Abstract Submitted
for the DFD10 Meeting of
The American Physical Society

Hydronium-dominated ion transport in carbon-dioxide-saturated electrolytes at low salt concentrations in nanochannels SUMITA PENNATHUR, UCSB, KRISTIAN JENSEN, JESPER KRISTENSEN, DTU, ANDREW CRUMRINE, UCSB, MATHIAS ANDERSEN, HENRIK BRUUS, DTU — Nanochannel ion transport is known to be governed by surface charge at low ionic concentrations. In this talk, we show that this surface charge is dominated by hydronium ions arising from dissolution of ambient atmospheric carbon dioxide. By refining the electrokinetic model of the nanochannel conductance for low salt concentrations, we identify a minimum conductance value before saturation at a value independent of salt concentration in the dilute limit. Our model self-consistently couples chemical equilibrium models of the silica wall and the electrolyte bulk, and is parameterized by only the surface reaction equilibrium constant for silica/hydronium reactions. The model describes our experimental data with aqueous potassium chloride solutions in 165-nm-high silica nanochannels well, and furthermore, by comparing model predictions with measurements in bulk and in nanochannels with hydrochloric acid solutions, we verify its predictive power.

Sumita Pennathur
UCSB

Date submitted: 06 Aug 2010 Electronic form version 1.4