Abstract Submitted
for the MAR15 Meeting of
The American Physical Society

Large modification of electrostatic fields in liquids between charged plates: Effects of the dielectric response of solvent molecules
HONGBO CHEN, ISSEI NAKAMURA, State Key Laboratory of Polymer Physics and Chemistry, Changchun Institute of Applied Chemistry, Chinese Academy of Sciences — We study the effects of dielectric inhomogeneity on the electrostatic properties of liquids between two charged plates, developing a modified Poisson-Boltzmann equation via the Booth theoryfor the dielectric response of solvents under external electrostatic fields. We show that variations in the capacitance for ion-containing solutions can be non-monotonic, whereas the conventional Poisson-Boltzmann theorypredicts monotonic behavior. Importantly, the effects of ions on the reorganization of solvent dipoles near electrodes significantly affect the capacitance. Furthermore, we show thatthe dielectric contrast in immiscible liquid mixturesunder external electrostatic fields may cause conceptually new phase behaviors between charged plates; interfaces between the liquidsperpendicular to an external fieldmay be energetically favored over parallel interfaces.

Hongbo Chen
State Key Laboratory of Polymer Physics and Chemistry,
Changchun Institute of Applied Chemistry, Chinese Academy of Sciences

Date submitted: 05 Nov 2014 Electronic form version 1.4