Abstract Submitted
for the DFD06 Meeting of
The American Physical Society

Induced-charge electro-osmosis over non-ideally polarizable surfaces GILAD YOSSIFON, School of Mechanical Engineering, Tel-Aviv University, ITZCHAK FRANKEL, Faculty of Aerospace Engineering, Technion, TOUVIA MILOH, School of Mechanical Engineering, Tel-Aviv University — Appearance of vortices in electro-kinetic flows around corners in micro-channel junctions have recently been documented in the literature. Their occurrence is related to the nonlinear mechanism of induced-charge electroosmosis (ICEO). This is associated with the small yet finite dielectric constant of the channel walls allowing for electric-field leakage through them. This leakage localized at the corner polarizes it bringing opposite excess ion concentrations across the corner, thus modifying the electric body force acting on the fluid within the Debye layer. This, in turn, has a global effect on the hydrodynamics of the fluid outside the Debye layer and, under certain conditions, may induce vortices. We study theoretically the onset of such vortices in channel junctions and provide a physically and mathematically consistent description of the general ICEO phenomena over non-ideally polarizable (dielectric) surfaces. An effective channel-wall boundary condition is obtained which 'integrates out' the thin electric double layer domain, thus, allowing a purely macro-scale calculation of the ICEO flow. Finally, encouraged by our success of modeling the occurrence of vortices in the micro-scale regime we extend our theory to the nano-scale regime.

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Date submitted: 08 Aug 2006 Electronic form version 1.4