Order vs. Disorder: Does Pore Geometry Affect the Electrochemical Performance of Carbon Electrode Nanoarchitectures?

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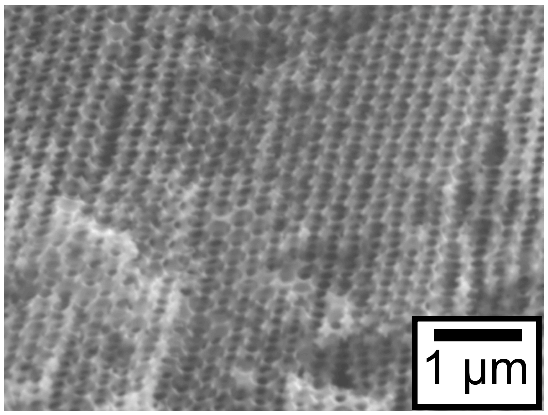
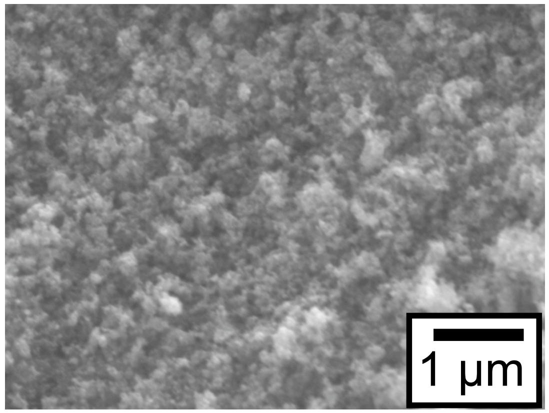
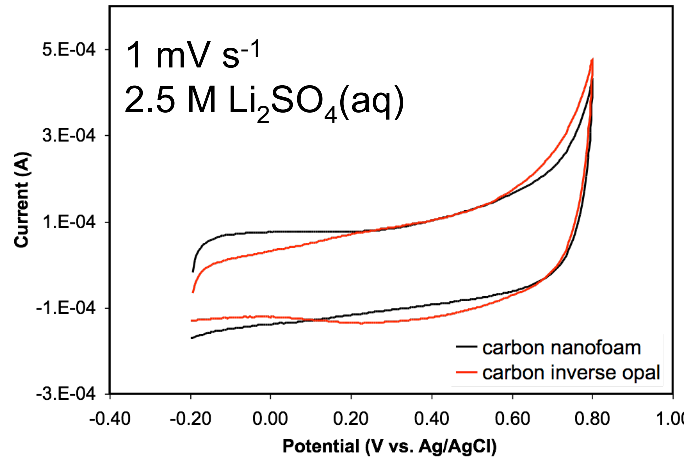
Hypothesis: Carbon inverse opals will not offer any capacitance gains beyond those of comparable carbon electrodes with disordered pore geometries, because the magnitude of capacitance is proportional to the electrochemically accessible surface area of an electrode.



carbon inverse opal



carbon nanofoam



Results & Goals: We have successfully fabricated carbon inverse opals and nanofoams with comparable macropore sizes, electrode thicknesses, and electronic conductivities. Carbon inverse opal papers offer >10 times the electronic conductivity of conventional carbon inverse opal monoliths. Preliminary results reveal that both materials discharge similar magnitudes of specific capacitance (30 vs. 32 F g^{-1}) and have comparable charge transport kinetics for ions to diffuse through pore networks. We seek to demonstrate the reproducibility of these measurements and to analyze surface chemistries via XPS.