[0005] In addition to the providing of mechanical strength, automotive applications also commonly require impact resistance, e.g., minimization of cabin noise, vibration, and harshness optionally via deformation. These performance characteristics, however, are often associated with conventional polyamide compositions, which have not been designed for imparting increased strength. In view of the existing art, the need therefore remains for improved polyamide compositions that effectively deliver both strength and impact resistance, e.g., toughness, as may be quantified by notched Izod and Charpy impact energy losses.

SUMMARY

[0006] In one example, the disclosure is to an impact-modified polyamide composition including (from 5 wt% to 85 wt%) of one or more polyamide polymers, (10 wt% to 60 wt%) of glass fiber, (from 3 wt% to 30 wt%) of an impact modifier, e.g., a modified olefin, for example a maleic anhydride-modified olefin, acrylate, or acrylic, or combinations thereof, (less than 5 wt.%) of a melt stabilizer, e.g., a saturate fatty acid, for example stearic acid, and an optional (less than 5 wt.%) of heat stabilizer. The weight ratio of the impact modifier to the melt stabilizer may range from 1.0:1 to 100:1. The polyamide composition may demonstrate an un-notched Charpy impact energy loss at 23 °C that is greater than 80 kJ/m^2 and/or a tensile strength greater than 135 MPa. In certain examples, the one or more polyamide polymers includes a PA66 polymer and/or a PA6 polymer and/or has a number average molecular weight less than 100,000. In certain examples, the impact modifier includes an ethylene-octene copolymer. In certain examples, the polyamide composition includes nigrosine at a concentration less than 5 wt%. In certain examples, the polyamide composition includes carbon black at a concentration less than 5 wt%. In some cases, the polyamide composition demonstrates a 60º tan delta greater than 0.04; and/or a 90º tan delta greater than 0.1. The impact modifier may have a glass transition temperature less than 0ºC. In some cases, the weight ratio of the polyamide polymer to the glass fiber may range from 0.1 to 10; and/or the weight ratio of the polyamide polymer to the impact modifier may range from 0.2 to 30; and/or the weight ratio of the impact modifier to the melt stabilizer ranges from 1:1 to 40:1; and/or the weight ratio of the glass fiber to the impact modifier ranges from 0.3 to 20; and/or the weight ratio of the impact modifier to the heat stabilizer ranges from 0.5 to 300. In some examples, the polyolefin comprises 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. 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 5 wt% to 85 wt% of polyamide polymer; from 10 wt% to 60 wt% glass fiber; from 3 wt% to 30 wt% of an impact modifier; and a melt stabilizer at a concentration less than 5 wt%; 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.