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Influence of Phase Separation and Shear on the Crystallization of Polyolefin Blends¹

CHARLES C. HAN, Institute of Chemistry, Chinese Academy of Sciences, Beijing, 100080, China

The correlation between liquid-liquid phase separation (LLPS) and crystallization at several compositions in statistical copolymer blends of poly (ethylene-co-hexene) (PEH) and poly (ethylene-co-butene) (PEB) has been examined by optical microscopy (OM), atomic force microscopy (AFM) and differential scanning calorimetry (DSC). The overwhelming change in the crystallization kinetics due to the density fluctuation caused by the spontaneous spinodal LLPS is observed. This coupling mechanism suggests a new mechanism in the nucleation-crystallization process. All evidences are pointing to a cross-over mechanism from the spinodal fluctuations (of liquid-liquid phase separation) to the nucleation and than crystallization. Also, the shear dependence and mechanism of the Shih-kebab formation in the isotactic polypropylene (iPP) and isotactic polypropylene/polyethylene-co-octene blends have been studied. The network strands deformation and the primary nucleation mechanism have been studied by the time resolved small angle light scattering and AFM. New mechanism has been proposed. The above studies are aimed to understand the enhanced primary nucleation mechanisms in crystallizable polymers and polymer blends which have not been emphasized in most of the traditional nucleation and crystallization research in polymers. The detailed experimental evidences and proposed physical model will be presented.

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