Abstract Submitted
for the DFD11 Meeting of
The American Physical Society

The effect of dissolved oxygen on electrohydrodynamic aggregation of colloidal particles near electrodes T.J. WOEHL, N.D. BROWNING, W.D. RISTENPART, University of California at Davis — Colloidal particles suspended in dilute electrolytes have been widely observed to aggregate laterally along electrodes in response to oscillatory electric fields. Studies on the effects of particle type and electrode material have suggested that electrochemical reactions play a role in driving aggregation, but the detailed mechanism remains unclear. Here we demonstrate that, at sufficiently low frequencies, the dissolved oxygen (DO) content of the suspending electrolyte strongly affects the aggregation behavior of micron-scale particles. At 100 Hz, colloids in aqueous KCl saturated with oxygen exhibit an aggregation rate three times larger compared to aggregation in deoxygenated solutions. In contrast, no effect of DO content is observed at 500 Hz with KCl, and no effect is observed at either frequency when the suspending electrolyte is KOH. We investigate the role of DO using cyclic voltammetry, and we interpret the observations in terms of the effect of DO on the magnitude of the electrochemical current driving the electrohydrodynamic flow.

William Ristenpart

Date submitted: 11 Aug 2011 Electronic form version 1.4