Reaction-induced Crystallization Kinetics during the Anionic Polymerization of ε-Caprolactam

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The kinetics of crystallization during anionic polymerization of ε-caprolactam was studied by the adiabatic temperature rise method. A new kinetic model for the nonisothermal crystallization was derived and the possibility of its application was investigated. It was shown that the adiabatic temperature rise method was useful to predict the nonisothermal crystallization kinetic during the polymerization process. The proposed kinetic model for the nonisothermal crystallization was appropriate to describe the reaction-induced crystallization kinetics during the anionic polymerization of ε-caprolactam. By evaluating the model's diffusion and nucleation parameters for the given system, the crystallization behavior during the polymerization process was analyzed. At lower conversion, the reaction mixture was less viscous, a condition which made transport to the liquid-crystal interface easier, and thus the activation energy for transport decreased. On the other hand, the increasing mobility resulted in the difficulty in forming the stable nucleus and the free energy of the formation of a nucleus increased.