Abstract Submitted
for the DFD12 Meeting of
The American Physical Society

Electrohydrodynamic interactions of spherical particles under Quincke rotation DEBASISH DAS, DAVID SAINTILLAN, Department of Mechanical Science and Engineering, University of Illinois, Urbana-Champaign — Quincke rotation denotes the spontaneous rotation of dielectric particles immersed in a slightly dielectric liquid when subjected to a high enough DC electric field. It occurs when the charge relaxation time of the particles is greater than that of the fluid medium, causing the particles to become polarized in a direction opposite to that of the electric field and therefore giving rise to an unstable equilibrium position. When slightly perturbed, the particles start to rotate, and if the electric field exceeds a critical value the perturbations do not decay and the particle rotations reach a steady state with a constant angular velocity. We use a combination of numerical simulations and asymptotic theory to study the effect of electrohydrodynamic interactions between particles under Quincke rotation. We study the prototypical case of two equally charged spheres carrying no net charge and interacting with each other both hydrodynamically and electrically. The case of spherical particles free to roll on a horizontal grounded electrode is also described. We show that Quincke rotation results in self-propulsion of the particles in the plane of the electrode, and interactions between a pair of such "rollers" are analyzed.

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Date submitted: 31 Jul 2012 Electronic form version 1.4