

Abstract Submitted
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Nanoparticle diffusion in complex and confined media¹ JACINTA CONRAD, Univ of Houston, FIROOZEH BABAYEKHORASANI, University of Houston, DAVE DUNSTAN, University of Melbourne, RAMANAN KRISHNAMOORTI, University of Houston — We identify distinct mechanisms controlling slowing of nanoparticle diffusion through complex media featuring both rigid geometrical confinement and soft mobile crowders. We use confocal microscopy and single particle tracking to probe diffusion of 400 nm nanoparticles suspended in water, in glycerol/water, or in a polymer solution through a packed bed of microscale glass beads. Long-time diffusive mobility of nanoparticles slows as the average pore size of the packed bed decreases for all solutions. The distribution of particle displacements is non-Gaussian, consistent with spatially heterogeneous confinement imposed by the bed. The slowing of nanoparticle mobility in all solutions follows predictions from hydrodynamic models. In polymer solutions, depletion interactions mediated by polymers result in temporary adsorption of particles onto the bead surface. Our results suggest that confined diffusive dynamics of nanoparticles in polymer solutions is controlled by two competing mechanisms: hydrodynamic interactions between particles and spatial obstacles, which dictate long-time slowing of diffusion, and depletion interactions between particles and confining walls due to macromolecules, which control transient adsorption and hence alter the statistics of the short-time motion.

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