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Formation of Complex Spherical Packing Phases in Binary Blends of Diblock Copolymers

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The emergence and relative stability of complex spherical packing phases in binary blends composed of A1B1 and A2B2 diblock copolymers are systematically studied using the polymeric self-consistent field theory. Phase diagrams are constructed in a large parameter space of the system. The results demonstrated that complex spherical packing phases including the Frank-Kasper A15 and □ phases, and the Laves C14 and C15 phases can be stabilized by the addition of longer A2B2 copolymers to asymmetric A1B1 - copolymers. Furthermore, the formation of complex spherical packing phases requires that the added A2B2 - copolymers have a longer A-block. A detailed analysis of the block distributions reveals the existence of inter-and intra-domain segregation of different copolymers, which provides a mechanism to aid the formation of spherical domains with different sizes and shapes. The predicted phase behaviours require that the added A2B2 - copolymers have a longer A-block and an overall chain length at least comparable to the host copolymer chains are in good agreement with available experimental and theoretical results. The study demonstrated that binary blends of diblock copolymers provide an efficient route to regulate the emergence and stability of complex spherical packing phases.

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