Abstract Submitted
for the DFD10 Meeting of
The American Physical Society

Electrokinetic locomotion due to Reaction Induced Charge Auto-Electrophoresis JEFFREY MORAN, JONATHAN POSNER — Synthetic nanomotors, like their biological counterparts, propel themselves through aqueous solutions by harvesting chemical energy from their local environment and converting it to mechanical energy. We study bimetallic rod-shaped particles which move autonomously by catalytically decomposing hydrogen peroxide to oxygen and water. We present a scaling analysis and computational simulations that describe the locomotion of bimetallic rod-shaped motors in hydrogen peroxide solutions due to reaction-induced charge auto-electrophoresis. The model shows that the locomotion results from electrical body forces in the surrounding fluid, which are generated by a coupling of an asymmetric dipolar charge density distribution and the electric field it generates. The simulations make the predictions, in agreement with experiment, that the rods' velocity depends linearly on both the surface charge and reaction rate.

Jeffrey Moran

Date submitted: 05 Aug 2010 Electronic form version 1.4