Modifying Nucleation Kinetics of Polymorphic Crystals in Bulk and Emulsion States

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This paper discusses thermodynamic and kinetic influences on nucleation processes of polymorphic crystalline systems in bulk and emulsion states in comparative ways. Three main characteristics may be revealed in the crystallization processes in emulsion droplets: (1) reduction in nucleation rate caused by thermodynamic and kinetic effects, (2) interfacial crystallization caused by molecular interactions between interfacial membrane and the solute molecules, and (3) droplet-droplet interactions of two kinds; dilution of solute/solvent molecules which are slightly soluble in the continuous phase, and partial coalescence of the particles after crystallization. Based on recent experimental work of melt crystallization of long-chain lipophilic materials in oil-in-water emulsion droplets, we discuss the polymorphic crystallization behavior related to the reduction in nucleation rate and the interfacial crystallization.

Keywords: polymorphism, nucleation kinetics, emulsion