POLYOLEFIN ELASTOMER FORMULATIONS

FIELD OF THE INVENTION

[1] The invention relates to olefin block copolymer formulations comprising polyethylene and polypropylene that provide improved adhesion properties to polypropylene while maintaining desired flexural modulus characteristics and are particularly suited for overmolded goods.

BACKGROUND

[2] Olefin block copolymers (OBCs) are useful for producing soft compounds such as soft-touch articles. OBCs find application in soft compounds such as overmolded grips because the block architecture of the OBC results in good tensile strength, compression set and temperature resistance. However, a need exists for blends of OBCs and polyolefins that provide improved adhesion to substrates such as polypropylene for these overmolded goods applications.

SUMMARY

[3] The disclosure provides a formulation comprising: a) an olefin block copolymer comprising hard blocks and soft blocks wherein the soft blocks comprise 9-27 mol% comonomer, preferably 15-22 mol%; and wherein the block copolymer has a melt index, I_2 at 190 °C of 0.5 to 30 g/10 min, preferably 5-15 g/10 min; and a density of 0.866 – 0.887 g/cm^3, preferably 0.866 – 0.877 g/cm^3; b) a polyethylene having a melt index, I_2 at 190 °C of 0.5-200 g/10 min, preferably 30-150 g/10 min and a density of 0.910-0.965 g/cm^3, preferably 0.915-0.935 g/cm^3; and, c) a polypropylene having a Melt Flow Rate at 230 °C of 2-80 g/10 min, preferably 30-80 g/10 min; wherein the ratios of block copolymer to polyethylene to polypropylene are 50 – 90/5 – 45/5 – 20, preferably 55 - 75/15 - 35/5 – 15; and, the formulation has a melt index, I_2 at 190 °C of 1-70 g/10 min, preferably 10-40 g/10min; a Shore A hardness of 65-95, preferably 70-90; a flexural modulus (2% secant) of 4-14 ksi, preferably 8-12 ksi; an adhesion to polypropylene via the tensile bar weld line test of greater than 3.2 MPa; and, an adhesion to polypropylene via the 90° butt joint test of > 5 kgf. The disclosure additionally provides articles comprising the formulation, in particular, but not limited to, overmolded goods.

[3a] In a first aspect, there is provided a formulation comprising:

a) an olefin block copolymer comprising hard blocks and soft blocks wherein the soft blocks comprise 9-27 mol% comonomer; and wherein the block copolymer has a melt index, I_2 at 190 °C of 0.5 to 30 g/10 min; and a density of 0.866 – 0.887 g/cm^3;

b) a polyethylene having a melt index, I_2 at 190 °C of ~~0.5-200 g/10 min~~ 30-80 g/10 min and a density of ~~0.910-0.965 g/cm^3~~ 0.915-0.935 g/cm^3; and,

c) a polypropylene having a Melt Flow Rate at 230 °C of ~~2-80 g/10 min~~ 30-80 g/10 min;

wherein:

the ratios of block copolymer to polyethylene to polypropylene are 50 – 90/5 – 45/5 – 20,

the formulation has a melt index, I_2 at 190 °C of 1-70 g/10 min;

a Shore A hardness of 65-95

a flexural modulus (2% secant) of 4-14 ksi;

an adhesion to polypropylene via the tensile bar weld line test of greater than 3.2 MPa; and,

an adhesion to polypropylene via the 90° butt joint test of > 5 kgf.

[3b] In another aspect, there is provided a formulation for an overmolded good including the formulation as defined above.

[3c] In another aspect, there is provided an article comprising: a polypropylene substrate; and an overmolded layer on the polypropylene substrate, the overmolded layer including the formulation as defined above.

DETAILED DESCRIPTION

[4] The present disclosure provides formulations of olefin block copolymers, polyethylene and polypropylene that provide certain advantageous properties as described herein.

DEFINITIONS

[5] 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 parts and percents are based on weight. For purposes of United States patent practice, the contents of any patent, patent application, or publication referenced herein

CLAIMS

1. A formulation comprising:

a) an olefin block copolymer comprising hard blocks and soft blocks wherein:

the soft blocks comprise 9-27 mol% comonomer; and wherein the block copolymer has a melt index, I_2 at 190 °C of 0.5 to 30 g/10 min, and a density of 0.866 – 0.887 g/cm^3;

b) a polyethylene having a melt index, I_2 at 190 °C of ~~0.5-200 g/10 min~~ 30-80 g/10 min, and a density of ~~0.910-0.965 g/cm^3~~ 0.915-0.935 g/cm^3; and,

c) a polypropylene having a Melt Flow Rate at 230 °C of ~~2-80 g/10 min~~ 30-80 g/10 min; wherein:

the ratios of block copolymer to polyethylene to polypropylene are 50 – 90/5 – 45/5 – 20,

the formulation has a melt index, I_2 at 190 °C of 1-70 g/10 min;

a Shore A hardness of 65-95;

a flexural modulus (2% secant) of 4-14 ksi;

an adhesion to polypropylene via the tensile bar weld line test of greater than 3.2 MPa; and,

an adhesion to polypropylene via the 90° butt joint test of > 5 kgf.

2. The formulation of claim 1, wherein the soft blocks comprise 15-22 mol% comonomer, the melt index of the block copolymer is from 5-15 g/10 min, and the density of the block copolymer is from 0.866 – 0.877 g/cm^3.

~~3. The formulation of claim 2, wherein the melt index of the polyethylene is from 30-150 g/10 min and the density of the polyethylene is from 0.915-0.935 g/cm^3.~~

~~4. The formulation of claim 3, wherein the Melt Flow Rate of the polypropylene is from 30-80 g/10 min.~~

~~5~~3. The formulation of claim 41, wherein the ratios of block copolymer to polyethylene to polypropylene is from 55 - 75/15 - 35/5 – 15.

~~6~~4. The formulation of claim ~~5~~3, wherein the Shore A hardness is from 70-90.

~~7~~5. The formulation of claim ~~6~~4, wherein the flexural modulus is from 8-12 ksi.

86. A formulation for an overmolded good including the formulation as claimed in claim 1.

97. An article comprising:

a polypropylene substrate; and

an overmolded layer on the polypropylene substrate, the overmolded layer including the formulation as claimed in claim 1.