

Simulation of Self-Assemblies of Colloidal Particles by Using a Lattice Boltzmann Pseudo-Solid Model

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Lattice Boltzmann pseudo-solid model is a newly proposed method for the efficient simulation of colloidal particles' motion in single or multiphase fluids. In this study, the model is applied to study the self-assemblies of colloidal particles partially immersed in a fluid layer on a substrate. The formation of hexagonally close-packed two dimensional arrays is recovered, showing a good agreement with previous studies with discrete element methods. Simulation results also show that the separation of particles of different sizes can emerge as the ratio of particles radii increases, a complex phenomenon which is demonstrated for the first time in numerical experiment.

Keywords: Lattice Boltzmann method, Solid-liquid flows, Colloid particle arrays, Self-assembling process, Capillary interactions, Hydrodynamic interactions