

Abstract Submitted
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The Effect of Nanoparticle Radius of Gyration on the Diffusion of Polystyrene in a Nanocomposite ADAM IMEL, BRAD MILLER, University of Tennessee, WADE HOLLY, Oak Ridge National Laboratory, DURAIRAJ BASKARAN, J.W. MAYS, MARK D. DADMUN, University of Tennessee — Controlling the dispersion of nanoparticles throughout a polymer matrix is difficult. We have found that nanoparticle dispersion can be achieved by incorporating soft, organic nanoparticles with complementary chemical moieties, thus achieving favorable enthalpic interactions. The rational design of soft nanoparticles can create an interface that allows interpenetration of the polymer chains and particles reducing the depletion of entropy that is the main contributing force to the flocculation of nanoparticles. The nanoparticles are produced by intra-molecularly crosslinking a single polystyrene chain via a nano-emulsion technique with divinyl benzene. This synthetic approach allows the effects from structure, size and softness of the nanoparticle to be examined as they contribute to the dynamics of the polymer matrix by varying the crosslink density. This report focuses on the effect that these nanoparticles have on the diffusion coefficient of polystyrene. Neutron reflectivity was used to monitor the interdiffusion of deuterated polystyrene and protonated polystyrene with and without the soft nanoparticles in the respective layers. It has been proposed that the ratio of the radius of gyration (R_g) of the polymer chain to the nanoparticle controls the dynamics, thus the molecular weights of the matrix in this study have been varied from 535, 173, to 68 kg/mol. Initial results suggest when the R_g of the polymer is larger than that of the nanoparticle R_g the dynamics are impacted the most.

Adam Imel
University of Tennessee

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