A New Kinetic Model for Interdiffusion at Semicrystalline Polymer Interfaces

Chieh-Tsung Lo and Balaji Narasimhan

Department of Chemical Engineering, Iowa State University

A new kinetic model has been developed to describe the interfacial behavior of semicrystalline polymers. In these systems, the competition between interdiffusion and crystallization drives the overall transport and has major consequences for applications such as co-extrusion and adhesion. The crystallization rate is based on the Avrami equation, in which the Avrami exponent, n, and the crystallization rate coefficient, k, as a function of temperature and blend composition are determined by *in situ* optical microscopy (OM) and differential scanning calorimetry (DSC). The blend composition dependence of the mutual diffusion coefficients is obtained by using the fast mode theory. The predicted density profiles as a function of position are used to extract the equilibrium interfacial width. At low temperatures, the crystallization rate is fast, and the crystals present at or near the interface hinder the interdiffusion, causing the interfacial width to be small. At high temperatures, the crystallization is much slower, and interdiffusion dominates crystallization. The model predictions were compared with interfacial behavior observed by transmission electron microscopy (TEM) and small angle X-ray scattering (SAXS) in a system comprised of polyethylene (PE) and isotactic polypropylene (iPP).