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Hydrodynamic entrainment in micro-confined suspensions and its implications for two-point microrheology CHRISTIAN APONTE-RIVERA, Robert Frederick Smith School of Chemical and Biomolecular Engineering, Cornell University, ROSEANNA N. ZIA, Chemical Engineering, Stanford University —

We study hydrodynamic entrainment in spherically confined colloidal suspensions of hydrodynamically interacting particles as a model system for intracellular and other micro-confined biophysical transport. Modeling of transport and rheology in such materials requires an accurate description of the microscopic forces driving particle motion and of particle interactions with nearby boundaries. We carry out dynamic simulations of concentrated, spherically confined colloids as a model system to study the effect of 3D confinement on entrainment and rheology. We show that entrainment between two tracer particles exhibits qualitatively different functional dependence on inter-particle separation as compared to an unbound suspension, and develop a scaling theory that collapses the concentrated mobility of spherically confined suspensions for all volume fractions and particle to cavity size ratios onto a master curve. For widely separated particles, the master curve can be predicted via a Green's function, which suggests a framework with which to conduct two-point microrheology measurements near confining boundaries. The implications of these results for experiments in micro-confined biophysical systems, such as the interior of eukaryotic cells, are discussed.

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