1 wt% to 2 wt% nigrosine; from 0.1 wt% to 1 wt% heat stabilizer; less than 20 wt% PA6 polyamide polymer; less than 3 wt% carbon black; and less than 1 wt% melt stabilizer. In some cases, the impact modifier comprises a maleic anhydride-modified olefin, acrylate, or acrylic, or combinations thereof; and the weight ratio of the impact modifier to the melt stabilizer ranges from 5 to 50; and the melt stabilizer comprises a saturated fatty acid wherein the polyamide composition; and wherein the polyamide composition demonstrates a tensile elongation greater than 2.5 %; and an un-notched Charpy impact energy loss at -40 °C that is greater than 65 kJ/m^2. In some cases, the polyamide composition comprises from 13 wt% to 68 wt% of a PA66 polyamide polymer; from 25 wt% to 40 wt% glass fiber; and the polyamide composition has a notched Charpy impact energy loss at 23 °C greater than 11 kJ/m^2.

[0006a] In one aspect, the present disclosure refers to an impact-modified polyamide composition comprising: from 13~~5~~ wt% to 68~~85~~ wt% of a PA66 polyamide polymer; from 25~~10~~ wt% to 40~~60~~ wt% glass fiber; from 3 wt% to 30 wt% of an impact modifier; nigrosine at a concentration from 1 wt% to 2 wt%; heat stabilizer at a concentration from 0.1 wt% to 1 wt%; PA6 polyamide polymer at a concentration less than 20 wt%; carbon black at a concentration less than 3 wt%; and a melt stabilizer at a concentration less than 1~~5~~ wt%, wherein the melt stabilizer comprises stearic acid; wherein the weight ratio of the impact modifier to the melt stabilizer ranges from 1.0:1 to 100:1; and wherein the polyamide composition demonstrates an un-notched Charpy impact energy loss at 23 °C that is greater than 80 kJ/m^2 and a tensile strength greater than 135 MPa.

[0007] In another example the disclosure relates to a method of preparing a polyamide composition. The method includes providing one or more polyamide polymers, glass fiber, an impact modifier, and an optional heat stabilizer. The method further includes combining the one or more polyamide polymers, the glass fiber, the impact modifier, and the heat stabilizer to produce the polyamide composition. In certain examples, the method further includes providing nigrosine, and adding the nigrosine to the polyamide composition. In certain examples, the method further includes providing carbon black, and adding the carbon black to the polyamide composition. In some examples, the method further includes providing a melt stabilizer, and adding the melt stabilizer to the polyamide composition.

[0008] In another example, the disclosure is to an injection molded article. The article includes any of the provided polyamide compositions. In one aspect, the present disclosure refers to an injection molded article comprising the polyamide composition disclosed herein.

DETAILED DESCRIPTION

[0009] The present disclosure generally relates to polyamide compositions that, when employed for example in injection molded applications, provide advantageous improvements in both strength and impact resistance, e.g., toughness. For example, it is beneficial for molded thermoplastic parts to have a high degree of rigidity and stiffness, allowing them to provide sufficient strength in applications calling for lightweight constructions materials that can be substituted for metals. It is also beneficial for molded plastics to have adequate impact resistance to enable the material to minimize unwanted vibrations and better absorb impact forces.

We claim:

1. An impact-modified polyamide composition comprising:

from 13~~5~~ wt% to 68~~85~~ wt% of a PA66 polyamide polymer;

from 25~~10~~ wt% to 40~~60~~ wt% glass fiber;

from 3 wt% to 30 wt% of an impact modifier;

nigrosine at a concentration from 1 wt% to 2 wt%;

heat stabilizer at a concentration from 0.1 wt% to 1 wt%;

PA6 polyamide polymer at a concentration less than 20 wt%;

carbon black at a concentration less than 3 wt%; and

a melt stabilizer at a concentration less than 1~~5~~ wt%, wherein the melt stabilizer comprises stearic acid;

wherein the weight ratio of the impact modifier to the melt stabilizer ranges from 1.0:1 to 100:1; and

wherein the polyamide composition demonstrates an un-notched Charpy impact energy loss at 23 °C that is greater than 80 kJ/m^2 and a tensile strength greater than 135 MPa.

2. The polyamide composition of claim 1, wherein the weight ratio of the PA66 polyamide polymer to the glass fiber ranges from 0.1 to 10.

3. The polyamide composition of claim 1, wherein the weight ratio of the PA66 polyamide polymer to the impact modifier ranges from 0.2 to 30.

4. The polyamide composition of claim 1, wherein the weight ratio of the impact modifier to the melt stabilizer ranges from 1:1 to 40:1.

5. The polyamide composition of claim 1, wherein the polyamide composition demonstrates a 60º tan delta greater than 0.04.

6. The polyamide composition of claim 1, wherein the polyamide composition demonstrates a 90º tan delta greater than 0.1.

7. The polyamide composition of claim 1, wherein the impact modifier comprises a modified olefin.

8. The polyamide composition of claim 1, wherein the impact modifier comprises a maleic anhydride-modified olefin, acrylate, or acrylic, or combinations thereof.

9. The polyamide composition of claim 1, wherein the impact modifier comprises a maleic anhydride-modified olefin.

10. The polyamide composition of claim 1, wherein the impact modifier has a glass transition temperature less than 0ºC.

~~11. The polyamide composition of claim 1, wherein the melt stabilizer comprises a saturated fatty acid.~~

~~12. The polyamide composition of claim 1, wherein the melt stabilizer comprises stearic acid.~~

~~13.~~11. The polyamide composition of claim 1, wherein the weight ratio of the glass fiber to the impact modifier ranges from 0.3 to 20.

~~14.~~12. The polyamide composition of claim 1, wherein the weight ratio of the impact modifier to the heat stabilizer ranges from 0.5 to 300.

~~15.~~13. The polyamide composition of claim 1, wherein

the impact modifier comprises a maleic anhydride-modified olefin, acrylate, or acrylic, or combinations thereof; and the weight ratio of the impact modifier to the melt stabilizer ranges from 5 to 50; and the melt stabilizer comprises a saturated fatty acid wherein the polyamide composition; and wherein the polyamide composition demonstrates a tensile elongation greater than 2.5 %; and an un-notched Charpy impact energy loss at -40 °C that is greater than 65 kJ/m^2.

~~16. The polyamide composition of claim 1, wherein the polyamide polymer comprises a PA66 polymer.~~

~~17.~~14. The polyamide composition of claim 1, wherein the number average molecular weight of each of the PA66 polyamide polymers is independently less than 100,000.

~~18.~~15. The polyamide composition of claim 1, comprising:

from 13 wt% to 68 wt% of a PA66 polyamide polymer;

from 25 wt% to 40 wt% glass fiber; wherein

the polyamide composition has a notched Charpy impact energy loss at 23 °C greater than 11 kJ/m^2.

~~19. The polyamide composition of claim 1, comprising:~~

~~from 13 wt% to 68 wt% PA66 polyamide polymer;~~

~~from 25 wt% to 40 wt% glass fiber;~~

~~impact modifier;~~

~~from 1 wt% to 2 wt% nigrosine;~~

~~from 0.1 wt% to 1 wt% heat stabilizer;~~

~~less than 20 wt% PA6 polyamide polymer;~~

~~less than 3 wt% carbon black; and~~

~~less than 1 wt% melt stabilizer.~~

~~20.~~16. An injection molded article comprising the polyamide composition of claim 1.