Abstract Submitted
for the MAR10 Meeting of
The American Physical Society

Electro-fluidic gating in solid-state nanopores with a chemically reactive surface DEREK STEIN, ZHIJUN JIANG, Brown University — We are exploring the use of electrically functionalized solid-state nanopores for controlling the transport of ions and single DNA molecules in solution. Modulating the surface charge density in a fluidic device differs crucially from gating in a semiconductor because real, chemically reactive surfaces obtain a charge density spontaneously in contact with solution. An applied gate field can shift the chemical equilibrium of the ionizable surface groups. Here we present an electrochemical model of electro-fluidic gating that captures the influence of pH, salt concentration, and specific chemical surface groups. We have also tested ion transport in electrostatically actuated nanopore devices in which the applied gate potential influenced the ionic conductance through the pore. Our experiments reveal how applied electric fields can influence the density of mobile counter-ions inside the pore, but that capacitive charging and the chemistry of the surface both play important roles.

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Date submitted: 20 Nov 2009 Electronic form version 1.4