Abstract Submitted
for the DFD06 Meeting of
The American Physical Society

The role of Faradaic reactions in microchannel flows. DAVID BOY, BRIAN STOREY, Olin College — Microfluidic applications involving induced charge electroosmosis often rely upon having closely spaced electrodes inside the device. High electric fields are generated at relatively low voltage, which can drive significant flow. Even at low voltage, Faradaic reactions are known to occur and can impact device performance. This work considers the role of Faradaic reactions on microchannel flows, paying close attention to body forces on the bulk fluid. Binary electrolytes are modeled with the Poisson-Nernst-Planck equations with Butler-Volmer reaction kinetics. Two geometrical configurations are considered; an electrolyte between two parallel plate electrodes and an electrolyte over an alternating array of positive and negative electrodes. In the parallel plate configuration, body forces on the bulk fluid drive an instability in the system. Electroconvection sets in below the classical limiting current and impacts the predicted polarographic curves. In the alternating electrode configuration, we compare flow features and velocities from full numerical simulations to simpler models that assume electroneutrality in the bulk.

Brian Storey
Olin College

Date submitted: 02 Aug 2006 Electronic form version 1.4