ETHYLENE/ALPHA-OLEFIN/NONCONJUGATED POLYENE BASED COMPOSITIONS AND FOAMS FORMED FROM THE SAME

REFERENCE TO RELATED APPLICATIONS

This application claims the benefit of U.S. Provisional Application No. 61/731,869, filed on November 30, 2012.

BACKGROUND OF THE INVENTION

There is a need for polymer compositions that have improved foaming characteristics (high expansion and smooth surface quality) and reduced water absorption for the targeted foam density. The observed water absorption relates directly to the foamed structure and number of closed cells present in the foam. The foaming process is a delicate balance of the cross-linking of the EPDM and expansion (from a foaming agent, such as CELOGEN OT), which depends highly on the melt elasticity of the EPDM, as well as on the viscosity increase during the expansion and cure cycle. The melt elasticity of the polymer is related to its molecular weight and degree of long-chain branching present. Typical sponge EPDM products, such as VISTALON 8800 (Exxon-Mobil) and KELTAN 7341A (Lanxess), are oil-extended products that are high in molecular weight, and are relatively amorphous. When formulated and vulcanized into a foamed article, these EPDM resins are generally considered the 'best-in-class' in terms of water absorption, and foamed properties, such as compression set and tensile. Rubber compositions for foams and/or other applications are also disclosed in the following: US20110233448A1, US6384290B1, US5691413B1, US20090209672, US4722971A, US5610254, US20110160323, WO2009/072503 (abstract), JP2006307100A (abstract), JP2007191497A (abstract), and JP2006335847A (abstract).

However, there is a need for new polymer compositions that have improved foaming characteristics (high expansion and smooth surface quality) and reduced water absorption for the targeted foam density. These needs have been met by the following invention.

SUMMARY ~~OF THE INVENTION~~

The ~~invention~~ present disclosure provides a composition comprising a first composition that comprises an ethylene/alpha-olefin/nonconjugated polyene interpolymer that has the following properties:

A) a Mw greater than, or equal to, 150,000 g/mole, as determined by conventional GPC; and

B) a peak area from 21.3 ppm to 21.8 ppm that is greater than, or equal to, 3.0 percent of the total integral area from 19.5 ppm to 22.0 ppm, as determined by 13C NMR; and

wherein the first composition has a tan delta (190°C at 0.1 rad/sec) less than, or equal to, 1.0.

In one aspect of the present disclosure, there is provided a composition comprising a first composition that comprises an ethylene/alpha-olefin/nonconjugated polyene interpolymer that has the following properties:

A) a Mw greater than, or equal to, 150,000 g/mole; and

B) a peak area from 21.3 ppm to 21.8 ppm that is greater than, or equal to, 3.0 percent of the total integral area from 19.5 ppm to 22.0 ppm, as determined by 13C NMR; and

wherein the first composition has a tan delta (190°C at 0.1 rad/sec) less than, or equal to, 1.0.

In another aspect of the present disclosure, there is provided an article comprising at least one component formed from a composition disclosed herein.

In a further aspect of the present disclosure, there is provided a process for preparing a composition disclosed herein, said process comprising polymerizing, in solution, at least the following: ethylene, an alpha-olefin and a nonconjugated polyene.

BRIEF DESCRIPTION OF THE FIGURES

Figure 1 depicts the Tan Delta 0.1 rad/sec, measured at 190°C) versus the Weight Average Molecular Weight (Mw) for inventive and comparative polymers.

Figure 2 depicts the Tan Delta versus Frequency (rad/s) profiles at 190°C for inventive and comparative polymers.

Figure 3 depicts "Water Absorption (wt%) versus Foam Density" for Foamed Rods at 230°C.

Figure 4 depicts "Water Absorption (wt%) versus Foam Density" for Foamed Tapes at 230°C.

DETAILED DESCRIPTION OF THE INVENTION

As discussed above, the invention provides a composition comprising a first composition that comprises an ethylene/alpha-olefin/nonconjugated polyene interpolymer that has the following properties:

A) a Mw greater than, or equal to, 150,000 g/mole; and

B) a peak area from 21.3 ppm to 21.8 ppm that is greater than, or equal to, 3.0 percent of the total integral area from 19.5 ppm to 22.0 ppm, as determined by 13C NMR; and wherein the first composition has a tan delta (190°C at 0.1 rad/sec) less than, or equal to, 1.0.

The composition may comprise a combination of two or more embodiments described herein.

The first composition may comprise a combination of two or more embodiments described herein.

The ethylene/alpha-olefin/nonconjugated polyene interpolymer may comprise a combination of two or more embodiments described herein.

In one embodiment, the ethylene/α-olefin/nonconjugated polyene interpolymer is an ethylene/α-olefin/diene interpolymer (EAODM). In a further embodiment, the interpolymer