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Microstructure, Thermal Behavior, and Mechanical Property of Injection Molded PA6 Microcellular Nanocomposites

M.Yuan and L.-S. Turng
Polymer Engineering Center, University of Wisconsin-Madison, Madison, WI 53706, USA

Microstructure, thermal behavior, and mechanical property of microcellular nanocomposites have been studied. Microcell wall structure and smoothness were determined by the size of the crystalline structure, which, in turn, were based on the material system and molding conditions. The correlation between cell density and cell size of the materials studied followed an exponential relationship. Nanoclay in the microcellular injection molding process promoted the γ-form and suppressed the α-form crystalline structure of PA6. In the crystallization kinetics study, the Avrami equation and the modified Ozawa equation were used for isothermal and nonisothermal crystallization processes, respectively. The activation energies determined using the Arrhenius relation for isothermal crystallization and the Kissinger method for nonisothermal crystallization agree with each other well. The existence of nanoclay increases the magnitude of the activation energy. Nanocomposite with an optimal amount of nanoclay has a high nucleation activity. Both the nanoclay and the dissolved gas reduced the overall crystallinity of the microcellular injection molded nanocomposite parts. Solid nanocomposite parts, microcellular neat resin parts, and microcellular nanocomposite parts all have lower crystallinity in the core and higher crystallinity near the skin. The collective effect of the dissolved gas and nanoclay is to shorten the molding cycle time greatly.