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Phase Behavior of Polymer-Grafted Nanoparticles in a Polymer Matrix KATRINA IRENE MONGCOPA, University of Houston, RANA ASHKAR, PAUL BUTLER, National Institute of Standards and Technology, RAMANAN KRISHNAMOORTI, University of Houston — We examine the thermodynamic interactions of polystyrene (PS) grafted onto spherical silica nanoparticles blended with a poly(vinyl methyl ether) (PVME) matrix using light, x-ray and neutron scattering techniques. PS/PVME systems are known to exhibit a lower critical solution temperature, with blending thermodynamics greatly affected by the chain length of the components. Thus, we study how enthalpic and entropic effects play a role in the dispersion of PS-grafted nanoparticles in a chemically-distinct matrix, especially as the system approaches a phase boundary. Scattering techniques are used to examine the effect of molecular weight on the blend thermodynamics and concentration fluctuations for such strongly interacting polymer blends. X-ray scattering data and analysis of the structure factor reveal that for a grafted deuterated polystyrene brush (33,000 Da) in a PVME matrix (226,000 Da), an initial dispersion of nanoparticles occurs at low temperatures. The system then gradually transitions to an aggregated state as temperature is increased, suggesting the presence of strong inter-particle interactions that lead to fractal formation as the system approaches a phase boundary. Complementary neutron scattering experiments confirm this phenomenon.

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