The effect of electric double layers, zeta potential and pH on apparent viscosity of non-Brownian suspensions

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Abstract

We carried out 3-D simulations of monodisperse particle suspensions subjected to a constant shear rate with the view to investigate the effect of electrical double layers around the particles on apparent suspension viscosities. To this end, expressions for Debye length, zeta potential and ionic strength (pH) of the liquid were incorporated into our in-house lattice Boltzmann code that uses the Immersed Boundary method and includes sub-grid lubrication models. We varied the solids concentration and particle radius, keeping the particle Reynolds number equal to 0.1. We report on results with respect to the effect of pH (in the range 9 through 12) and Debye length on apparent viscosity and spatial suspension structures, particularly at higher solids volume fractions, and on the effect of flow reversals.

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