

Oral Presentation: Rheology and Rheometry

Viscosity Reduction of Poly(ethylene terephthalate) Melt by Dissolution of Carbon Dioxide

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Abstract

Melt viscosity measurement of poly(ethylene terephthalate)/carbon dioxide (PET/CO₂) system was carried out using two types of PET with different molecular weights, i.e. Mw = 70,000 for HMW-PET and Mw = 110,000 for UHMW-PET. A capillary rheometer installed at the head of a twin-screw extruder was employed to minimize the effect of thermal degradation of the polymer prior to the viscosity measurement. In addition, a drain was installed in between the head of extruder and the capillary with the intention of measuring the viscosity under various strain rates while keeping a constant operation condition of the extruder. In this manner, changes of residence time, degree of thermal degradation, and condition of dissolving CO₂ during the viscosity measurement can be eliminated. Viscosity of PET decreased by dissolving the CO₂, however, strain-rate dependence and temperature dependence (activation energy) of PET and PET/CO₂ system were similar. Measurement of viscosity was possible down to the temperature of 230°C where the polymer melt loose its fluidity because of the starting of crystallization. This temperature is much lower than the crystalline melting temperature of PET. It has been reported that the crystallization rate of PET/CO₂ system is higher than that of PET under a quiescent state. Therefore, it was speculated that the occurrence of crystallization during the viscosity measurement is affected by the shear flow.