STABILITY ANALYSIS OF MAGNETIC PARTICLE DISPERSIONS BY STOKESIAN DYNAMICS SIMULATION

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Ferrofluids (FFs) and magnetorheological fluids (MRFs) are magnetic-field responding fluids, which are known as functional fluids. It is well known that magnetic particles form chain-like aggregates under uniform magnetic fields and these phenomena have been analyzed by different methods, including Monte Carlo 1, Stokesian Dynamics 2, and Dissipative Particle Dynamics 3. Recently it was reported that the sedimentation rate in iron/FFs suspensions is significantly lower than in iron/kerosene MRFs, which suggests that FFs are more stable than MRFs 4. The mechanism of the phenomena is not known yet. In this work, Stokesian Dynamics (SD) Simulation was applied to these systems, considering both near-field and far-field hydrodynamic interaction. The following results were obtained: (a) clusters parallel to the direction of magnetic fields are obtained under magnetic fields; (b) dynamics of magnetic particles become active with magnetic moment; (c) structures of cluster become irregular with magnetic moment. These results show that the hydrodynamic interaction becomes a significant factor in stabilizing dispersions of FFs.

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