

Abstract Submitted
for the DFD08 Meeting of
The American Physical Society

Topology optimization of induced-charge electro-osmotic flows

MISHA MARIE GREGERSEN, FRIDOLIN OKKELS, Department of Micro and Nanotechnology, Technical University of Denmark, MARTIN Z. BAZANT, Department of Mathematics, Massachusetts Institute of Technology, HENRIK BRUUS, Department of Micro and Nanotechnology, Technical University of Denmark — Non-linear induced-charge electro-osmotic (ICEO) flows with both AC and DC forcing have recently been observed around isolated and inert (but polarizable) objects, offering the possibility to manipulate liquids and suspensions of nanoparticles. ICEO is the nonlinear electro-osmotic slip that occurs in an electrolyte when an applied electric field acts on the ionic charge it induces around a polarizable surface of any dielectric in contact with an electrolyte. We present a numerical study of ICEO of electrolytes in microfluidic channels containing a fixed dielectric structure with a complex geometry. The full nonlinear coupled equation system is solved, enabling studies of finite Debye layers and confinement effects. A method has been established for optimizing the shape of the dielectric structure for any given objective function. Optimized structures have been achieved for maximizing the pumping velocity generated by asymmetric structures.

Misha Marie Gregersen
Department of Micro and Nanotechnology, Technical University of Denmark

Date submitted: 31 Jul 2008

Electronic form version 1.4