SPECIAL PHYSICAL MATHEMATICS SEMINAR

ELECTROKINETIC DYNAMICS AND CONTROL OF METALLIC NANORODS

KLINT ROSE
Department of Mechanical Engineering
Stanford University

ABSTRACT:

Micro- and nano-barcode technologies have the potential to realize large-scale multiplexing of hundreds of reactions in a single hybridization assay. Commercially available rod-shaped metallic particles with 30 nm to 1 mm diameters and lengths of 1 to 10 microns can be grown with metallic stripes that encode on the order of 10 bits of information. Each particle then carries a "barcode" that identifies a hybridization reaction that can be performed and detected in parallel with many other particles in a reaction chamber or fluidic channel. We have explored the feasibility of transporting and manipulating these particles in a microfluidic device using DC and AC electric fields. Our preliminary experiments track the translation, diffusion, and alignment of cylindrical particles 6 microns long and 0.25 microns in diameter under settling conditions and in both DC and AC electric fields. We have developed a model for the electrophoretic translation and rotation of these particles, including induced charge effects, that accurately predict this alignment. The model includes Brownian forces, hydrodynamic forces, and particle-induced electroosmotic flow. We are also investigating the particle-particle interactions due to induced charge electroosmosis around the particles. The basic studies are being used to guide the design of a fully automated particle reaction, sorting, separation, and read-out system for multiplexed immunoassays.

FRIDAY, OCTOBER 14, 2005
1:00 PM
Building 2, Room 255

Refreshments at 2:15 PM in Building 2, Room 349.

Massachusetts Institute of Technology
Department of Mathematics
Cambridge, MA 02139