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Equilibrium interactions and phase behavior of nanoparticles in solutions of adsorbing polymers MEGHA SURVE, VICTOR PRYAMITSYN, VENKAT GANESAN, University of Texas at Austin — We present the polymer mediated pair-interaction potentials, phase and percolation behavior of nanoparticles in presence of adsorbing polymers. We propose a "saturable" adsorption model to capture the effect of the finite surface saturation capacity for adsorption, and use polymer self-consistent field theory in combination with a McMillan-Mayer framework to compute the pair interaction potentials. Our results demonstrate novel size effects that distinguish the adsorption characteristics of nanoparticles from that of larger particles. Specifically, we predict that the nanoparticle regime is characterized by a significant adsorbance of polymers, distributed predominantly in the form of tails. We also demonstrate that an interplay between the surface saturation, polymer-to-particle size ratios and the polymer concentrations governs the overall effective interactions between nanoparticles in presence of adsorbing polymer. Our results show that the percolation threshold for smaller particles are significantly smaller (and overall correspond only to a few volume percent) compared to that of the larger particles. Further, with a decrease in the size of the particles, we also predict a considerable increase in the miscibility of the polymer-particle mixtures. The importance of surface saturation considerations is highlighted by comparing our results with the previous approaches.

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