Behavior of Nanoporous Carbon Aerogels in Liquid Hydrogen

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Securing this nation's energy future will require the development of new materials for energy storage applications as well as for energy conversion. Here, nanostructured – specifically nanoporous – solids have the potential to lead to many technological breakthroughs. Their high surface area, electrical conductivity, environmental compatibility and chemical inertness make them very promising materials for use as electrode materials in supercapacitors and rechargeable batteries. At Lawrence Livermore National Laboratory research on nanoporous materials is driven by their use in targets for high-energy physics experiments. Ironically, understanding how the pore structure and materials strength evolve as the surface environment is manipulated is a common theme in designing new porous materials for both these two diverse applications. The ability to measure changes in morphology of the nanoporous materials *in situ* with a combination of small-angle x-ray scattering (SAXS) and diffractive x-ray imaging has provided the needed feedback to develop nanoporous materials with optimized microstructures for these applications. In many cases unique properties are observed in nanoporous materials as the surface environment and density are manipulated. We will present examples how SAXS measurements have lead to the development of carbon aerogels able to wick cryogenic hydrogen needed for laser fusion targets and development of super strong carbon aerogels able to with stand volume changes associated charge-discharge in supercapacitors and rechargeable batteries.