Abstract Submitted
for the DFD12 Meeting of
The American Physical Society

Size-based dielectrophoretic particle sorting in a microfluidic device with thermal effects BARUKYAH SHAPARENKO, University of Pennsylvania, HAN-SHENG CHUANG, National Cheng Kung University, HOWARD HU, HAIM BAU, University of Pennsylvania — Dielectric particles in a dielectric medium experience a force known as dielectrophoresis (DEP) when subjected to a nonuniform electric field. Since this DEP force is proportional to the particle volume, it is well-suited for size-based particle sorting. Additionally, we use the geometric constraints of a narrow segment of microchannel to aid sorting by means of pinched flow fractionation (PFF). We found that in microfluidic devices, thermal effects due to Joule heating may be important. Temperature variations of the electrical material properties give rise to additional forces, including electrothermal flow in the medium and a thermal DEP force acting on the particles. We combine PFF and DEP in series to create a microfluidic sorting device, with an interdigitated array of five L-shaped electrodes and five outlet channels permitting the sorting of up to five different particle sizes. The sorting process is regulated by on-chip voltage control, so that the same device is easily adaptable to different particle sizes. We compare computed particle trajectories from an analytical solution with experimental sorting results.

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Date submitted: 01 Aug 2012 Electronic form version 1.4