Modular material properties in bimodal blends of amine functionalized polyolefins

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ABSTRACT

The rheological properties of associating polymers are driven by a combination of entanglements and dynamic intermolecular interactions between chains. Binary mixtures of aminopolyolefin associating polymers with low and high molecular weight (M_w) were prepared at systematic mass fractions. The ability to tune rheological, mechanical, and adhesive properties was investigated. A transition from viscoelastic liquid to elastic solid is traversed between the limits of low and high M_w by controlling the ratio of the two components. As the fraction of high M_w increases, the mechanical properties (Young's modulus, tensile strength) increase. Transitions between cohesive and adhesive bonding to low surface energy substrates are also observed, while the peel and lap shear strength can be tuned by the molecular weight distribution. Due to the high density of polar amine groups, recoverable adhesion on poly(tetrafluoroethylene) is facilitated by the inherent self-healing ability of the associating polymers. The adhesion strength recovers monotonically with healing time. Controlling the ratio of low and high M_w could be used to accurately control material properties from two simple component feedstocks, replicating the behavior of an individual monomodal sample.

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