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Direct Neutron Scattering Measurements of Grafted Polymer Chain Conformations from Functionalized Nanoparticles MICHAEL J.A. HORE, BOUALEM HAMMOUDA, NIST - Natl Inst of Stds & Tech — The conformations of grafted polymers play an important role in determining the physical properties of polymer nanocomposites. Small-angle neutron scattering (SANS) is performed to quantify the conformation of poly(methyl methacrylate)($M_w > 27{,}000$ g/mol) and polystyrene chains ($M_w > 57{,}000$ g/mol) which are attached to iron oxide nanoparticles ($R_{np} = 2.5$ nm, $\sigma = 0.73$ chains/nm^2) and small fractal aggregates ($R \approx 11$ nm, $\sigma = 0.2$ chains/nm^2), respectively. Unlike light scattering or microscopy, SANS can directly measure the grafted polymer chain conformations. In a homopolymer melt, we find the grafted chains adopt stretched conformations near the nanoparticle surface, and transition to ideal, random coils past a cutoff distance r_c, in agreement with scaling arguments in the literature. We find the conformation of the polymer chains is largely unaffected by the ratio of the degree of polymerization of the matrix (P) to that of the brush (N). Finally, we extend this work to measure grafted polymer conformation in solution as a function of solvent quality, and find the grafted chains behave as swollen coils with an excluded volume parameter ν that decreases as the solvent cools to the Θ temperature.

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