

Order-Order Transition of the Spherical Micelles of Block Copolymer/Homopolymer Blend

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Crystallization is a self-ordering process that prevails among various systems ranging from microscopic objects such as atoms and molecules to mesoscopic colloidal particles. Micelles formed by block copolymers are soft colloids which also exhibit the propensity to crystallize under appropriate conditions. In contrast to hard spherical colloids, the spherical micelles formed by diblock copolymers in the quiescent melt have been found to organize almost exclusively in BCC lattice, although closely-packed lattices have been predicted by self-consistent mean-field calculations. In this study, we present the experimental observations of FCC lattice and the order-order transition (OOT) between BCC and FCC lattice of the spherical micelles formed in a blend of a poly(ethylene oxide)-*block*-poly(1,4-butadiene) (PEO-*b*-PB) and a PB homopolymer (h-PB). It will be shown that the OOT is “precursor driven”, where the process is accessible only when the system contains the BCC or FCC grains prior to the transition. This precursor-driven mechanism is phenomenologically similar to the self-nucleation in atomic or molecular crystallization, where the residual nuclei persisted in the melt promotes the crystallization upon cooling. The activation barrier associated with the BCC-FCC OOT in the present system is proposed to be entropic in origin, stemming from the deformations of PB blocks and h-PB chains in the lattice transition proceeding through the Bain distortion mechanism.