

particles that are small enough scale such that a minimum volume is needed to improve the impact performance without adversely affecting the modulus of the blend.

An additional improvement would be to develop an elastomer that improves the impact performance without adversely affecting its clarity or other preferred properties. Ideally, the modulus and clarity of the PP/propylene-containing elastomer blend product should be comparable to that of PP homopolymer.

### SUMMARY

The disclosure provides a composition comprising: polypropylene; an elastomer with bimodal or multi-modal molecular weight distribution characteristics and, optionally, bimodal or multi-modal composition characteristics; a block composite as a compatibilizer; and, an optional filler such as talc.

~~The disclosure provides~~ In one aspect, there is provided a composition comprising: polypropylene; and, a multi-mode molecular weight distribution elastomer; a block composite; and, optionally, a filler; wherein the multi-mode molecular weight distribution elastomer has a high molecular weight fraction and a low molecular weight fraction and an overall density of less than 0.9 g/cc; wherein the low molecular weight fraction of the multi-mode molecular weight distribution elastomer has a molecular weight of 5 kg/mol to 50 kg/mol; wherein the high molecular weight fraction of the multi-mode molecular weight distribution elastomer has a comonomer content that is at least 10 wt% greater than that of the low molecular weight fraction of the multi-mode molecular weight distribution elastomer; and wherein the block composite comprises a soft copolymer, a hard polymer, and a block copolymer having a soft segment and a hard segment, wherein the hard segment of the block copolymer is the same composition as the hard polymer in the block composite and the soft segment of the block copolymer is the same composition as the soft copolymer of the block composite.

### BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 shows a deconvoluted GPC curve for Example 1.

Figure 2 shows a deconvoluted GPC curve for Example 1.

Figure 3 shows a deconvoluted GPC curve for Example 1.

Figure 4 shows viscosity curves for the indicated polymers.

DETAILED DESCRIPTION

Polypropylene

Impact modified compositions comprise a matrix polymer toughened via blending with an elastomer composition. In one embodiment, the matrix polymer is a polypropylene. Any polypropylene known to a person of ordinary skill in the art may be used to prepare the polymer blends disclosed herein. Non-limiting examples of polypropylene include low density polypropylene (LDPP), high density polypropylene (HDPP), high melt strength polypropylene (HMS-PP), high impact polypropylene (HIPP), isotactic polypropylene (iPP), syndiotactic polypropylene (sPP) and the like, and combinations thereof.

The amount of the polypropylene in the polymer blend, or composition, can be from about 0.5 to about 99 wt%, from about 10 to about 90 wt%, from about 20 to about 80 wt%, from about 30 to about 70 wt%, from about 5 to about 50 wt%, from about 50 to about 95 wt%, from about 10 to about 50 wt%, or from about 50 to about 90 wt% of the total weight of the polymer blend. In one embodiment, the amount of the polypropylene in the polymer

CLAIMS

1. A composition comprising:

polypropylene; and,

a multi-mode molecular weight distribution elastomer;

a block composite; and,

optionally, a filler;

wherein the multi-mode molecular weight distribution elastomer has a high molecular weight fraction and a low molecular weight fraction and an overall density of less than 0.9 g/cc;

wherein the low molecular weight fraction of the multi-mode molecular weight distribution elastomer has a molecular weight of 5 kg/mol to 50 kg/mol;

wherein the high molecular weight fraction of the multi-mode molecular weight distribution elastomer has a comonomer content that is at least 10 wt% greater than that of the low

molecular weight fraction of the multi-mode molecular weight distribution elastomer; and

wherein the block composite comprises a soft copolymer, a hard polymer, and a block copolymer having a soft segment and a hard segment, wherein the hard segment of the

block copolymer is the same composition as the hard polymer in the block composite and the soft segment of the block copolymer is the same composition as the soft copolymer of

the block composite.

~~2. The composition of Claim 1 wherein the multi-mode molecule weight distribution elastomer has a high molecular weight fraction and a low molecular weight fraction.~~

~~3.2. The composition of Claim 2-1 wherein the high molecular weight fraction has a molecular weight of 75 kg/mol to 600 kg/mol.~~

~~4. The composition of Claims 2 wherein the low molecular weight fraction has a molecular weight of 5 kg/mol to 50 kg/mol.~~

~~5. The composition of Claim 2 wherein the high molecular weight fraction has a comonomer content that is at least 10% wt greater than that of the low molecular weight fraction.~~

3. The composition of claim 1, wherein the multi-mode molecular weight distribution elastomer further comprises a comonomer content of greater than 20 wt% by NMR.

4. The composition of claim 1, wherein the comonomer content of the high molecular weight fraction of the multi-mode molecular weight distribution elastomer is at least 20 wt%  
5 greater than that of the low molecular weight fraction of the multi-mode molecular weight distribution elastomer.