Abstract Submitted
for the DFD11 Meeting of
The American Physical Society

Continuum and Molecular Dynamics Studies On the Diffusiophoretic Motion NIMA SHARIFI-MOOD, JOEL KOPLIK, CHARLES MALDARELLI, the City College of New York & Levich Institute — The self-propulsion of micron or sub-micron objects has a number of applications as miniaturized motors. One method for particle self propulsion is to utilize a surface chemical reaction on one part of the particle surface to create concentration gradients of solutes across the particle. These gradients drive a diffusiophoretic motion due to unbalanced (van der Waals) attractions between the particle and the solutes and solvent within an intermolecular length scale (L, 10-100 nm) of the particle surface. Prior continuum studies assume the interaction creates a local slip velocity at the particle surface, and find the terminal velocity U of spherical particles to be independent of the radius a. We provide numerical solutions for U which account directly for the solute transport and flow within L, and matched asymptotic solutions as L/a tends to zero. The leading order expression for U is independent of a, but U decreases with the particle radius for L/a greater than .01. Molecular dynamics simulation is also undertaken using Lennard-Jones potentials to provide a more complete picture of nanoscale propulsion.

Nima Sharifi-Mood
the City College of New York & Levich Institute

Date submitted: 09 Aug 2011 Electronic form version 1.4