Abstract Submitted
for the DFD07 Meeting of
The American Physical Society

Hydrodynamic effects on dielectrophoretic separation of carbon nanotubes JUNICHIRO SHIOMI, The University of Tokyo, YUAN LIN, KTH Mechanics, Sweden, SHIGEO MARUYAMA, The University of Tokyo, GUSTAV AMBERG, KTH Mechanics, Sweden — Single-walled carbon nanotubes (SWNTs) are key materials in nanotechnology as potential candidates for diverse applications due to their extraordinary mechanical, thermal, optical and electrical properties. One of the current critical challenges is the separation of metallic (m-SWNTs) and semiconducting SWNTs (s-SWNTs). Among various post-synthesis separation methods devised and applied, dielectrophoretic (DEP) separation of SWNTs in dispersed form has been demonstrated to be possible with high selectivity and simplicity. The method can also be utilized to maneuver SWNTs to selected locations. Although the concept of DEP-separation in principle is simple, the system involves effects that may cause bulk flow motions such as electroosmosis, thermal convection and electrothermal flow, which is driven by a body force caused by electric field acting on gradients in permittivity and/or conductivity due to a non-uniform temperature field. In the current study, we investigate the impact of the thermo-hydrodynamics on the DEP-separation of SWNTs by formulating a dynamical model of the integrated system. The results show that, under typical experimental conditions, electrothermal flow can dominate the motion of s-SWNTs and significantly weakens the DEP separation.

Junichiro Shiomi
The University of Tokyo

Date submitted: 03 Aug 2007 Electronic form version 1.4