Abstract Submitted
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Wall-induced Particle migration in Dilute Suspensions of Spheres in Creeping Flow[1] JERZY BLAWZDZIEWICZ, MAURICIO ZURITA-GOTOR, Yale University, ELIGIUSZ WAJNRYB, IPPT, Warsaw, Poland — The effects of confinement on the dynamics of binary encounters between spherical particles in shear flow are studied for a system bounded by a single planar wall or two parallel planar walls under creeping flow conditions. We show that wall proximity gives rise to a new class of binary trajectories resulting in cross-streamline migration of particles. In contrast, in unbounded space spherical particles on open trajectories return to their original streamlines after a binary encounter is completed (with no non-hydrodynamic forces present). The physical origin of the new trajectories is explained in terms of counter-rotation of particle pairs that is driven by the dynamic pressure distribution. The new type of trajectories constitutes the dominant cross-streamline migration mechanism in dilute wall-bounded suspensions. We show that this mechanism is responsible for the unusually large self-diffusivity observed in experiments by Zarraga and Leighton (2002). The effect of the new migration behavior in dilute suspensions is illustrated using a Boltzmann–Monte Carlo simulation technique. We show that apart from the enhanced self-diffusivity, the walls may also cause formation of a layered suspension microstructure in the low-concentration regime.

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