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SVC047-15 Room:301B Time:May 24 12:15-12:30

Self-organized microstructure in flowing suspension

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We present a 3-D numerical simulation developed by combining the discrete element method (DEM) and computational fluid dynamics (CFD), assuming suspensions containing uniform rectangular rigid particles within a Newtonian viscous matrix. Our simulation revealed how the bulk viscosity is determined by the particle orientation, particle concentration, and development of both particle clusters and contact force chains. The evolution of the microstructure is governed by two factors: (1) geometric relationships between the particle orientation and the maximum principal axis and (2) magnitude of particle-fluid and particle-particle interactions, which modifies the rotation behavior of particles. The first factor results in the coupling of the particle orientation and the local fraction of particles. The second factor controls the mean preferred particle orientation and its intensity. Through the combined effect of the two factors, particles are rearranged because of shear-induced strain, and both the microstructure and the bulk viscosity reach a steady-state condition. Under this condition, the microstructure is composed of two domains having different particle fractions and particle orientations. These findings have important implications for the kinematics of the flow-related microstructure recorded in igneous rocks.