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Temperature Dependence of Rheology and Polymer Diffusion in Silica/Polystyrene Nanocomposites[1] WEI-SHAO TUNG, University of Pennsylvania, NIGEL CLARKE, University of Sheffield, RUSSELL COMPOSTO, University of Pennsylvania, JEFFREY METH, DuPont Nanocomposite Technologies and DuPont Central Corporate Analytical Services,, KAREN WINEY, University of Pennsylvania — Time-temperature superposition using the WLF equation is well-established for both the zero shear viscosity and the polymer diffusion coefficient in homopolymer melts. This talk will present the temperature-dependence of polymer dynamics in polymer nanocomposites comprised of polystyrene and phenyl-capped silica nanoparticles (0 – 50 vol%). The WLF equation fits the temperature dependence of the tracer polymer diffusion coefficient and the fitting parameter (B/fo) decreases smoothly with nanoparticle concentration suggesting an increase in the thermal expansion coefficient for the free volume. The WLF equation also fits the temperature dependence of the zero shear viscosity from oscillatory shear experiments, although the fitting parameter (B/fo) increases substantially with nanoparticle concentration. This discrepancy between the diffusion and rheology will be discussed with respect to the reptation model, which predicts that the temperature dependence of polymer diffusion depends predominately on the temperature dependence of local viscosity, and the elastic response in nanocomposites.

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