CLAIMS

1. A polyolefin-polybutadiene block-copolymer that is the reaction product of a functionalized polar polybutadiene (fPB), a vinyl-terminated macromer (VTM), and optional cross-linker compound (XL):

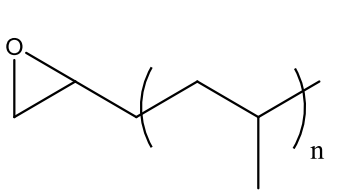
where the vinyl-terminated macromer comprises a polyolefin block (PO) having a weight average molecular weight within the range of from 1000 to 150,000 g/mole;

the functionalized polar polybutadiene (fPB) having a weight average molecular weight within the range of from 500 to 30,000 g/mole; and

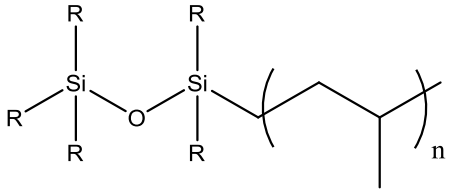
the optional cross-linker compound (XL) comprises at least two cross-linking moieties wherein at least one moiety reacts with the vinyl group of the VTM and at least one moiety reacts with the fPB.

2. The polyolefin-polybutadiene block-copolymer of claim 1, wherein the VTM comprising the cross-linking moiety (XL—PO) reacts with the fPB to form the polyolefin-polybutadiene block-copolymer, or the fPB comprising the cross-linking moiety (fPB—XL) reacts with the VTM to form the polyolefin-polybutadiene block-copolymer.

3. The polyolefin-polybutadiene block-copolymer of claim 1 or 2, wherein XL—PO has the general formula selected from the group consisting of:

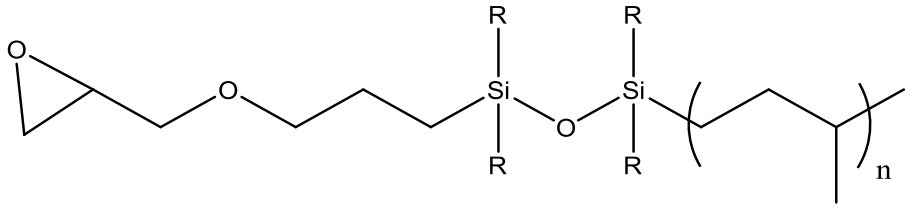


,



,

and



;

wherein each "R" group is independently selected from C_1 to C_{10} alkyls, and wherein the value of "n" is within the range of from 50 to 1000.

4. The polyolefin-polybutadiene block-copolymer of any one of claims 1 to 3, wherein weight average molecular weight of the polyolefin-polybutadiene block-copolymer is within a range from 1,000 to 150,000 g/mole.

5. The polyolefin-polybutadiene block-copolymer of any one of claims 1 to 4, having the general formula:

PO—XL—fPB ;

where "PO" is a polyolefin block having a weight average molecular weight within the range of from 1000 to 150,000 g/mole, the "fPB" is a functionalized polar polybutadiene block having a weight average molecular weight within the range of from 500 to 30,000 g/mole, and "XL" is a cross-linking moiety that covalently links the PO and fPB blocks.

6. The polyolefin-polybutadiene block-copolymer of any one of claims 1 to 5, wherein XL is directly derived from an epoxide, an organosilane, an organosiloxane, or an epoxy-siloxane.

7. The polyolefin-polybutadiene block-copolymer of any one of claims 1 to 6, wherein the fPB comprises a polybutadiene primary component and at least one functional group selected from primary, secondary or tertiary amines, acrylonitrile, hydroxide, styrene, isoprene, acrylate, methacrylate, and combinations thereof.

8. A tire tread formulation comprising the polyolefin-polybutadiene block-copolymer of any one of claims 1 to 7.

9. The tire tread formulation of claim 8, further comprising from 5 to 20 wt%, by weight of the formulation, of a propylene-α-olefin elastomer.

10. The tire tread formulation of claim 8 or claim 9, further comprising 15 to 60 wt% of a styrenic copolymer; 0 to 40 wt% of processing oil; and 20 to 60 wt% of filler.

11. The tire tread formulation of any one of claims 8 to 10, wherein the Modulus at 300% of the cured composition is within the range of from 1000 psi to 2200 psi.

12. The tire tread formulation of any one of claims 8 to 11, wherein the Ultimate Tensile Strength of the cured composition is within the range of from 1600 psi to 3000 psi.

13. The tire tread formulation of any one of claims 8 to 12, wherein the Ultimate elongation of the cured composition is within the range of from 320% to 500%.

14. The tire tread formulation of any one of claims 8 to 13, wherein the Tangent Delta (0^{o}C) of the cured composition is greater than 0.330.

15. The tire tread formulation of any one of claims 8 to 14, wherein the Tangent Delta (60^{o}C) of the cured composition is greater than 0.172.

16. The tire tread formulation of any one of claims 8 to 15, wherein the Maximum Energy Loss (Tangent Delta, wherein the slope is zero) of the immiscible polyolefin domain is a temperature within the range from -30^{o}C to 10^{o}C.

17. The tire tread formulation of any one of claims 8 to 16, wherein micelles comprising the polyolefin-polybutadiene block-copolymer in the polymer matrix of the other components have sizes less than 20 microns.

18. The polyolefin-polybutadiene block-copolymer of any one of claims 1 to 7, wherein the reactions of the fPB, the VTM, and optionally the XL to form the reaction product are conducted within the temperature range of from 50°C to 110°C.

19. The polyolefin-polybutadiene block-copolymer of claim 18, wherein the reactions of the fPB, the VTM, and optionally the XL to form the reaction product are conducted in a solvent selected from the group consisting of toluene, xylene, chlorobenzene, trichlorobenzene, and mixtures or combinations thereof.