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Dynamics of nanoparticles in non-Newtonian aqueous dispersions

JACINTA CONRAD, FIROOZEH BABAYE KHORASANI, RAMANAN KRISHNAMOORTI, University of Houston — The transport properties of nanoparticles in soft complex media are relevant for polymer and hydrogel nanocomposites but are still poorly understood. We use single-particle tracking to measure the diffusional dynamics of nanoparticles in non-Newtonian aqueous polymer solutions, which also serve as models of viscoelastic porous media. We track the motion of polystyrene nanoparticles of diameter 400 nm in aqueous solutions of hydrolyzed polyacrylamide whose radii of gyration are comparable to the diameter of the nanoparticles over a wide range of dilute and semi-dilute concentrations. At all concentrations, the mean-square displacement (MSD) of nanoparticles at long times is linearly proportional to time, indicating diffusive motion. The viscosity extracted from the MSD systematically varies with polymer concentration but is smaller than the zero shear rate viscosity measured at each polymer concentration using bulk rheometry, indicating that the dynamics cannot be explained in the context of microrheology of viscous solutions.

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