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Abstract for an Invited Paper
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Structure and Dynamics of Polymer/Polymer grafted nanoparticle composite¹

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Addition of nanoparticles to polymers is a well-practiced methodology for augmenting various properties of the polymer host, including mechanical strength, thermal stability, barrier properties, dimensional stability and wear resistance. Many of these property changes are known to arise from nanoparticle-induced modification of polymer structure and chain dynamics, which are strong functions of the dispersion state of the nanoparticles' and on their relative size (D) to polymer chain dimensions (e.g. Random coil radius R_g or entanglement mesh size a). This talk will discuss polymer nanocomposites (PNCs) comprised of Polyethylene Glycol (PEG) tethered silica nanoparticles (SiO_2 -PEG) dispersed in polymers as model systems for investigating phase stability and dynamics of PNCs. On the basis of small-angle X-ray Scattering, it will be shown that favorable enthalpic interactions between particle-tethered chains and a polymer host provides an important mechanism for creating PNCs in which particle aggregation is avoided. The talk will report on polymer and particle scale dynamics in these materials and will show that grafted nanoparticles well dispersed in a polymer host strongly influence the host polymer relaxation dynamics on all timescales and the polymers in turn produce dramatic changes in the nature (from diffusive to hyperdiffusive) and speed of nano particle decorrelation dynamics at the polymer entanglement threshold. A local viscosity model capable of explaining these observations is discussed and the results compared with scaling theories for NP motions in polymers

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