Hybrid Structures Formed by Asymmetric ABC-type Block Copolymers

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Block copolymers (BCPs) provide a versatile platform for the formation of various nanostructures. Among them, ABC-type BCPs hold significant potential for creating complex structures, which have promising applications in nanotechnology. Especially when the A and C components are asymmetric, ABC-type block copolymers can form asymmetric ordered structures, or even hybrid structures of different geometric shapes composed of A and C domains. However, the self-assembly behavior of ABC-type block copolymers has not been well understood due to its complexity.

In this work, based on the ordered structures of AB-type block copolymers, we propose a useful rule to systematically assume ordered structures possibly formed by ABC-type BCPs. We then introduced topological asymmetry into the ABC system (i.e., $A(BC)_m$ miktoarm star), allowing A and C components to form domains of different shapes. By employing Self-Consistent Field Theory (SCFT), a series of novel hybrid structures, including sphere-diamond and spheres within double-gyroid networks, were predicted to be stable due to the combination of compositional and topological asymmetry. We conjecture that the balance between the stability of the A and C domains in ABC-type block copolymers is crucial for the formation of these novel hybrid structures. Our work provides a useful guide for the exploration of novel structures in ABC-type BCPs, and demonstrates that the combination of compositional and topological asymmetry can lead to the fabrication of novel hybrid morphologies.

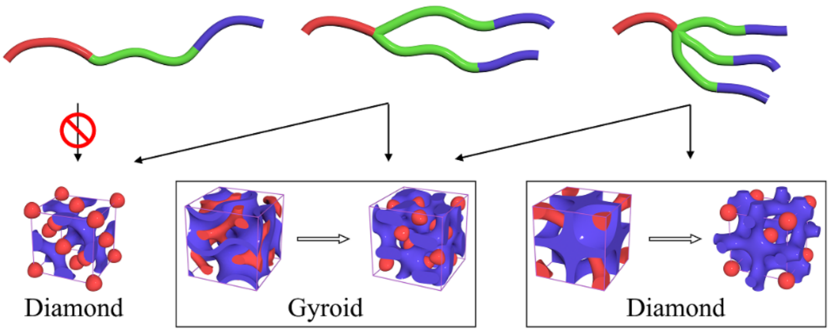

Figure 1. Novel hybrid structures formed by asymmetric ABC-type block copolymers

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[1] Q. Dong, W. Li, *Macromolecules*, **54**, 203 (2021).
[2] Q. Dong, L. Li, Z. Xu, W. Li, *Phys. Rev. Mater.*, **8**, 025601(2024).