# PROPYLENE-BASED COMPOSITIONS COMPRISING CARBON FIBERS AND A THERMOPLASTIC POLYOLEFIN ELASTOMER

## Field

**[0001]** Embodiments relate to propylene-based compositions that include carbon fibers and at least one thermoplastic polyolefin elastomer.

## Introduction

**[0002]** One of the key challenges in the automotive industry is the desire to reduce the weight of a vehicle in order to decrease fuel consumption. Decreased fuel consumption would result in reduced pollution and would benefit the environment. Carbon fibers, with their low density (around 1.78 g/cc) and high stiffness, offer an interesting source of substitution to conventional glass fibers (density of around 2.60 g/cc) and high strength steel (density of around 7.80 g/cc) currently used in the automotive industry. However, carbon fibers present impact performance challenges as they are very brittle and break down to small fibers after being compounded or injection molded into parts. Accordingly, a need exists for carbon fiber solutions that provide high stiffness and good impact performance while retaining a high and commercially interesting modulus.

**[0003]** A further challenge in the automotive industry is thermal expansion of polypropylene-based compounds. In the automotive industry, it is important to limit dimensional changes with temperature fluctuations. While glass fibers and talc are typical fillers used to limit the Coefficient of Linear Thermal Expansion (CLTE) in polypropylene-based compounds, a need exists for solutions for achieving even lower CLTE values.

## Summary

**[0004]** The present disclosure relates to a composition comprising:

(A) from 30 wt% to 94 wt% of a propylene component including at least one propylene-based polymer having a propylene content of at least 75 wt%, based on

the total weight of the propylene-based polymer, and a melt flow rate of at least 10 g/10 minutes as measured by ISO 1133 at 230°C/2.16 kg;

(B) from 1 wt% to 50 wt% of a carbon fiber component; and

(C) from 5 wt% to 69 wt% of a thermoplastic polyolefin elastomer.

**[0004a]** In one aspect, the present disclosure relates to a composition comprising:

(A) from 40 wt% to 85 wt% of a propylene component including at least one propylene-based polymer having a propylene content of at least 75 wt%, based on the total weight of the propylene-based polymer, and a melt flow rate of at least 10 g/10 minutes as measured by ISO 1133 at 230°C/2.16 kg;

(B) from 2 wt% to 40 wt% of a carbon fiber component; and

(C) from 10 wt% to 50 wt% of a thermoplastic polyolefin elastomer, wherein the thermoplastic polyolefin elastomer is an ethylene/α-olefin multi-block interpolymer.

**[0005]** In one example of the present disclosure, the composition described above may optionally include (D) from 0.1 wt% to 15 wt% of a compatibilization agent.

## Detailed Description

*Definitions*

**[0006]** The numerical ranges disclosed herein include all values from, and including, the lower value and the upper value. For ranges containing explicit values, any subrange between any two explicit values is included. As used with respect to a chemical compound, unless specifically indicated otherwise, the singular includes all isomeric forms and vice versa.

**[0007]** All references to the Periodic Table of the Elements herein shall refer to the Periodic Table of the Elements, published and copyrighted by CRC Press, Inc., 2003. Also, any references to a Group or Groups shall be to the Groups or Groups reflected in this Periodic Table of the Elements using the IUPAC system for numbering groups. Unless stated to the contrary, implicit from the context, or customary in the art, all components and percents are based on weight. For purposes of United States patent practice, the contents of any patent, patent application, or publication referenced herein are hereby incorporated by reference in their entirety (or the equivalent US version thereof is so incorporated by reference) especially with respect to the disclosure of synthetic techniques, definitions (to the extent not inconsistent with any definitions provided herein) and general knowledge in the art.

**[0008]** "Composition" and like terms is a mixture of two or more components. Included in compositions are pre-reaction, reaction and post-reaction mixtures, the latter of which will include reaction products and by-products, as well as unreacted components of the reaction mixture and decomposition products, if any, formed from the one or more components of the pre-reaction or reaction mixture.

CLAIMS

1. A composition comprising:

(A) from 40 wt% to 85 wt% of a propylene component including at least one propylene-based polymer having a propylene content of at least 75 wt%, based on the total weight of the propylene-based polymer, and a melt flow rate of at least 10 g/10 minutes as measured by ISO 1133 at 230°C/2.16 kg;

(B) from 2 wt% to 40 wt% of a carbon fiber component; and

(C) from 10 wt% to 50 wt% of a thermoplastic polyolefin elastomer, wherein the thermoplastic polyolefin elastomer is an ethylene/α-olefin multi-block interpolymer.

2. The composition of claim 1, further comprising (D) from 0.1 wt% to 15 wt% of a compatibilization agent.

3. The composition according to any of the preceding claims, wherein the carbon fiber component comprises chopped carbon fibers sized with an epoxy- and phenoxy-based emulsion.

4. The composition according to any of the preceding claims, wherein the thermoplastic polyolefin elastomer has a density from 0.850 g/cc to 0.875 g/cc as measured by ASTM D792 and a melt flow index from 0.1 g/10 minutes to 50 g/10 minutes as measured by ASTM D1238 at 190°C/2.16 kg.

5. The composition according to any of the preceding claims, wherein the compatibilization agent is a maleic anhydride grafted polypropylene.

6. The composition according to any of the preceding claims, further comprising a flexural modulus of greater than 2000 MPa, a Charpy impact strength of greater than 6 $kJ/m^2$, and a falling dart maximum force energy of greater than 4 J.

7. The composition according to any of the preceding claims, further comprising an average CLTE value of less than 5E-05 m/m/°C via machine direction and an average CLTE value of less than 8E-05 m/m/°C via transverse direction.