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Helical Ordering in Chiral Diblock Copolymers – the Effect of Chirality WEI ZHAO, SUNG WOO HONG, GREGORY GRASON, THOMAS RUSSELL, University of Massachusetts Amherst — Introducing molecular chirality into the segments of block copolymers can influence the nature of the resultant morphology. Such an effect was found for poly(styrene-b-L-lactide) (PS-b-PLLA) diblock copolymers where hexagonally packed PLLA helical microdomains (H* phase) form in a PS matrix. However, molecular ordering of PLLA within the helical microdomains and the transfer of chirality from the segmental level to the morphological scale is still not well understood. We used a coarse-grained model to describe the interactions between segments of chiral blocks, and calculated the bulk morphologies of chiral AB diblock copolymers using self-consistent field theory (SCFT). We also performed in situ grazing incidence small angle x-ray scattering experiments to investigate the formation of the helical microdomains by changing solvents. Experiments confirmed that the H* phase is a kinetically trapped, metastable morphology below the melting point of PLLA block, while the SCFT explores the range of thermodynamic stability of helical structures in the phase diagram of chiral block copolymer melts.

Wei Zhao
University of Massachusetts Amherst

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