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Phase Behavior of Thin Film Polystyrene(PS)-Coated Nanoparticles/PS Mixtures JENNY KIM, PETER GREEN, University of Michigan — We show that the phase behavior of supported thin film mixtures of polystyrene (PS) brush-coated spherical nanoparticle and PS homopolymers is characterized by three regimes, depending on P, the degree of polymerization of the PS host, and N, the degree of polymerization of the grafted chains. Phase separation between the nanoparticles and the host chains occurs in samples for which $N < N^*$ and $P>>N$. Specifically, the nanoparticles segregate exclusively at the substrate and free surface in these samples, forming a trilayered structure. When $P>>N$ and $N> N^*$, preferential segregation of the grafted nanoparticles to the interfaces is accompanied by a structural instability (surface roughening). We identify this as Regime I and the former as Regime II. The system is miscible in Regime III ($P < N$ and $N > N^*$); the nanoparticles are dispersed throughout the film. The characteristics of Regime I are reminiscent of phase separation in polymer/polymer thin film mixtures, whereas Regime II is reminiscent of the interfacial segregation of hard spheres in an athermal melt of polymer chains.

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