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Theory of Hierarchical Morphologies in Binary Blends of AB/CD Diblock Copolymers ASHKAN DEHGHAN, McMaster University, WEIQUAN XU, PINGWEN ZHANG, Peking University, AN-CHANG SHI, McMaster University — The self-assembled structures formed in binary blends of AB/CD diblock copolymers are studied using the real space Self-Consistent Field Theory (SCFT), focusing on the cases with attractive A/C and repulsive B/D interactions. The attractive A/C interaction prevents macroscopic phase separation, whereas the repulsive B/D interaction leads to the formation of complex nanoscopic structures. The combination of these features makes the AB/CD blend an ideal model system for the study of hierarchical self-assembly. Our results demonstrate that the B/D separation leads to the emergence of hierarchal alternate lamellar, cylinders and checker board morphologies from the classical lamellar structure. Similar behavior in the cylindrical phase, where an increase in the BD interaction leads to a phase transition from the classical hexagonally packed cylinders to alternating cylinders, has also been predicted. The theoretical predictions are consistent with available experiments and, more importantly, provide an interesting route for the engineering of hierarchically ordered structures using block copolymer blends.

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