Abstract Submitted
for the MAR12 Meeting of
The American Physical Society

Helical Ordering in Chiral Block Copolymers WEI ZHAO, SUNG WOO HONG, DIAN CHEN, 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 mesoscale is still not well understood. We developed a field theoretic model to describe the interactions between segments of chiral blocks, which have the tendency to form a "cholesteric" texture. Based on the model, we calculated the bulk morphologies of chiral AB diblock copolymers using self-consistent field theory (SCFT). Experiments show that the H* phase only forms when microphase separation between PS and PLLA block happens first and crystallization of PLLA block is suppressed or happens within confined microdomain. Hence, crystalline ordering is not necessary for H* phase formation. The SCFT offers the chance to explore the range of thermodynamic stability of helical structures in the phase diagram of chiral block copolymer melts, by tuning parameters not only like the block segregation strength and composition, but also new parameters such as the ratio between preferred helical pitch to the radius of gyration and the Frank elastic constant for inter-segment distortions.

Wei Zhao
University of Massachusetts Amherst

Date submitted: 09 Nov 2011 Electronic form version 1.4