Equilibrium Structure and Miscibility of Soft Nanoparticles in Polymer Melts DEBAPRIYA BANERJEE, KENNETH SCHWEIZER, University of Illinois at Urbana-Champaign — Crosslinked polymeric nanoparticles of tunable softness are modeled statistically using particle form factors obtained from scattering experiments. The model yields effective interactions between two fluctuating particles, and one fuzzy particle and a monomer. Using these effective interactions, microscopic PRISM integral equation theory is employed to study the structure and miscibility of soft nanogels in homopolymer melt. In the dilute particle limit, under chemistry-matched conditions, the monomer-particle pair correlations exhibit increasing polymer penetration in the nanogels with increasing surface fuzziness leading to improved dispersion of the particles, contrary to the depletion attraction induced between hard spheres by non-adsorbing polymers. However, beyond certain fuzziness, the polymers are excluded from the surface and the particles tend to "self-bridge" leading to aggregation. Miscibility of soft nanogels turns out to be a non-monotonic function of both particle softness and size. Increasing the matrix degree of polymerization tends to destabilize the system. In the non-dilute-particle limit, the many-body effects of the particles on the structure are studied and different qualitative trends are predicted depending on the particle softness.

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