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Phase Behavior of Nanoparticle/Diblock Copolymer Composites. P. Thiyagarajan[1], Chieh-Tsung Lo[2], Byeongdu Lee[2], Randall E. Winans[2,3], [1]IPNS, [2]XFD, APS, [3]Chemistry Div., Argonne National Laboratory, Argonne, IL, USA.

Our research is focused on developing techniques to organize nanoparticles in 2D arrays by using self-assembled copolymers as templates. Our method involves the synthesis of nanoparticles covalently attached to a polymer that can selectively sequester into one domain of diblock copolymers. We investigated the effect of fillers on the phase behavior of polymer nanocomposites composed of polystyrene-*b*-poly(2-vinylpyridine) (PS-PVP) and thiol terminated PS stabilized Au nanoparticles in *d*-toluene at semidilute concentration. We observe that the morphologies of the neat and nanoparticle containing polymer solutions strongly depend on the copolymer composition, polymer molecular weight, filler loading and temperature. Comparison of the phase diagrams of the neat and nanoparticle loaded polymer solutions as a function of temperature shows dramatic shifts in the order-disorder and order-order transition temperatures. This dramatic effect can be understood by a model wherein the added nanoparticles that sequester in the preferred PS domains lead to an increase in the interfacial curvature and hence the nanostructure of the composite. Knowledge gained from these studies on the effects of nanoparticle loading and temperature on the phase behavior of the polymer nanocomposites will be critical to tailor the physical properties of these novel nanocomposites for various applications.

This work supported by the LDRD and benefited by the use of APS and IPNS funded by DOE-BES under contract #W-31-109-ENG-38.