Development of Electrode Architectures for High Energy Density Electrochemical Capacitors

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Purpose

Overarching goal:
High power (electric double layer) and high energy density (pseudocapacitance)

Conceptual approach:
Nanoscale integration of porous carbons with mesoporous metal oxides

Impact on DoE Energy Storage Mission

Low-cost pseudocapacitive energy storage:
Fast response rate power management for grid scale applications; integration of intermittent power sources

Preliminary Results

Carbon framework: carbide-derived carbon
Hierarchical porosity & large surface area

Niobium oxide:
Increase in energy density after hydrothermal synthesis on carbon

Research Plan

Near term:
Optimize synthesis to achieve designed architecture & detailed material characterization

Next year:
Film preparation; prototype fabrication & benchmarking