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Entropic Effects in the Phase Behavior of Athermal Nanoparticle/Homopolymer Thin Film Mixtures LUCIANA MELI, ABRAHAM ARCEO, PETER GREEN, University of Michigan — The phase behavior of an athermal nanoparticle/polymer mixture, composed of polystyrene-coated gold nanoparticles embedded in polystyrene thin film hosts, was examined. It is shown that the spatial distribution of nanoparticles is readily tailored through control of: the grafting density of the brush, the length of both grafted and free chains, and the relative size of the nanoparticles in comparison to the size of the polymer melt chains. The distribution of nanoparticles within the polymer host, including a surface-induced phase separation, may be understood as a balance between the conformational entropy of the polymer chains, which is compromised when the chains have to stretch around the nanoparticles and penetrate their brush, and the translational entropy of the nanoparticles, which favors their homogeneous distribution. This is the first report that systematically studies the entropic effects that lead to surface phase transitions in polymer/nanoparticle thin film mixtures. Our results may also prove helpful in understanding nanofiller dispersion in analogous bulk mixtures.

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