Abstract Submitted
for the MAR15 Meeting of
The American Physical Society

X-ray Scattering Studies of Ionic Liquid Structure and Dynamics at Charged Graphene Interface[1] AHMET UYSAL, SANG SOO LEE, HUA ZHOU, PAUL FENTER, Argonne National Laboratory, PENGFEI ZHANG, SHENG DAI, Oak Ridge National Laboratory — Room temperature ionic liquids (RTILs) are promising electrolytes for energy storage systems, especially for supercapacitors. However, our knowledge of these highly dense ionic plasmas at electrified interfaces is still at its infancy due to the lack of *in situ* experimental data about their potential-dependent electric double layer (EDL) structures and dynamics. In particular, the behavior of mixed electrolytes (RTIL/RTIL and Solvent/RTIL), which are significantly important for practical applications, have been little studied with structural probes. We use *in situ*, real-time X-ray reflectivity to elucidate the role of different anion-cation combinations and solvents on the interfacial ionic liquid structure and dynamics at epitaxial graphene electrode during cyclic voltammetry and potential steps. Our results give direct information about the EDL structure and response, which helps us to connect the macroscopic system properties to the nanoscale structure.

[1]This work was supported as part of the Fluid Interface Reactions, Structures and Transport (FIRST) Center, an Energy Frontier Research Center funded by the U.S. Department of Energy, Office of Science, Office of Basic Energy Sciences.

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Date submitted: 14 Nov 2014 Electronic form version 1.4