyamide in the manufacture of fibers, textiles and carpets for its anti-staining properties.

BACKGROUND OF THE INVENTION

[0002] Polyamides (like those derived from phthalic acids and aliphatic diamines, i.e. polyphthalamides, or those derived from aromatic diamines and aliphatic diacids) are polymers having excellent mechanical, physical and chemical properties which make them useful for a wide variety of different applications.

[0003] Polyamide fibers are relatively inexpensive and offer a desirable combination of qualities such as durability, comfort, and ease of manufacture into a broad range of colors, patterns, and textures. As a result, polyamide fibers are widely used in the home and industry as carpets, drapery material, upholstery, and clothing. Carpets and rugs made from polyamide fibers are a popular floor covering for residential and commercial applications.

[0004] Polyamide fibers dye easily with dyes. As a consequence, polyamide fibers, textiles and carpets suffer from a significant drawback: they are not resistant to staining agents that are often put in contact with these articles. Typical staining agents include artificial or natural colorants (such as those found in soft drinks, coffee, red wine, food) and makeup (such as lipstick, lip gloss, lip liner, lip plumper, lip balm, foundation, powder, blush). In contact with these staining agents, the prior art articles are easily stained.

[0005] The resulting stains cannot be easily removed under ordinary cleaning conditions. The severe staining of carpeting is a major problem for consumers. In fact, surveys show that more carpets are replaced because of staining than because of wear. Accordingly, it is desirable to provide polyamide fibers that resist common household and common stains, thereby increasing the life of the carpet and textiles.

[0006] Many attempts have been made to offer an anti-staining polyamide carpets and textiles. For example, one way of avoiding such staining is to topically apply to the surface of the polyamide filaments materials a specific anti-staining agent. US 6,488,893 provides for example a solution comprising condensation product of sulfonated naphthalene sulfonic acid, and aldehyde and a dihydroxydiphenyl sulfone together with a methacrylic acid polymer that function as stain blockers so as to prevent stains from permanently coloring the yarn. Topical treatments, however, tend to be costly and non-permanent (washed away with one or more washings).

[0007] US 3,579,414 discloses melt-spun filaments and yarns with superior heat durability, Young's modulus and dyeability made from a specific copolyamide obtained through the polycondensation of 1,11-diaminoundecane, terephthalic acid and ϵ -caprolactam.

[0008] There remains a need for stain- or dye-resistant polyamide fibers, carpets and textiles that overcome the above-discussed limitations.

[0009] Therefore, it is another object of the present invention to provide polyamide anti-staining fibers, carpets and textiles.

DETAILED DESCRIPTION OF THE INVENTION

[0010] In a first aspect, the present invention relates to a fiber as claimed in claim 1.

[0011] A further aspect of the present invention is directed to textiles and carpets comprising the fiber according to the present invention featuring outstanding anti-staining properties.

[0012] In a particular embodiment, the present invention relates to fibers, textiles and carpets having a stain-resistance with respect to dyes or pigments made of a polymer comprising more than 50 mol % of recurring units made of an aromatic diacid such as terephthalic acid and at least one aliphatic diamine selected from the group consisting of 1,8-octanediamine, 1,9-nonanediamine, 2-ethyl-1,8-octanediamine, 1,10-decanediamine, 1,12-dodecanediamine, 2,2,4-trimethyl-1,6-hexanediamine, 2,4,4-trimethyl-1,6-hexanediamine, 5-methyl-1,9-nonanediamine, methylcyclohexanediamine, isophoronediamine and mixtures thereof

[0013] In still a further aspect, the present invention relates to a method for conferring anti-staining properties to fibers, textiles or carpets comprising using a semi-aromatic polyamide comprising recurring units resulting from the condensation of terephthalic acid and at least one aliphatic diamine selected from the group consisting of 1,8-octanediamine, 1,9-nonanediamine, 2-methyl-1,8-octanediamine, 1,10-decanediamine, 1,12-dodecanediamine, 2,2,4-trimethyl-1,6-hexanediamine, 2,4,4-trimethyl-1,6-hexanediamine, 5-methyl-1,9-nonanediamine, methylcyclohexanediamine, isophoronediamine and mixtures thereof, for the manufacture of said fibers, textiles or carpets.

[0014] The fibers, carpets and textiles according to the present invention exhibit outstanding anti-staining properties.

More precisely, the fibers, carpets and textiles according to the present invention have a stain-resistance rating of 1 on the Stain Rating Scale of the Stain Test Method described below. The staining is herein intended to denote a coloration produced by a staining agent that penetrates a material. In many cases, stains can be affected by heat and moisture, and may become reactive enough to bond with the underlying material. Extreme heat can cause a chemical reaction on an otherwise removable stain, turning it into a chemical compound that is impossible to remove.

[0015] The staining agent is intended to denote any agent that causes the material that comes in contact with it to stain. Typically, staining agents comprise at least one dye or pigment. Both dyes and pigments appear to be colored because they absorb and reflect some wavelengths of light preferentially. Typical staining agents include : makeup (such as lipstick, lip gloss, lip liner, lip plumper, lip balm, foundation, powder, blush), artificial or natural colorants (such as those found in soft drinks, coffee, red wine, mustard and ketchup), dyes and pigments (such as those found in dyed textiles and leather).

The fiber, textile and carpet

[0016] The fiber, textile and carpet according to the present invention have advantageously a lightness (L^*) of at least 60 in the CIE 1976 (L^* , a^* , b^*) color space when measured according to ASTM E308-08. The procedure used to measure the luminance is detailed here below:

The lightness (L^*) was determined using a CE7000 Gretag MacBeth spectrophotometer using Cool White Fluorescent (F2) illuminant, a 10° observer, a 10 nm wavelength interval, a spectral range of from 360 to 700 nm and a D/8 optical geometry configuration with a bandpass correction using table 5.27 of the ASTM E 308-08 (on page 22). Values were measured on CIE Lab coordinates. The three coordinates of CIELAB represent the lightness of the color ($L^* = 0$ yields black and $L^* = 100$ indicates diffuse white ; specular white may be higher), its position between red and green (a^* , negative values indicate green while positive values indicate red) and its position between yellow and blue (b^* , negative values indicate blue and positive values indicate yellow).

[0017] The fiber, textile and carpet according to the present invention have preferably a lightness (L^*) of at least 65, more preferably at least 70, still more preferably of at least 75 and most preferably of at least 80.

[0018] A fiber is intended to denote a class of materials that are continuous filaments or are in discrete elongated pieces, similar to lengths of thread. The length of the fiber according to the present invention may vary widely. It is usually from 2 to 50 mm, preferably from 10 to 40 mm, more preferably from 20 to 30 mm. The diameter of the fiber can also vary greatly. It is generally from $1 \cdot 10^{-6}$ m to $1 \cdot 10^{-4}$ m, preferably from $5 \cdot 10^{-6}$ m to $5 \cdot 10^{-5}$ m, more preferably about $1 \cdot 10^{-5}$ m.

[0019] The fiber, textile and carpets according to the present invention may be manufactured by various methods known in the art.

[0020] A textile is intended to denote a flexible material consisting of a network of natural or artificial fibres often referred to as thread or yarn. Yarn is produced by spinning fibers on a spinning wheel to produce long strands. Textiles are formed by weaving, knitting, crocheting, knotting, or pressing fibres together.

[0021] A carpet is intended to denote a textile floor covering consisting of an upper layer of "pile" attached to a backing. The pile usually consists of twisted tufts which are often heat-treated to maintain their structure.

[0022] The fiber, textile and carpet of the present invention may be dyed in various colors.

The semi-aromatic polyamide

[0023] The semi-aromatic polyamide according to the present invention comprises recurring units (R) resulting from the condensation of terephthalic acid and at least one aliphatic diamine selected from the group consisting of 1,8-octanediamine, 1,9-nonanediamine, 2-methyl-1,8-octanediamine, 1,10-decanediamine, 1,12-dodecanediamine, 2,2,4-trimethyl-1,6-hexanediamine, 2,4,4-trimethyl-1,6-hexanediamine, 5-methyl-1,9-nonanediamine, methylcyclohexanediamine, isophoronediamine and mixtures thereof.

[0024] Preferably, the at least one aliphatic diamine is selected from the group consisting of 1,8-octanediamine, 1,9-nonanediamine, 2-methyl-1,8-octanediamine, 1,10-decanediamine, 1,12-dodecanediamine, 2,2,4-trimethyl-1,6-hexanediamine, 2,4,4-trimethyl-1,6-hexanediamine, 5-methyl-1,9-nonanediamine and mixtures thereof. More preferably, the at least one aliphatic diamine is selected from the group consisting of 1,9-nonanediamine, 2-methyl-1,8-octanediamine, 1,10-decanediamine, 1,12-dodecanediamine and mixtures thereof. Still more preferably, the at least one aliphatic diamine is selected from the group consisting of 1,9-nonanediamine, 2-methyl-1,8-octanediamine, 1,10-decanediamine and mixtures thereof. Most preferably, the at least one aliphatic diamine is selected from the group consisting of 1,9-nonanediamine, 1,10-decanediamine and mixtures thereof.

[0025] In a particular embodiment, the aliphatic diamine having more than 8 carbon atoms is a C9 diamine. In such a case; the diamine may be 1,9-nonanediamine (NDA) and/or 2-methyl-1,8-octanediamine (MODA). The 2-methyl-1,8-

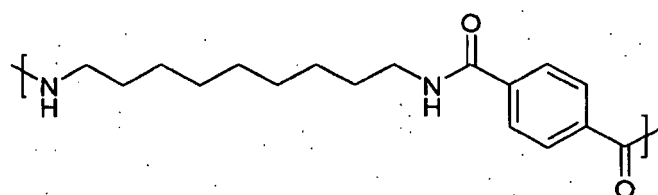
octanediamine (MODA) may be present from 0 to 50 mole %, based on the total number of moles of the diamine. When the aliphatic diamine having more than 8 carbon atoms is a mix of NDA and MODA, the molar ratio [(NDA) : (MODA)] is advantageously of at least 1, preferably of at least 2, more preferably of at least 3 and still more preferably of at least 4; besides, it is advantageously of at most 9, preferably of at most 7, and more preferably of at most 6."

[0026] Excellent results were obtained when the invented polyamide consisted essentially of:

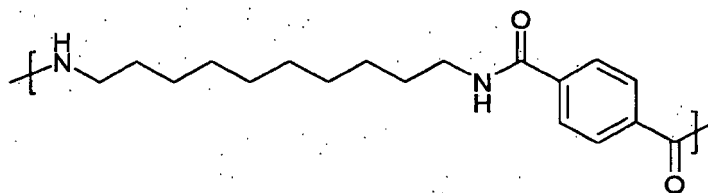
- a diamine component (a) consisting essentially of a mixture of 1,9-nonanediamine and 2-methyl-1,8-octanediamine in a molar ratio [(NDA): (MODA)] of about 1.5 or 5.6, and
- a dicarboxylic acid component (b) consisting essentially of terephthalic acid.

[0027] Preferred polyamides are those often referred to as PA 9T, PA 10T, PA 12T and mixtures thereof.

[0028] PA 9T, when made using 1,9-nonanediamine, is a polyamide the recurring units of which have the following structure :



[0029] PA 10T is a polyamide the recurring units of which have the following structure :



[0030] PA10T may be prepared by various ways. It is advantageously prepared at least partially from decanediamine derived from a renewable raw material such as castor bean.

[0031] The semi-aromatic polyamide according to the present invention may comprise other recurring units than recurring units (R).

[0032] The semi-aromatic polyamide according to the present invention may be obtained by the condensation of one or more dicarboxylic acids and one or more diamines, and/or one or more aminocarboxylic acids, and/or ring-opening polymerization products of one or more cyclic lactams.

[0033] In addition to terephthalic acid (abbreviated as "T" in polyamide designations), suitable dicarboxylic acids include, but are not limited to, succinic acid, glutaric acid, sebacic acid, adipic acid, azelaic acid, 1,6-cyclohexanedicarboxylic acid, naphthalenedicarboxylic acid and isophthalic acid (abbreviated as "I" in polyamide designations). Preferably, adipic acid is present in an amount of at most 30 mol %, more preferably at most 20 mol %, even more preferably at most 10 mol %, based on the total number of moles of the diacid component. Most preferably the diacid component is free of adipic acid.

[0034] Suitable diamines include, but are not limited to, tetramethylenediamine, hexamethylenediamine, octamethylenediamine, nonamethylenediamine, decamethylenediamine, dodecamethylenediamine, 2-methylpentamethylenediamine, 2-methyloctamethylenediamine, trimethylhexamethylenediamine, bis(p-aminocyclohexyl)methane, m-xylylenediamine, and p-xylylenediamine.

[0035] In a particular embodiment, fibers are obtained from a polymer composition (C) where the at least one semi-aromatic polyamide comprises in addition to the above described recurring units (R) (resulting from the condensation of terephthalic acid and at least one aliphatic diamine selected from the group consisting of 1,8-octanediamine, 1,9-nonanediamine, 2-methyl-1,8-octanediamine, 1,10-decanediamine, 1,12-dodecanediamine, 2,2,4-trimethyl-1,6-hexanediamine, 2,4,4-trimethyl-1,6-hexanediamine, 5-methyl-1,9-nonanediamine, methylcyclohexanediamine, isophoronediamine and mixtures thereof), other recurring units (R') resulting from the condensation of dicarboxylic acids selected from succinic acid, glutaric acid, sebacic acid, adipic acid, azelaic acid, 1,6-cyclohexanedicarboxylic acid, naphthalenedicarboxylic acid and isophthalic acid with diamines selected from tetramethylenediamine, hexamethylenediamine, octamethylenediamine, nonamethylenediamine, decamethylenediamine, dodecamethylenediamine, 2-methylpentame-

thylenediamine, 2-methyloctamethylenediamine, trimethylhexamethylenediamine, bis(p-aminocyclohexyl)methane, m-xylylenediamine, and p-xylylenediamine.

[0036] Excellent results were obtained when hexamethylene diamine was used, leading for example to the obtention of the following copolymers PA 6T/10T, PA6T/10T/6I/10I, PA 6T/6,6, PA10T/10,10, PA 10T/6T/6,10/10,10.

[0037] The semi-aromatic polyamide according to the present invention comprises at least 20 wt. %, preferably at least 40 wt. %, more preferably at least 50 wt. %, even more preferably at least 60 wt. % and most preferably at least 80 wt. % of recurring units (R) based on the total weight of the semi-aromatic polyamide. Excellent results were obtained when the semi-aromatic polyamide was essentially free or even completely free of recurring units other than recurring units (R).

[0038] More than one semi-aromatic polyamide may be present in the polymer composition (C). In such a case, the semi-aromatic polyamide comprising recurring units resulting from the condensation of terephthalic acid and at least one aliphatic diamine comprising more than 8 carbon atoms detailed above is preferably present in at least 20 wt. %, more preferably at least 40 wt. %, even more preferably at least 50 wt. %, still more preferably at least 60 wt. % and most preferably at least 70 wt. %, based on the total weight of the semi-aromatic polyamides.

[0039] The semi-aromatic polyamide according to the present invention has advantageously a high melting point. Its melting point is preferably above 200°C, more preferably above 240°C, even more preferably above 280°C and most preferably above 300°C. Excellent results were obtained with a semi-aromatic polyamide featuring a melting point of 316°C.

[0040] The semi-aromatic polyamide according to the present invention has advantageously a high heat deflection temperature. Its heat deflection temperature is preferably above 200°C, more preferably above 250°C, even more preferably above 270°C and most preferably above 290°C. Excellent results were obtained with a semi-aromatic polyamide featuring a heat deflection temperature of 295°C.

[0041] The semi-aromatic polyamide according to the present invention having advantageously a high heat deflection temperature and a high melting point, it features therefore excellent high temperature resistance.

[0042] The semi-aromatic polyamide according to the present invention is present in the polymer composition (C) in an amount of at least 20 wt. %, preferably of at least 30 wt. % and most preferably of at least 40 wt. %, based on the total weight of the polymer composition (C). On the other hand, the semi-aromatic polyamide according to the present invention is preferably present in the polymer composition (C) in an amount of at most 99 wt. %, more preferably of at most 95 wt. %, still more preferably of at most 90 wt. % and most preferably of at most 85 wt. %, based on the total weight of the polymer composition (C). Excellent results were for example obtained when the semi-aromatic polyamide according to the present invention was present in the polymer composition (C) in about 50 wt. %, based on the total weight of the polymer composition (C).

Optional ingredients of the polymer composition (C)

[0043] The polymer composition (C) may further comprise at least one filler selected from the group consisting of fibrous fillers, particulate fillers and mixture thereof. Examples of such filler include, but are not limited to, glass fiber, carbon fiber, glass fibers having a non-circular cross section, glass flakes, carbon fibers, wollastonite, calcined clay, kaolin, and the like.

[0044] In a particular embodiment of the present invention, the filler is preferably a particulate filler. Examples of such particulate filler include carbon black, talc, glass balls, calcium silicate, calcium metasilicate, kaolin, chalk, powdered quartz, mica, barium sulfate, aluminium silicate, calcium carbonate, clay and the like.

[0045] In a particular embodiment of the present invention, the filler is preferably a fibrous filler.

[0046] The fibrous filler may have a circular or a non-circular cross section having a major axis lying perpendicular to a longitudinal direction of the reinforcing agent and corresponding to the longest linear distance in the cross section. The non-circular cross section has a minor axis corresponding to the longest linear distance in the cross section in a direction perpendicular to the major axis. The ratio of the length of the major axis to that of the minor axis is preferably between about 1.5:1 and about 6:1. The ratio is more preferably between about 2:1 and 5:1 and yet more preferably between about 3:1 to about 4:1.

[0047] The fibrous reinforcing agent may be glass, carbon fibers, or other materials. Glass fibers are preferred. The fibrous reinforcing agent may be in the form of long glass fibers, chopped strands, milled short glass fibers, or other suitable forms known to those skilled in the art. Particularly preferred according to the invention are glass fibers having a fiber diameter between 7 and 18 μm , preferably between 9 and 15 μm .

[0048] In a particular embodiment of the present invention, the filler is preferably a mixture of particulate and fibrous filler.

[0049] In a preferred embodiment, the polymer composition (C) comprises at least 20 wt. %, more preferably at least 30 wt. %, still more preferably at least 40 wt. % and most preferably at least 45 wt. % of the filler, based on the total weight of the polymer composition (C). On the other hand, the polymer composition (C) comprises preferably at most 80 wt. %, more preferably at most 70 wt. %, still more preferably at most 60 wt. % and most preferably at most 55 wt. % of the filler, based on the total weight of the polymer composition (C).

% of the filler, based on the total weight of the polymer composition (C).

[0050] The polymer composition (C) may further comprise at least one pigment.

[0051] Such pigment may be chosen from inorganic and organic pigments. Such pigments are well known from the skilled person and are notably chosen from : titanium dioxide, zinc sulfide pigments, iron oxide pigments, chromium oxide green, lead chromate molybdate pigments, cadmium pigments, mixed metal oxide pigments, ultramarine blue, etc

[0052] The pigments according to the present invention are preferably present in the composition (C) in an amount of at least 1 wt. %, more preferably of at least about 2 wt. %, yet more preferably of at least about 3 wt. %, or still more preferably of at least about 4 wt. %, based on the total weight of the polymer composition (C). On the other hand, the pigments according to the present invention are preferably present in the polymer composition (C) in an amount of at most 15 wt. %, more preferably of at most 10 wt. %, yet more preferably of at most 8 wt. %, or still more preferably of at most 6 wt. %, based on the total weight of the composition. Excellent results were obtained when the pigments were present in the polymer composition (C) in about 5 wt. %, based on the total weight of the polymer composition (C).

[0053] The polymer composition (C) comprises preferably at least one white pigment. Among white pigments, the white pigment according to the present invention is preferably selected from titanium dioxide, barium sulfate and zinc sulfide. More preferably, the white pigment is titanium dioxide or zinc sulfide.

[0054] The polymer composition (C) may further comprise other polymer(s). In particular, the polymer composition (C) may further comprise other polyamides including aliphatic polyamides such as polyamide 6 ; polyamide 6,6 ; polyamide 4,6 ; polyamide 6,10 ; polyamide 6,12 ; polyamide 11 ; polyamide 12 ; polyamide 9,10 ; polyamide 9,12 ; polyamide 9,13 ; polyamide 9,14 ; polyamide 9,15 ; polyamide 6,16 ; polyamide 9,36 ; polyamide 10,10 ; polyamide 10,12 ; polyamide 10,13 ; polyamide 10,14 ; polyamide 12,10 ; polyamide 12,12 ; polyamide 12,13 ; polyamide 12,14 ; polyamide 6,14 ; polyamide 6,13 ; polyamide 6,15 ; polyamide 6,16 ; polyamide 6,13 ; and semi-aromatic polyamides such as poly(m-xylylene adipamide) (polyamide MXD,6), poly(dodecamethylene terephthalamide) (polyamide 12,T), poly(non-amethylene terephthalamide) (polyamide 9,T), hexamethylene adipamide/hexamethylene terephthalamide copolyamide (polyamide 6,T/6,6), hexamethylene terephthalamide. The polymer composition (C) further comprises preferably at least one aliphatic polyamide such as polyamide 6,6.

[0055] The polymer composition (C) may further optionally comprise additional additives such as ultraviolet light stabilizers, heat stabilizers, antioxidants, processing aids, lubricants, flame retardants, and/or conductivity additive such as carbon black and carbon nanofibrils.

[0056] In a preferred embodiment, the polymer composition (C) comprises preferably:

- at least 20 wt. %, more preferably of at least 30 wt. % and most preferably of at least 40 wt. % of the at least one semi-aromatic polyamide comprising recurring units resulting from the condensation of terephthalic acid and at least one aliphatic diamine selected from the group consisting of 1,8-octanediamine, 1,9-nonanediamine, 2-methyl-1,8-octanediamine, 1,10-decanediamine, 1,12-dodecanediamine, 2,2,4-trimethyl-1,6-hexanediamine, 2,4,4-trimethyl-1,6-hexanediamine, 5-methyl-1,9-nonanediamine, methylcyclohexanediamine, isophoronediamine and mixtures thereof, and
- at least 1 wt. %, more preferably at least about 2 wt. %, yet more preferably at least about 3 wt. % of pigments, based on the total weight of the polymer composition (C).

[0057] In another preferred embodiment, the polymer composition (C) comprises preferably:

- at least 20 wt. %, more preferably of at least 30 wt. % and most preferably of at least 40 wt. % of at least one semi-aromatic polyamide selected from PA 9T, PA 10T and PA 12T ;
- at least 1 wt. %, more preferably at least about 2 wt. %, yet more preferably at least about 3 wt. % of at least one white pigment selected from titanium dioxide, barium sulfate and zinc sulfide, based on the total weight of the polymer composition (C).

[0058] The polymer composition (C) molded into a plaque has preferably a lightness (L^*) of at least 60, more preferably at least 65, still more preferably at least 70, even more preferably of at least 75 and most preferably of at least 85 in the CIE 1976 (L^* , a^* , b^*) color space when measured according to ASTM E308-08.

[0059] Should the disclosure of any patents, patent applications, and publications which are incorporated herein by reference conflict with the description of the present application to the extent that it may render a term unclear, the present description shall take precedence.

EXAMPLES

[0060] Makeup was used as the staining agent. More precisely, the makeup was Maybelline Blush 10 Romantic Plum blush.

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[0061] This staining agent was tested on various 0.3 cm thick molded plaques made of different materials:

PA 6,6 : Zytel® 101 commercialized by E. I. du Pont de Nemours and Company

PA 6T/6,6 : AMODEL® A-4122 L WH905 commercialized by SOLVAY ADVANCED POLYMERS, L.L.C.

PA 6T/6I/6,6 : AMODEL® A-1133 NL WH505 commercialized by SOLVAY ADVANCED POLYMERS, L.L.C.

PA 10,10 : Commercially available from Shandong Dongchen Engineering Plastic Co., Ltd.

PA 10,12 : Commercially available from Shandong Dongchen Engineering Plastic Co., Ltd.

PA 9T: polymer obtained by the condensation of C9 aliphatic diamine and terephthalic acid, supplied by Kuraray.

PA 10T: Vicnyl 700 commercialized by Kingfa.

Glass fiber: CSG3PA-820 commercialized by Nitobo.

Colored pigments: a mixture of pigments were used for color matching.

White pigment I: zinc sulfide: Sachtolith® HD-L commercialized by Sachtleben Chemie GmbH.

White pigment II: titanium dioxide: R-105 commercialized by DuPont Titanium Technologies.

Talc: Steamic® OOS commercialized by Talc de Luzenac France.

Sebum: Synthetic sebum commercialized by Scientific Services.

Table 1: Materials tested

	CE1	CE2	CE3	CE4	CE5	E1	E2
Polyamide							
PA 6,6	50						
PA 6T/6,6		66					
PA 6T/6I/6,6			58,7				
PA 10,10				46,22			
PA 10,12					46,22		
PA 9T						46,22	
PA 10T							46,22
Filler							
Glass fiber	50	21	34,5	47,26	47,26	47,26	47,26
Pigments							
Colored pigments				0,025	0,025	0,025	0,025
White pigment I				4,755	4,755	4,755	4,755
White pigment II		12	6				
Additives							
Typical PA additives		1	0.5	0,74	0,74	0,74	0,74
Talc			0,3	1	1	1	1

STAINING TEST METHOD

[0062] The color of the plaques were measured, and in particular the lightness (L*) of the samples were determined using a CE7000 Gretag MacBeth spectrophotometer using Cool White Fluorescent (F2) illuminant and the 10° observer, as detailed above.

[0063] The following test procedure was used to determine the stain-resistance performance of examples of this invention, this test method simulates a potential real life method of staining whereby a person wearing makeup may introduce colorants to the worn fiber/textile. Synthetic face oil, sebum, was used to simulate a possible carrier or solvent for the dyes.

[0064] A mixture of staining agent is prepared by heating sebum until it is liquid, then mixing 3 parts of the heated sebum to one part of the makeup and finally heating the mixture to maintain liquidity.

[0065] The prepared staining agent mixture is applied to the surface of the molded plaques with a cotton swab. The

plaques are placed in an environmental chamber at 65°C and 90 % humidity for 24 hours. The molded plaques are then placed at room temperature before wiping their surface with isopropyl alcohol. Once cleaned, the plaques are finally inspected for staining.

[0066] The color of the fiber made of the polymer composition (C) according to the present invention is always lighter than the color of the same composition (C) as measured on a plaque. The anti-staining effect can however be detected more easily and more accurately on a plaque than on a fiber.

[0067] The inspection step comprises the measurement of the lightness (L^*), as detailed above. The difference between the original L^* measured and the L^* measured after the staining treatment is calculated.

[0068] Stain Rating Scale: the stains can be categorized according to the following standards:

1 = no staining = $\Delta L \leq 0.5$

2 = moderate staining = $0.5 < \Delta L < 5$

3 = heavy staining = $\Delta L > 5$

[0069] In other words, a stain-rating of 1 is excellent, showing good stain resistance, whereas 3 is a poor rating, showing persistence of heavy staining. For a substrate to be considered to have adequate stain resistance, it should have a rating of 1 on the above-described Stain Rating Scale.

Table 2: Staining test results

	CE1	CE2	CE3	CE4	CE5	E1	E2
Initial L^* value	61.6	91.0	93.9	90.9	90.8	89.7	89.4
L^* value after staining treatment	58.4	90.0	92.7	84.3	84	89.7	89.0
Staining rating	2	2	2	3	3	1	1

Claims

1. A fiber made of a polymer composition (C) comprising at least 20 wt. % of at least one semi-aromatic polyamide comprising at least 20 wt. % of recurring units (R) resulting from the condensation of terephthalic acid and at least one aliphatic diamine selected from the group consisting of 1,8-octanediamine, 1,9-nonanediamine, 2-methyl-1,8-octanediamine, 1,10-decanediamine, 1,12-dodecanediamine, 2,2,4-trimethyl-1,6-hexanediamine, 2,4,4-trimethyl-1,6-hexanediamine, 5-methyl-1,9-nonanediamine, methylcyclohexanediamine, isophoronediamine and mixtures thereof, wherein the color of said polymer composition (C) when molded into a plaque has a lightness (L^*) of at least 60 in the CIE 1976 (L^* , a^* , b^*) color space when measured according to ASTM E308-08.
2. The fiber according to claim 1, wherein the color of said polymer composition (C) when molded into a plaque has a lightness (L^*) of at least 70 in the CIE 1976 (L^* , a^* , b^*) color space when measured according to ASTM E308-08.
3. The fiber according to claim 1 or 2, wherein the at least one aliphatic diamine is selected from the group consisting of 1,9-nonanediamine, 2-methyl-1,8-octanediamine, 1,10-decanediamine, 1,12-dodecanediamine and mixtures thereof.
4. The fiber according to claim 3, wherein the at least one aliphatic diamine is selected from the group consisting of 1,9-nonanediamine, 1,10-decanediamine and mixtures thereof.
5. The fiber according to anyone of the preceding claims, wherein the semi-aromatic polyamide is selected from the group consisting of PA9T, PA10T, PA12T and mixtures thereof.
6. The fiber according to anyone of the preceding claims, wherein the polymer composition (C) comprises more than 30 wt. % of the semi-aromatic polyamide, based on the total weight of the polymer composition (C).
7. The fiber according to anyone of the preceding claims, wherein the polymer composition (C) further comprises at least 1 wt. % of one or more pigments, based on the total weight of the polymer composition (C).
8. The fiber according to claim 7, wherein the pigments comprise a white pigment.

9. The fiber according to claim 8, wherein the white pigment is selected from titanium dioxide, barium sulfate and zinc sulfide.
10. A textile comprising the fiber according to anyone of the preceding claims.
11. A carpet comprising the fiber according to anyone of the preceding claims.
12. The fiber according to anyone of the preceding claims having a stain-resistance rating of 1 on the Stain Rating Scale of the Stain Test Method.
13. Method for conferring anti-staining properties to fibers, textiles or carpets comprising using a polymer composition (C) comprising at least 20 wt. % of a semi-aromatic polyamide comprising at least 20 wt. % of recurring units (R) resulting from the condensation of terephthalic acid and an aliphatic diamine selected from the group consisting of 1,8-octanediamine, 1,9-nonanediamine, 2-methyl-1,8-octanediamine, 1,10-decanediamine, 1,12-dodecanediamine, 2,2,4-trimethyl-1,6-hexanediamine, 2,4,4-trimethyl-1,6-hexanediamine, 5-methyl-1,9-nonanediamine, methylcyclohexanediamine, isophoronediamine and mixtures thereof, for the manufacture of said fibers, textiles or carpets.

Patentansprüche

1. Faser aus Polymermasse (C) umfassend mindestens 20 Gew.-% mindestens eines halbaromatischen Polyamids, umfassend mindestens 20 Gew.-% an wiederkehrenden Einheiten (R) aus der Kondensation der Terephthalsäure mit mindestens einem aliphatischen Diamin aus der Gruppe bestehend aus 1,8-Octandiamin, 1,9-Nonandiamin, 2-Methyl-1,8-octandiamin, 1,10-Decandiamin, 1,12-Dodecandiamin, 2,2,4-Trimethyl-1,6-hexandiamin, 2,4,4-Trime-
thyl-1,6-hexandiamin, 5-Methyl-1,9-nonandiamin, Methylcyclohexandiamin, Isophorondiamin und deren Mischungen, wobei ein aus der Polymermasse (C) geformtes Plättchen bei der farbmtrischen Vermessung gemäß ASTM E308-08 im Farbraum CIE 1976 (L*, a*, b*) eine Helligkeit (L*) von mindestens 60 aufweist.
2. Faser nach Anspruch 1, bei der ein aus der Polymermasse (C) geformtes Plättchen bei der farbmtrischen Vermessung gemäß ASTM E308-08 im Farbraum CIE 1976 (L*, a*, b*) eine Helligkeit (L*) von mindestens 70 aufweist.
3. Faser nach Anspruch 1 oder 2, bei der das mindestens eine aliphatische Diamin ausgewählt ist aus der Gruppe bestehend aus 1,9-Nonandiamin, 2-Methyl-1,8-octandiamin, 1,10-Decandiamin, 1,12-Dodecandiamin und deren Mischungen.
4. Faser nach Anspruch 3, bei der das mindestens eine aliphatische Diamin ausgewählt ist aus der Gruppe bestehend aus 1,9-Nonandiamin, 1,10-Decandiamin und deren Mischungen.
5. Faser nach einem der vorhergehenden Ansprüche, bei der das halbaromatische Polyamid ausgewählt ist aus der Gruppe bestehend aus PA9T, PA10T, PA12T und deren Mischungen.
6. Faser nach einem der vorhergehenden Ansprüche, bei der die Polymermasse (C) bezogen auf das Gesamtgewicht der Polymermasse (C) mehr als 30 Gew.-% des halbaromatischen Polyamids umfasst.
7. Faser nach einem der vorhergehenden Ansprüche, bei der die Polymermasse (C) bezogen auf das Gesamtgewicht der Polymermasse (C) ferner mindestens 1 Gew.-% mindestens eines Pigments umfasst.
8. Faser nach Anspruch 7, bei der die Pigmente ein Weißpigment umfassen.
9. Faser nach Anspruch 8, bei der das Weißpigment ausgewählt ist aus Titandioxid, Bariumsulfat und Zinksulfid.
10. Textilie umfassend die Faser gemäß einem der vorhergehenden Ansprüche.
11. Teppich umfassend die Faser gemäß einem der vorhergehenden Ansprüche.
12. Faser nach einem der vorhergehenden Ansprüche mit einem Anschmutzungswiderstand der Note 1 auf der Skala zur Bewertung der Anschmutzung im Fleckschutz-Prüfverfahren.

13. Verfahren zur schmutzabweisenden Ausrüstung von Fasern, Textilien oder Teppichen, bei dem man eine Polymermasse (C) umfassend mindestens 20 Gew.-% eines halbaromatischen Polyamids, umfassend mindestens 20 Gew.-% an wiederkehrenden Einheiten (R) aus der Kondensation von Terephthalsäure und einem aliphatischen Diamin aus der Gruppe bestehend aus 1,8-Octandiamin, 1,9-Nonandiamin, 2-Methyl-1,8-octandiamin, 1,10-Decandiamin, 1,12-Dodecandiamin, 2,2,4-Trimethyl-1,6-hexandiamin, 2,4,4-Trimethyl-1,6-hexandiamin, 5-Methyl-1,9-nonandiamin, Methylcyclohexandiamin, Isophorondiamin und deren Mischungen, zur Herstellung der Fasern, Textilien oder Teppiche verwendet.

Revendications

1. Fibre constituée d'une composition polymère (C) comprenant au moins 20 % en poids d'au moins un polyamide semi-aromatique comprenant au moins 20 % en poids de motifs récurrents (R) résultant de la condensation d'acide téréphthalique et d'au moins une diamine aliphatique choisie dans le groupe constitué par la 1,8-octanediamine, la 1,9-nonanediamine, la 2-méthyl-1,8-octanediamine, la 1,10-décanediamine, la 1,12-dodécanediamine, la 2,2,4-triméthyl-1,6-hexanediamine, la 2,4,4-triméthyl-1,6-hexanediamine, la 5-méthyl-1,9-nonanediamine, la méthylcyclohexanediamine, l'isophoronediamine et les mélanges de celles-ci, la couleur de ladite composition polymère (C) lorsqu'elle est moulée en une plaque ayant une clarté (L*) d'au moins 60 dans l'espace colorimétrique CIE 1976 (L*, a*, b*) lorsqu'elle est mesurée selon l'ASTM E308-08.
2. Fibre selon la revendication 1, la couleur de ladite composition polymère (C) lorsqu'elle est moulée en une plaque ayant une clarté (L*) d'au moins 70 dans l'espace colorimétrique CIE 1976 (L*, a*, b*) lorsqu'elle est mesurée selon l'ASTM E308-08.
3. Fibre selon la revendication 1 ou 2, dans laquelle l'au moins une diamine aliphatique est choisie dans le groupe constitué par la 1,9-nonanediamine, la 2-méthyl-1,8-octanediamine, la 1,10-décanediamine, la 1,12-dodécanediamine et les mélanges de celles-ci.
4. Fibre selon la revendication 3, dans laquelle l'au moins une diamine aliphatique est choisie dans le groupe constitué par la 1,9-nonanediamine, la 1,10-décanediamine et les mélanges de celles-ci.
5. Fibre selon l'une quelconque des revendications précédentes, dans laquelle le polyamide semi-aromatique est choisi dans le groupe constitué par le PA9T, le PA10T, le PA12T et les mélanges de ceux-ci.
6. Fibre selon l'une quelconque des revendications précédentes, la composition polymère (C) comprenant plus de 30 % en poids du polyamide semi-aromatique, rapporté au poids total de la composition polymère (C).
7. Fibre selon l'une quelconque des revendications précédentes, la composition polymère (C) comprenant en outre au moins 1 % en poids d'un ou plusieurs pigments, rapporté au poids total de la composition polymère (C).
8. Fibre selon la revendication 7, dans laquelle les pigments comprennent un pigment blanc.
9. Fibre selon la revendication 8, dans laquelle le pigment blanc est choisi parmi le dioxyde de titane, le sulfate de baryum et le sulfure de zinc.
10. Textile comprenant la fibre selon l'une quelconque des revendications précédentes.
11. Tapis comprenant la fibre selon l'une quelconque des revendications précédentes.
12. Fibre selon l'une quelconque des revendications précédentes ayant une note de résistance aux taches de 1 sur l'échelle de résistance aux taches de la méthode d'essai de tache.
13. Procédé pour conférer des propriétés antitaches à des fibres, des textiles ou des tapis comprenant l'utilisation d'une composition polymère (C) comprenant au moins 20 % en poids d'un polyamide semi-aromatique comprenant au moins 20 % en poids de motifs récurrents (R) résultant de la condensation d'acide téréphthalique et d'une diamine aliphatique choisie dans le groupe constitué par la 1,8-octanediamine, la 1,9-nonanediamine, la 2-méthyl-1,8-octanediamine, la 1,10-décanediamine, la 1,12-dodécanediamine, la 2,2,4-triméthyl-1,6-hexanediamine, la 2,4,4-triméthyl-1,6-hexanediamine, la 5-méthyl-1,9-nonanediamine, la méthylcyclohexanediamine, l'isophoronediamine et

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les mélanges de celles-ci pour la fabrication desdites fibres, textiles ou tapis.

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REFERENCES CITED IN THE DESCRIPTION

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