Abstract

This study is about rheology, i.e., material properties to determine macroscopic flowing behaviors, of two-phase systems consisting of a viscous liquid and solid particles. Solid particles are sufficiently small, so that particle inertia is entirely negligible in the particle dynamics. Such dense suspensions exhibit a remarkable rheological behavior, shear thickening, i.e., the fluid becomes more viscous under higher shear stresses. This behavior is considered as paradoxical because it implies that internal structure grows up under higher stress. Usually, we expect that strong forces break up structures into smaller pieces. To understand such unusual rheology, we introduced a simulation model to predict microstructure under a flow. Our simulation model is based on Stokesian Dynamics, which is a relevant framework to reproduce dissipative particle dynamics under imposed flows. Additionally, we consider frictional contact forces, which are indeed essential in crowded situations.