Abstract Submitted
for the DFD16 Meeting of
The American Physical Society

Confinement effect on liquid and ion transport in nanochannels coated with environmental-stimuli-responsive polyelectrolyte(PE) brushes GUANG CHEN, SIDDHARTHA DAS, The Department of Mechanical Engineering, University of Maryland — We study the confinement effect in the electrokinetic transport in polyelectrolyte(PE)-brush-grafted nanochannels. Starting with thermodynamically self-consistent description, i.e., accounting for the elastic, excluded volume and electrostatic effects of the PE brush and the effects of the induced electric double layer, we first probe the equilibrium brush height. We show that this height is dictated by PE size, grafting density, concentration of electrolyte solution and the extent of confinement. Shrinking-swelling behavior of PE brush with various configurations are compared: 1) short sparse end-charged PE brush swells as the salt concentration increases, while long dense end-charged PE brush shrinks; 2) PE brush with constant volume charge along the backbone always shrinks with the increase of the salt concentration. This shrinking-swelling behavior as well as the monomer distribution of PE interplay with the PE-induced drag force to dictate the overall electroosmotic and ionic current transport in such PE-brush-grafted nanochannels. We exhibit that among other factors, height of the nanochannels can be tuned to regulate this transport. We anticipate that our study will shed new light on structure of nano confined PE brushes with implications in ionic current rectifier design.

Guang Chen
The Department of Mechanical Engineering, University of Maryland

Date submitted: 01 Aug 2016 Electronic form version 1.4