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Formation of Frank-Kasper σ-phase from polydisperse diblock copolymers MEIJIAO LIU, WEIHUA LI, Fudan University, AN-CHANG SHI, McMaster University — Recent experimental and theoretical studies have revealed a number of complex spherical phases including the complex Frank-Kasper σ-phase, which consists of 30 spheres in a unit cell. It is desirable to understand the mechanisms for the formation of the complex spherical phases such as the A15-phase and the Frank-Kasper σ-phase in block copolymers. Based on the observation that the A15-phase and the Frank-Kasper σ-phase are composed of spherical domains with different sizes, we hypothesize that polydispersity of the block copolymers could be used to obtain these complex phases. We tested this hypothesis by carrying out self-consistent field theory for polydisperse AB diblock copolymers. Specially we studied the relative stability of various spherical phases, including the fcc, bcc, A15 and Frank_Kasper σ-phase, in binary blends composed of AB block copolymers different lengths of the A-blocks. Our results revealed that the Frank-Kasper σ-phase could be stabilized by tailoring the length ratio as well as the compositions of the two diblock copolymers. The distribution of the diblocks in the system indicates that copolymer segregation is the origin of the formation of spherical domains with different sizes.

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