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Chirality Effect on Self-Assembly of Chiral Block Copolymers
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— Here, we report the mechanisms of chiral transfer at various length scales in the self-assembly of enantiomeric chiral block copolymers (BCPs*). We show the evolution of homochirality from molecular chirality into phase chirality in the self-assembly of the BCPs*. The chirality of the molecule in the BCP* is identified from circular dichroism spectra, while the handedness of the helical conformation in the BCP* is determined from a split-type Cotton effect in vibrational circular dichroism spectra. Microphase separation of the BCP* is exploited to form a helical (H*) phase, and the handedness of helical nanostructure in the BCP* is directly visualized from transmission electron microscopy tomography. Moreover, the phase transitions from the H* phase to both the hexagonal cylinder phase and gyroid phase are found after long-time thermal annealing. Those results suggest that the H* phase is a long-lived metastable phase. To demonstrate the universal behavior of the chirality effect on BCPs*, different block copolymers containing chiral segment are synthesized and examined, suggesting that the chirality effect indeed plays an important role in the formation of H* phase.

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