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Crossover length scale for viscosity experienced by Gold nanoparticles in semi dilute polymer solution INDERMEET KOHLI, RAMI OMARI, ASHIS MUKHOPADHYAY, Wayne State University — Gold nanoparticles (Au NPs) were used as a probe to characterize the crossover length scale for viscosity in semi dilute poly (ethylene glycol) (PEG)-water solutions. Fluctuation correlation spectroscopy (FCS) was used to measure the diffusion of these NPs as a function of their size (5-20 nm), PEG concentration (0 to 40%w/w) and PEG molecular weight (5 kDa to 35 kDa). Our results indicate that for particles with radius $R > R_g$, usual hydrodynamic conditions can be applied, but for particles with radius $R \leq R_g$, the diffusion is approximately an order of magnitude faster than that predicted by Stokes Einstein (SE) relation. The results imply that radius of gyration R_g of the polymer gives the crossover length scale from nanoviscosity to macroviscosity. The relative viscosity experienced by the particles was scaled as $\eta/\ \eta_0 = \exp\ (b\ (R_g/\xi)\ ^a)$, where η_0 is the water viscosity, ξ is the correlation length, $a = 0.70 \pm 0.03$ and $b = 1.59 \pm 0.07$.

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