Melting Point Depression and Phase Behavior of Poly(ether sulfone)/Poly(ethylene oxide) Blends

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The thermodynamic transition temperatures in miscible polymer blends are interpreted with Flory-Prigogine's equation of state theory (FP theory) and Sanchez-Lacombe's lattice fluid theory(LF theory).

The equations for equilibrium melting point depression in polymer mixture are derived based on both FP and LF theory. For a miscible blend systems, poly(ether sulfone) (PES)/poly(ethylene oxide) (PEO) blends, the newly derived equations are tested. The interaction parameters X_{12} for FP theory and ζ_{12} for LF theory can be determined with these equations. The theoretically predicted equilibrium melting point depression is subdivided into the three terms, namely, the equation of state, the entropy and the contact interaction terms. When the estimated interaction parameters are converted to Flory-Huggins interaction parameter χ and the heat of mixing via both theories, the composition dependence of χ and the heat of mixing can be properly predicted. The entropy correction factor Q_{12} in FP theory and q_{12} in LF theory are introduced to fit the simulated spinodal curves to the observed cloud point in PES/PEO blends. The equation for nonequilibrium melting point depression is also suggested; however, the interaction parameter could not be precisely estimated without the correct consideration of morphological effect on the nonequilibrium melting point depression.