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(54) **Title:** REINFORCED POLYAMIDE COMPOSITIONS COMPRISING TITANIUM DIOXIDE-COATED MICA FLAKES

(57) **Abstract:** Disclosed herein are reinforced polyamide compositions that comprise: reinforced polyamide composition comprises (a) at least one semi-crystalline polyamide; (b) about 8-60 wt% of glass fibers; and (c) about 0.1-5 wt% of TiO₂-coated mica flakes. Further disclosed herein are articles formed of the reinforced polyamide compositions.



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**REINFORCED POLYAMIDE COMPOSITIONS COMPRISING TITANIUM
DIOXIDE-COATED MICA FLAKES**

TECHNICAL FIELD

5 The disclosure is related to reinforced polyamide compositions containing TiO₂-coated mica flakes.

BACKGROUND

10 In order to further reduce the weight of portable electronic devices (such as laptop computers, tablet devices, mobile phones, hand-held play stations, etc.), light weight reinforced thermoplastic polymer materials (i.e., thermoplastic polymers incorporating reinforcing agents, such as glass fibers) have become more and more popular as the preferred materials to form the housing components. To achieve the desired mechanical strength, such

15 housing components are typically made using an injection molding process, during which the reinforcing agents are oriented and well-dispersed within the polymer matrix. Also, to provide a light or gray color to the housing components, inorganic white pigments (such as TiO₂ particles) with high refractive index are often added into the reinforced thermoplastic polymer

20 materials alone or in combination with carbon black. However, it is found that TiO₂ particles can be abrasive as to the reinforcing agents and therefore reduces the mechanical strength of the molded parts. ZnS also has been used as white pigments in reinforced thermoplastic polymer materials. However, the refractive index of ZnS is not as high as that of TiO₂. Thus,

25 there is still a need to develop a novel type of light colored particles with high refractive index and could be used in reinforced polyamides without compromising the mechanical properties thereof.

SUMMARY

The purpose of the present disclosure is to provide a reinforced polymer composition, which comprises: (a) at least one semi-crystalline polyamide; (b) 8-60 wt% of glass fibers; (c) 0.1-5 wt% of TiO₂-coated mica flakes, with the total wt% of all components comprised in the reinforced polymer composition totaling to 100 wt%, and wherein, the TiO₂-coated mica flakes comprise a core formed of mica flakes and the core is coated with 10-50 wt% of TiO₂, based on the total weight of the TiO₂-coated mica flakes.

In one embodiment of the reinforced polyamide composition, the composition comprises 0.5-5 wt%, or 0.5-3 wt% of the TiO₂-coated mica flakes, based on the total weight of the reinforced polyamide composition.

In a further embodiment of the reinforced polyamide composition, the at least one semi-crystalline polyamide is selected from the group consisting of aliphatic polyamides and semi-aromatic polyamides.

In a yet further embodiment of the reinforced polyamide composition, the at least one semi-crystalline polyamide is an aliphatic polyamide selected from the group consisting of 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 combinations of two or more thereof.

In a yet further embodiment of the reinforced polyamide composition, the at least one semi-crystalline polyamide is a semi-aromatic polyamide selected from the group consisting of polyamide MXD,6; polyamide 12,T;

polyamide 10,T; polyamide 9,T; polyamide 6,T/6,6; polyamide 6,T/6,I;
polyamide 6,T/D,T; polyamide 6,6/6,T/6,I; polyamide 6/6,T; polyamide 4,T;
and combinations of two or more thereof.

In a yet further embodiment of the reinforced polyamide composition,
5 the at least one semi-crystalline polyamide is selected from the group
consisting of polyamide 6; polyamide 6,6; polyamide 6,10; polyamide 10,10;
polyamide 6,T/6,6; polyamide 6,T/D,T; and combinations of two or more
thereof.

In a yet further embodiment of the reinforced polyamide composition,
10 the reinforced polyamide composition comprises 10-92 wt% of the at least
one semi-crystalline polyamide.

In a yet further embodiment of reinforced polyamide composition, the
glass fibers have non-circular cross sections.

In a yet further embodiment of the reinforced polyamide composition,
15 the reinforced polyamide composition comprises 10-55 wt%, or 20-55 wt% of
the glass fibers, based on the total weight of the reinforced polyamide
composition.

In a yet further embodiment of the reinforced polyamide composition,
the composition further comprises up to 0.02 wt% or 0.001-0.02 wt% of
20 carbon black based on the total weight of the reinforced polyamide
composition.

Further disclosed herein is an article formed of the reinforced
polyamide composition disclosed above.

In one embodiment of the article, the article is an injection molded
25 article.

In a further embodiment of the article, the article is a housings
component for an electronic device, preferably a housing component for a
computer.

In accordance with the present disclosure, when a range is given with two particular end points, it is understood that the range includes any value that is within the two particular end points and any value that is equal to or about equal to any of the two end points.

5

DESCRIPTION

Disclosed herein are reinforced polyamide compositions containing TiO₂-coated mica flakes. The reinforced polyamide composition comprises (a) at least one semi-crystalline polyamide; (b) about 8-60 wt% of glass fibers; and (c) about 0.1-5 wt% of the TiO₂-coated mica flakes, with the total wt% of all components comprised in the reinforced polyamide composition totaling to 100 wt%.

Polyamides are (a) condensation products of one or more dicarboxylic acids and one or more diamines, or (b) condensation products of one or more aminocarboxylic acids, or (c) ring opening polymerization products of one or more cyclic lactams. The aromatic polyamides used herein may be homopolymers, copolymers, terpolymers or higher polymers containing at least one aromatic monomer component. For example, an aromatic polyamide may be obtained by using an aliphatic dicarboxylic acid and an aromatic diamine, or an aromatic dicarboxylic acid and an aliphatic diamine as starting materials and subjecting them to polycondensation.

Suitable diamines used herein may be selected from aliphatic diamines, alicyclic diamines, and aromatic diamines. Exemplary diamines useful herein include, without limitation, tetramethylenediamine; hexamethylenediamine; 2-methylpentamethylenediamine; nonamethylenediamine; undecamethylenediamine; dodeca-methylenediamine; 2,2,4-trimethylhexamethylenediamine; 2,4,4-trimethylhexamethylenediamine; 5-methylnonamethylene-diamine; 1,3-

bis(aminomethyl)cyclohexane; 1,4-bis(aminomethyl)cyclohexane; 1-amino-3-aminomethyl-3,5,5-trimethylcyclohexane; bis(4-aminocyclohexyl)methane; bis(3-methyl-4-aminocyclohexyl)methane; 2,2-bis(4-aminocyclohexyl)propane; bis(aminopropyl)piperazine; aminoethylpiperazine; bis(p-aminocyclohexyl)methane; 2-methyloctamethylenediamine; trimethylhexamethylenediamine; 1,8-diaminooctane; 1,9-diaminononane; 1,10-diaminodecane; 1,12-diaminododecane; m-xylylenediamine; p-xylylenediamine; and the like and derivatives thereof.

- 10 Suitable dicarboxylic acids used herein may be selected from aliphatic dicarboxylic acids, alicyclic dicarboxylic acids, and aromatic dicarboxylic acids. Exemplary dicarboxylic acids useful herein include, without limitation, adipic acid; sebacic acid; azelaic acid; dodecanedioic acid; terephthalic acid; isophthalic acid; phthalic acid; glutaric acid; pimelic acid; suberic acid; 1,4-cyclohexanedicarboxylic acid; naphthalenedicarboxylic acid; and the like and the like and derivatives thereof.
- 15

 The term "semi-crystalline" used herein means that the heat of crystal melting measured on a differential scanning calorimeter (DSC) is at least about 5 cal/g. The semi-crystalline polyamides used herein may be aliphatic polyamides (i.e., polyamides containing no aromatic ring in the molecular chain) or semi-aromatic polyamides (i.e., homopolymers, copolymers, terpolymers, or higher order polymers containing at least one aromatic monomer component).

20

 Exemplary semi-crystalline aliphatic polyamides used herein include, without limitation, 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;

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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 the like.

Exemplary semi-crystalline semi-aromatic polyamides include,
5 without limitation, poly(m-xylylene adipamide) (polyamide MXD,6),
poly(dodecamethylene terephthalamide) (polyamide 12,T),
poly(decamethylene terephthalamide) (polyamide 10,T), poly(nonamethylene
terephthalamide) (polyamide 9,T), hexamethylene adipamide/hexamethylene
terephthalamide copolyamide (polyamide 6,T/6,6), poly(hexamethylene
10 terephthalamide/hexamethylene isophthalamide) (polyamide 6,T/6,I) (e.g.,
polyamide 6,T/6,I having at least about 55 mol% of its repeating units derived
from 6,T), hexamethylene terephthalamide/2-methylpentamethylene
terephthalamide copolyamide (polyamide 6,T/D,T); hexamethylene
adipamide/hexamethylene terephthalamide/hexamethylene isophthalamide
15 copolyamide (polyamide 6,6/6,T/6,I); poly(caprolactam-hexamethylene
terephthalamide) (polyamide 6/6,T); poly(tetramethylene terephthalamide)
(polyamide 4,T); and the like.

In one embodiment, the semi-crystalline polyamides used herein are
selected from polyamide 6; polyamide 6,6; polyamide 6,10; polyamide 10,10;
20 polyamide 6,T/6,6; polyamide 6,T/D,T; and combinations of two or more
thereof.

It is understood that the reinforced polyamide compositions disclosed
herein may also contain certain amounts of amorphous polyamides.
Amorphous polyamides are those having a heat of crystal melting (measured
25 on DSC) of about 1 cal/g or less). In those embodiments wherein
amorphous polyamide(s) are included in the reinforced polyamide
compositions, the weight ratio between the amorphous polyamides and the
semi-crystalline polyamides needs to be below 2:1.

Based on the total weight of the reinforced polyamide composition disclosed herein, the at least one semi-crystalline polyamide may be present at a level of about 10-92 wt%.

The glass fibers used herein may be those having circular or
5 non-circular cross sections. In a further embodiment, the glass fibers used herein have non-circular cross sections.

Glass fibers having non-circular cross sections are those glass fibers having a major axis lying perpendicular to a longitudinal direction of the fiber and corresponding to the longest linear distance in the cross section. The
10 non-circular cross section also has a minor axis corresponding to the longest linear distance in the cross section in a direction perpendicular to the major axis. The non-circular cross section of the fiber may have a variety of shapes including a cocoon-type shape, a rectangular shape, an elliptical shape, a semielliptical shape, a roughly triangular shape, a polygonal shape,
15 an oblong shape, and the like. As will be understood by those skilled in the art, the cross section may have other shapes. The ratio of the length of the major axis to that of the minor access 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. Suitable glass fibers
20 having non-circular cross sections are disclosed in EP 0 190 001 and EP 0 196 194. The glass fibers 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.

In accordance with the present disclosure, the glass fibers may be
25 present in the reinforced polyamide composition at a level of about 8-60 wt%, or about 10-55 wt%, or about 20-55 wt%, based on the total weight of the composition.

The TiO₂-coated mica flakes used herein are formed of

platelet-shaped mica flakes having on the surfaces thereof, a coating layer of TiO_2 . Such TiO_2 -coated mica flakes are well-known in the art and also referred to as nacreous or lustrous pigments.

In accordance with the present disclosure, the mica flakes used
5 herein include both naturally occurring mica flakes and synthetic mica flakes, while the TiO_2 particles used in forming the coating layers may be in the anatase form or the rutile form. Preferably, the TiO_2 particles used herein are in the rutile form. Also, the mica flakes used herein may have a major dimension ranging from about 1-75 μm and a specific surface area ranging
10 from about 1-7 m^2/g . The TiO_2 particles used herein for forming the coating layer may have a particle size less than about 0.1 μm . And, the TiO_2 coating layer may have a thickness ranging from about 20-350 nm.

The TiO_2 -coated mica flakes used herein may be prepared by any suitable process known in the art. For example, mica flakes coated with
15 TiO_2 in the anatase form and exemplary processes for making the same are disclosed in U.S. Patent Nos. 3,437,515; 3,418,146; and 3,087,828, while, mica flakes coated with TiO_2 in the rutile form and exemplary processes for making the same are disclosed in U.S. Patent Nos., 4,038,099; 4,086,100; and 4,867,794. More preferably, the TiO_2 -coated mica flakes used herein
20 are prepared by the processes disclosed in U.S. Patent No. 4,867,794, in which the process include first precipitating SnO_2 directly on the surface of the mica flakes and completing this precipitation before precipitating TiO_2 over the surfaces. In such embodiments, a minimum amount of SnO_2 (i.e., up to about 1 wt%, or up to about 0.25 wt%, relative to the weight of the mica
25 flakes) are coated over the surfaces of the mica flakes before the TiO_2 coating layer is applied.

The TiO_2 -coated mica flakes used herein also are commercially available from various vendors. For example, the TiO_2 -coated mica flakes

used herein may be purchased from Merck Performance Materials (Germany) under the trade name IriodinTM 100 and 103; from ECKART (Germany) under the trade names PHOENIXTM or SYMICTM; from BASF (Germany) under trade names MearlinTM Bright Silver, MearlinTM Bright White or GlacierTM White; or from Kobo (USA) under the trade name KTZTM White Pearlescent Pigments.

In accordance with the present disclosure, the TiO₂-coated mica particles may be present in the reinforced polyamide compositions at a level of about 0.1-5 wt%, or about 0.5-5 wt%, or about 0.5-3 wt%, based on the total weight of the composition.

Preferably, the reinforced polyamide compositions may further comprise up to about 0.02 wt%, or about 0.001-0.02 wt% of carbon black, based on the total weight of the composition.

Other suitable additives also may be included in the reinforced polyamide compositions. Such other additives may include, without limitation, flame retardant, impact modifiers, ultraviolet light stabilizers, heat stabilizers, antioxidants, flow enhancers, processing aids, lubricants, colorants (including dyes, pigments, carbon black, and the like), and combinations of two or more thereof.

The reinforced polyamide compositions disclosed herein may be prepared by melt-blending the components using any known methods. The component materials may be mixed to uniformity using a melt-mixer such as a single or twin-screw extruder, blender, kneader, Banbury mixer, etc. to give a resin composition. Or, part of the materials may be mixed in a melt-mixer, and the rest of the materials may then be added and further melt-mixed until uniform.

Further disclosed herein are articles formed of the reinforced polyamide compositions disclosed herein. The reinforced polyamide

compositions disclosed herein may be formed into articles using any known melt-processing means such as injection molding, blow molding, extrusion, or thermoforming. Articles molded using injection molding are most preferred.

The articles as such prepared typically have a non-transparent light or grey color. In those embodiments wherein no carbon black is added, the final article has a light color. And a desired color shade of the final article can be achieved by adjusting the content level of the TiO_2 -coated mica flakes. While in other embodiments wherein carbon black is added, the final article has a grey color. A desired color shade of the final article can be achieved by adjusting the weight ratio between the TiO_2 -coated mica flakes and the carbon black.

As demonstrated by the examples below, unlike other inorganic white pigments with high refractive index (such as ZnS or TiO_2 particles), the addition of TiO_2 -coated mica flakes in reinforced polyamide composition affords the articles formed therefrom a desirable light color without compromising the mechanical strength thereof.

In accordance with the present disclosure, the articles disclosed herein may be component parts of electronic devices (such as desktop computers, laptop computers, tablet devices, mobile phones, hand-held play stations, etc.), appliances, furniture, industrial equipment, office supplies, sporting goods, aircrafts, automotive, trains, railroads, healthcare apparatus, etc. In certain embodiments, the injection molded articles are used as housings for electronic devices, such as computers.

EXAMPLES

Material:

- PC: polycarbonate resin obtained from Styron (U.S.A.) under the trade name CaliberTM 201-22;

- PA66: polyamide 66 having a heat of crystal melting of 17 cal/g (measured on a DSC) and obtained from E.I. du Pont de Nemours and Company (U.S.A.) (hereafter "DuPont") under trade name Zytel® 101
- 5 • PA6T/66: polyamide 6T/66 having a heat of crystal melting of 14 cal/g (measured on a DSC) and obtained from DuPont under trade name Zytel® HTN 502HF;
- PA6I/6T: amorphous polyamide 6I/6T obtained from DuPont under trade name Zytel® HTN 503;
- 10 • GF-1: glass fiber obtained from Nippon Electric Glass Co., Ltd. (Japan) under the trade name NDG 187H;
- GF-2: glass fiber obtained from Nippon Electric Glass Co., Ltd. under the product name NDG 262H;
- GF-3: glass fiber obtained from Nitto Boseki Co., Ltd. (Japan) under the product name CSG 3PA-820;
- 15 • CB-1: carbon black obtained from Cabot Corporation (U.S.A.) under the trade name of VULCAN™ XC72R;
- CB-2: 20 wt% carbon black concentrate in Zytel® HTN 502HF resin;
- 20 • TiO₂-C-Mica: mica flakes coated with about 29 wt% of titanium dioxide and about 1 wt% of tin dioxide, which was obtained from Merck KGaA (Germany) under the trade name Iriodin™ 103;
- TiO₂-C-Al₂O₃: alumina flakes coated with about 37 wt% of titanium dioxide, which was obtained from Merck KGaA under the trade name of Xirallic™ T61-10;
- 25 • ZnS: zinc sulfide in powder form, which was obtained from Sachtleben Chemie GmbH (Germany) under the trade name of Sachtolith™ HDS;

- Mica: mica flakes obtained from Shijiazhuang Chenxing Industry Co., Ltd (China);
- SnO₂: tin dioxide obtained from Sinopharm Chemical Reagent Co. Ltd. (China);
- 5 • TiO₂: rutile phase titanium dioxide obtained from Cristal Global (Saudi Arabia) under the trade name of TionaTM RCL 69.
- FR (Flame-retardant): an aluminum diethylphosphinate based halogen-free flame-retardant obtained from Clariant (Switzerland) under the trade name ExolitTM OP1230;
- 10 • BMT: boehmite, a flame retardant synergist obtained from Kawai Sekkai Kogyo K.K. (Japan) under the trade name CelasuleTM BMT-33;
- HS (Heat Stabilizer): a blend of potassium iodide/copper iodide/aluminum distearate (weight ratio at 7:1:0.5) obtained from
- 15 Shepherd Chemical Company (U.S.A.);
- Lubricant-1: Aluminum distearate obtained from Shepherd Chemical Company;
- Lubricant-2: calcium montanate obtained from Clariant under the trade name LicomontTM CaV102;
- 20 • AO (Antioxidant): a 1:1 (by weight) mixture of Irganox 1010 and Irgafos 168 both obtained from BASF (Germany);
- NDA: naphthalene-2,6-dicarboxylic acid obtained from Mitsubishi Gas Chemical Company (Japan);
- ZB: Zinc borate obtained from US Borax (U.S.A.) under the trade
- 25 name FirebrakeTM ZB.

Comparative Examples CE1-CE7 and Examples E1:

In each of the Comparative Examples CE1-CE7 and Example E1, a polyamide composition (all components are listed in Table 1) was prepared

by compounding in a 32 mm ZSK twin screw extruder. All components were blended together and added to the rear of the extruder except that glass fibers were side-fed into a downstream barrel and FR was side-fed into a further downstream barrel. Barrel temperatures were set at about 310°C.

- 5 After exiting the extruder, the blended compositions were cooled and cut into resin pellets. The resin pellets used were then surface coated with 0.2 wt% of calcium montanate.

Thereafter, molded articles for the measurement of tensile strength, color lightness, and notched charpy impact strength were prepared on a
10 Sumitomo 100T injection molding machine, wherein the cylinder temperature was set at about 300°C and the molding temperature was set at about 100-120°C.

The tensile strength value for each sample was measured in accordance with ISO527-1/2; the notched charpy value for each sample was
15 measured in accordance with ISO179/1eA; and the color lightness for each sample was measured at D65/10° in accordance with ASTM E313, using a X-RiteColor Premier 8200 Benchtop Spectrophotometer (manufactured by X-Rite (U.S.A.)). The measurements are tabulated in Table 1 below.

Furthermore, the coated resin pellets obtained above were injection
20 molded into parts with an injection molding machine at the same molding conditions described above. After a continuous run for 24 hours, the diameter of the check ring located in the injection molding extruder were measured.

As demonstrated herein, when TiO₂ particles were added into
25 flame-retardant and glass-reinforced polyamides, although the color lightness of the molded part was improved, the notched charpy was very much deteriorated (see CE2-CE4 versus CE1). However, when flakes of TiO₂-C-Mica were added in place of TiO₂ particles, the color lightness of the molded part was improved without deteriorating the notched charpy thereof.
30 While on the other hand, the addition of mica flakes (CE6) failed to improve the color lightness of the molded parts, and flakes of TiO₂-C-Al₂O₃ (CE5) failed to retain good notched charpy performance. Moreover, the addition of ZnS

particles (CE7), although improved the color lightness of the molded part, major corrosion was observed.

Comparative Examples CE8-CE15 and Examples E2-E3

5 Similarly to the above, resin pellets and molded parts were prepared in each of the Comparative Example CE8-CE15 and Examples E2-E3 (all components are listed in Table 2). Here again, it is demonstrated that when TiO₂ particles (CE9 or CE10), or mixture of mica flakes, SnO₂ particles, and TiO₂ particles (CE11), or mica flakes (CE12 and CE13), or SnO₂ particles
10 (CE14) were added into polyamides, the notched charpy of the molded parts were very much deteriorated. However, when, flakes of TiO₂-C-Mica were added, the notched charpy of the molded part remained acceptable (E2).

Comparative Examples CE16-CE17

15 Similarly to the above, resin pellets and molded parts were prepared in each of the Comparative Example CE16 and CE17 (all components are listed in Table 3). It is demonstrated herein that, unlike in semi-crystalline polyamides, when TiO₂ particles and glass fibers are added into polycarbonates (CE16), the impact strength of the molded parts thereof
20 remained comparable with that of the molded parts having TiO₂-coated mica flakes and glass fibers added into polycarbonates (CE17).

TABLE 1

Samples	CE1	CE2	CE3	E1	CE4	CE5	CE6	CE7
Compositions								
PA6T/66 (wt%)	17.32	16.82	16.82	16.82	16.82	16.89	16.45	14.85
PA6I/6T (wt%)	22.83	22.33	23.04	22.33	22.33	22.45	21.7	19.92
ZB (wt%)	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
NDA (wt%)	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
Lubricant-2 (wt%)	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
CB-2 (wt%)	0.02	0.02	0.02	0.02	0.02	0.02	0.02	
GF (wt%)	50	50	50	50	50	50	50	50
FR (wt%)	9	9	9	9	9	9	9	9
BMT (wt%)	0.1	0.1	0.1	0.1	0.1	0.1	0.1	1.5
TiO ₂ -C-Mica (wt%)	-	-	-	1	-	-	-	-
TiO ₂ -C-Al ₂ O ₃ (wt%)	-	-	-	-	-	0.81	-	-
ZnS (wt%)	-	-	-	-	-	-	-	4
Mica (wt%)	-	-	-	-	0.7	-	2	-
SnO ₂ (wt%)	-	-	-	-	0.01	-	-	-
TiO ₂ (wt%)	-	1	0.29	-	0.29	-	-	-
Properties								
Tensile Strength (MPa)	219	N/D	N/D	211	N/D	N/D	N/D	N/D
Notched Charpy (KJ/m ²)	14.3	6.4	7.6	14.1	7.8	9.6	15.9	11
Corrosion	N/D	N/D	N/D	N	N/D	N/D	N/D	Y
Color lightness	33.9	70.3	58	57.7	58.3	58.4	40.1	72.5

Note: N/D – not determined;

N – reduction of the check ring diameter was not observed;

5

Y – reduction of the check ring diameter was observed.

TABLE 2

Samples	CE8	CE9	CE10	CE11	CE12	CE13	CE14	E2	CE15	E3
Compositions										
PA66 (wt%)	69.6	69.02	67.6	67.6	68.2	67.6	69.58	67.6	89.31	88.6
HS (wt%)	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Lubricant-2 (wt%)	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
GF-2 (wt%)	30	30	30	30	30	30	30	30	10	10
TiO ₂ -C-Mica (wt%)	-	-	-	-	-	-	-	2	-	1
Mica (wt%)	-	-	-	1.4	1.4	2	-	-	-	-
SnO ₂ (wt%)	-	-	-	0.02	-	-	0.02	-	-	-
TiO ₂ (wt%)	-	0.58	2	0.58	-	-	-	-	0.29	-
Properties										
Tensile Strength (MPa)	185	145	137	142	151	156	157	166	N/D	N/D
Notched Charpy (KJ/m ²)	10	4.6	3.9	4.7	5.6	6.6	5.9	7.1	2.1	3.1

Note: N/D - not determined.

TABLE 3

Samples	CE16	CE17
Compositions		
PC (wt%)	89.41	88.7
AO (wt%)	0.3	0.3
CB-1 (wt%)	0.004	0.004
GF-1 (wt%)	10	10
TiO ₂ -C-Mica (wt%)	-	1
TiO ₂ (wt%)	0.29	-
Properties		
Notched Charpy (KJ/m ²)	6	6.1

Note: N/D - not determined.

WHAT IS CLAIMED IS:

1. A reinforced polyamide composition, wherein the reinforced polyamide composition comprises:
 - 5 (a) at least one semi-crystalline polyamide;
 - (b) 8-60 wt% of glass fibers;
 - (c) 0.1-5 wt% of TiO_2 -coated mica flakes,with the total wt% of all components comprised in the reinforced polymer composition totaling to 100 wt%, and
 - 10 wherein, the TiO_2 -coated mica flakes comprise a core formed of mica flakes and the core is coated with 10-50 wt% of TiO_2 , based on the total weight of the TiO_2 -coated mica flakes.
2. The reinforced polyamide composition of Claim 1, which comprises 0.5-5
 - 15 wt%, or 0.5-3 wt% of the TiO_2 -coated mica flakes, based on the total weight of the reinforced polyamide composition.
3. The reinforced polyamide composition of Claim 1, wherein the at least one semi-crystalline polyamide is selected from the group consisting of
 - 20 aliphatic polyamides and semi-aromatic polyamides.
4. The reinforced polyamide composition of Claims 3, wherein the at least one semi-crystalline polyamide is an aliphatic polyamide selected from the group consisting of polyamide 6; polyamide 6,6; polyamide 4,6;
 - 25 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 combinations of
two or more thereof.

- 5 5. The reinforced polyamide composition of Claims 3, wherein the at least
one semi-crystalline polyamide is a semi-aromatic polyamide selected
from the group consisting of polyamide MXD,6; polyamide 12,T;
polyamide 10,T; polyamide 9,T; polyamide 6,T/6,6; polyamide 6,T/6,I;
polyamide 6,T/D,T; polyamide 6,6/6,T/6,I; polyamide 6/6,T; polyamide
10 4,T; and combinations of two or more thereof.
6. The reinforced polyamide composition of Claims 3, wherein the at least
one semi-crystalline polyamide is selected from the group consisting of
polyamide 6; polyamide 6,6; polyamide 6,10; polyamide 10,10;
15 polyamide 6,T/6,6; polyamide 6,T/D,T; and combinations of two or more
thereof.
7. The reinforced polyamide composition of Claim 1, wherein, the
reinforced polyamide composition comprises 10-92 wt% of the at least
20 one semi-crystalline polyamide.
8. The reinforced polyamide composition of Claim 1, wherein, the glass
fibers have non-circular cross sections.
- 25 9. The reinforced polyamide composition of Claim 1, wherein the reinforced
polyamide composition comprises 10-55 wt%, or 20-55 wt% of the glass
fibers, based on the total weight of the reinforced polyamide composition.
10. The reinforced polyamide composition of Claim 1, further comprising up
30 to 0.02 wt%, or 0.001-0.02 wt% of carbon black based on the total weight

of the reinforced polyamide composition.

11. An article formed of the reinforced polyamide composition of Claim 1.

5 12. The article of Claim 11, which is an injection molded article.

13. The article of Claim 11, which is a housings component for an electronic device.

10 14. The article of Claim 13, which is a housing component for a computer.

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2014/032512

A. CLASSIFICATION OF SUBJECT MATTER
INV. C08J5/10
ADD. C08L77/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
C08J

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EP0-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP S63 97656 A (DAINIPPON INK & CHEMICALS) 28 April 1988 (1988-04-28) abstract	1
A	JP H09 104774 A (BANPOO KOGYO KK) 22 April 1997 (1997-04-22) abstract	1
A	US 2002/099117 A1 (JEONG KIE-YOUN [KR] ET AL) 25 July 2002 (2002-07-25) claims 1,4	1



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

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"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/US2014/032512

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