Phase behavior of polystyrene acrylonitril copolymer and polymethylmethacrylate blends under shear

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Abstract :

Polymer blends undergo external stresses such as pressure and shear in course of processing cycles. The knowledge of their phase behavior at each step of these cycles is crucial for understanding their physical properties and eventually improves their performance in practical applications. The effects of shear on the phase diagram of binary polymer blends are considered. A theoretical formulism is used upon which the free energy is the sum of two terms. The first term is modeled with the Flory–Huggins free energy of mixing and describes the thermodynamic behavior of the system in the quiescent state. The second term represents the excess free energy stored during flow. In the presence of shear flow, the excess free energy is expressed in terms of the viscosity and the shear modulus. Both quantities depend on composition and shear rate. The curvature of the variation of viscosity versus composition has a tremendous impact upon the nature of phase separation. Phase diagrams are described by the spinodal curves and show for the case considered here miscibility enhancement with increasing shear rate. A good correlation is found with experimental data of the literature on blends of polystyrene acrylonitril copolymer and polymethylmethacrylate.

Keywords : blends; modulus; phase diagrams; shear; viscosity.

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