

Abstract Submitted
for the DFD10 Meeting of
The American Physical Society

Pumping of Dielectric Liquids Using Non-Uniform-Field Induced Electrohydrodynamic Flow¹ JAE CHUN RYU, WONKYOUNG KIM, KWAN HYOUNG KANG, Pohang University of Science and Technology (POSTECH) — Pumping of dielectric liquids or poorly conducting liquids is necessary in cooling of microelectronic devices, dispensing liquids in miniature systems for chemical and biological analysis, and micropumping of organic solvents for microreactor. Electrical pumping of liquids is more attractive than conventional mechanical pumping methods because of many advantages such as simple design, no mechanical parts, low acoustic noise, and lightweight. We present a new electrohydrodynamic (EHD) pumping method for dielectric liquids. The pumping method relies on the EHD flow generated by electric-field dependent electrical conductivity (Onsager effect). A polar additive plays an important role in enhancing the field-dependency of conductivity. When ac voltage is applied, a fast and regular flow was produced around electrodes. Flow speed is proportional to cube of electric-field strength and inversely to applied frequency. The experimental results showed good agreement with numerical analysis which is based on our model.

¹This research was financially supported by a grant to MEMS Research Center for National Defense funded by Defense Acquisition Program Administration.

Jae Chun Ryu
Pohang University of Science and Technology (POSTECH)

Date submitted: 20 Jul 2010

Electronic form version 1.4