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Confined relaxations of grafted polymer in solutions of linear polymer RYAN POLING-SKUTVIK, RAMANAN KRISHNAMOORTI, JACINTA CONRAD, University of Houston — Using neutron spin echo spectroscopy (NSE), we investigate the relaxations of polymer grafted to silica nanoparticles dispersed in semidilute solutions of linear polymer. The grafted polymer has a radius of gyration comparable to radius of the silica nanoparticle with a moderate grafting density so that the grafted polymer is more extended than a Gaussian chain. On length scales ranging from 1 to 20 nm and time scales less than 100 ns, the dynamics of the grafted polymer deviate from the standard Zimm model derived for linear polymers. Instead, the polymer chains are confined and unable to fully relax over the experimental time. The confinement length agrees with the distance between chains decreases as the linear polymer concentration is increased. Additionally, the confinement length is independent of linear polymer molecular weight, suggesting that linear polymer cannot penetrate the grafted layer. Instead, the grafted chains collapse onto themselves, similar to the structural changes observed in systems of star and linear polymers at high concentrations of linear polymer. We verify this physical picture using small-angle x-ray scattering and atomic force microscopy to observe aggregation of grafted particles at high concentrations of linear polymer.

Ryan Poling-Skutvik
University of Houston

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