MAR13-2012-020303

Abstract for an Invited Paper
for the MAR13 Meeting of
the American Physical Society

Hierarchical Structure in Liquid Crystalline Polymers and Block Copolymers[1]

RAJESWARI KASI, University of Connecticut

We are interested in developing general molecular engineering approaches to liquid crystalline and semicrystalline brush random and block copolymers. These polymers self-assemble into hierarchical supramolecular nano structures with organization over several length scales that allows for evolution for unique property and function. In these polymeric libraries, we exploit liquid crystalline units for its responsive optical and mechanical features and semicrystalline brush units for its mechanical and thermal features. These materials are useful for applications in 1D photonic band gap materials as well as templates for preparation of nanoporous scaffolds. A series of liquid crystalline monomers and semicrystalline brush macromonomers are synthesized and polymerized by ring opening metathesis methods to prepare liquid crystalline random brush copolymers and liquid crystalline block brush copolymers. All these copolymers exhibit atleast two levels of hierarchy: LC mesophase assembly and brush microphase segregation due to incompatibility with the LC phase. We investigate the phase evolution of these materials based on composition, molecular weight and length of the semicrystalline brush and we map out the phase behavior by a variety of techniques including thermal analysis, UV visible analysis, polarized optical microscopy, temperature controlled small angle x-ray, wide-angle x-ray, electron microscopy, dynamic mechanical analysis. In addition to thermal and microstructural analysis, we determine the order-disorder transition of the self-assembled copolymers. In closing, by exploiting molecular architecture and composition to modulate the self-assembly, hierarchical structure at multiple length scales can be obtained and preserved which allows for the creation of unique 1D-photonic band gap materials as well as nanoporous scaffolds.

[1]NSF CAREER (DMR-0748398), NSF SNM (CCMI 1246804)