MAR15-2014-020246

Abstract for an Invited Paper
for the MAR15 Meeting of
the American Physical Society

Nanostructured Block Copolymer Solutions and Composites: Mechanical and Structural Properties

LYNN WALKER, Carnegie Mellon University

Self-assembled block copolymer templates are used to control the nanoscale structure of materials that would not otherwise order in solution. In this work, we have developed a technique to use close-packed cubic and cylindrical mesophases of a thermoreversible block copolymer (PEO-PPO-PEO) to impart spatial order on dispersed nanoparticles. The thermoreversible nature of the template allows for the dispersion of particles synthesized outside the template. This feature extends the applicability of this templating method to many particle-polymer systems, including proteins, and also permits a systematic evaluation of the impact of design parameters on the structure and mechanical properties of the nanocomposites. The criteria for forming co-crystals have been characterized using small-angle scatting and the mechanical properties of these soft crystals determined. Numerous crystal structures have been reported for the block copolymer system and we have taken advantage of several to generate soft co-crystals. The result of this templating is spatially ordered nanoparticle arrays embedded within the block copolymer nanostructure. These soft materials can be shear aligned into crystals with long range order and this shear alignment is discussed. Finally, the dynamics of nanoparticles within the nanostructured material are characterized with fluorescence recovery after photobleaching (FRAP). The applications and general behavior of these nanostructured hydrogels are outlined.