

Abstract Submitted
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Scaling and phase behavior of polymer-linked particles. MUKTA TRIPATHY, Indian Institute of Technology Bombay — The entropy-driven depletion force is known to drive phase separation between polymers and modestly sized nanoparticles. Recent experiments have demonstrated that it is now possible to synthesize nanoparticles that are linked by a single polymer chain through hybridization of single stranded DNA grafts on disparate nanoparticles, and by crosslinking the two ends of a triblock copolymer, among other methods. We have used integral equation theory to study the phase behavior of polymer linked nanoparticles, and have found that a mesoscopically ordered phase emerges even with only hard core interactions, and modest size asymmetries between the polymer segment, and attached nanoparticles. This ordering occurs at melt-like densities, and is a result of depletion forces acting between polymers, and nanoparticles, which are now chemically linked to each other. The liquid-to-ordered phase transition density initially decreases with polymer length (in contrast to what is seen in mixtures of polymer and nanoparticles) and becomes independent of it at very long polymer lengths. The transition density is a nearly linear function of the ratio of the bead diameter to the polymer radius of gyration (R_g). Furthermore, it attains a unique value when this ratio is nearly one. The predicted ordering length scale is several times R_g . It rises linearly with R_g and then slowly plateaus. For all bead sizes, and polymer lengths studied, the ordering length scale follows a universal scaling behavior as a function of the nanoparticle diameter, and polymer density.

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