

Plane Couette Flow of Dense Liquid-Particle Suspensions

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We numerically study dense (26–59% solids volume fraction) neutrally buoyant solid-liquid suspensions undergoing shear at particle-Stokes numbers significantly larger than 1, inspired by Bagnold's 1954 Couette flow experiments. The three-dimensional, time-dependent simulations employ lattice-Boltzmann discretization of the Navier–Stokes equations to solve the fluid flow in between the particles and to account for solid-liquid interaction; and hard-sphere and lubrication force interaction between the particles. The simulations show shear induced ordering which strongly depend on solids volume fraction and polydispersity. The scaling of the normal stresses indicates the presence of a granular flow regime. So far, no evidence of a macro-viscous regime has been found.

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