

PROJECT FACTS

UNIVERSITY OF KENTUCKY CENTER FOR APPLIED ENERGY RESEARCH

ELECTROCHEMICAL POWER SOURCES

Asymmetric Capacitors for Grid Energy Storage

Numerous technologies are under development for storing off-grid electrical energy, including pumped hydropower, compressed air energy storage, flywheels, batteries, and electrochemical capacitors. Research efforts at UK-CAER are examining the efficacy of employing electrochemical capacitors for grid energy storage, including symmetric and asymmetric systems in aqueous and non-aqueous electrolytes. One asymmetric system of interest is based on an activated carbon positive/lithium titanate negative electrochemical couple in standard lithium-ion electrolytes. The activated double layer carbon is produced hydrothermally from inexpensive carbohydrate precursors, which results in the formation of mono-disperse carbon nanospheres. The lithium titanate (LTO) negative is a zero-strain lithium-ion intercalation anode which undergoes negligible volume expansion during cycling. Significant improvements in capacitor energy densities are realized through the use of an asymmetric design. The LTO utilizes faradaic reaction to store charge and the activated carbons utilize non-faradaic capacitive process to store charge. The main objective of this project is to develop an asymmetric hybrid supercapacitor based on non-aqueous battery electrolytes which can maintain high energy density, cycle life, and fast charge capability.

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