Interfacial Charge Induced Phenomena in Porous Graphene-Based Bulk Materials

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Monolithic graphene based carbon foams with hierarchical 3D architectures and high mass-specific surface areas have many promising applications ranging from hydrogen and electrical energy storage to desalination, catalysis and actuation. Here, we will discuss fundamental phenomena related to interfacial charging of the carbon/electrolyte interface and how these cause macroscopic effects such as reversible electrical conductivity changes and mechanical strain. To explore these phenomena, we apply a combination of atomistic simulations (DFT and MD) and various in-situ characterization techniques, including synchrotron-based in-situ electron spectroscopy to study interfacial charge induced changes of the electronic structure. Our results will guide the development of next generation carbon-based storage materials, and open the door to new applications of monolithic nanocarbon foams including all-carbon bulk actuator and transistor technologies.

Work at LLNL was performed under the auspices of the U.S. DOE by LLNL under Contract DE-AC52-07NA27344.