

PROJECT FACTS

UNIVERSITY OF KENTUCKY CENTER FOR APPLIED ENERGY RESEARCH

ELECTROCHEMICAL POWER SOURCES

Electrochemical Capacitors

Electrochemical capacitors (EC), also known as, “supercapacitors,” “double-layer capacitors,” or “ultracapacitors,” are energy storage devices with long cycle life, low internal resistance, fast charge and discharge rates, and high power densities. Due to these advantages ECs have drawn much attention recently and have been applied in electric/hybrid vehicles, heavy-construction equipment, electronics, and grid utility storage. Conventional electrode materials for ECs are activated carbons with nano-porosity and high surface area. Other materials include metal oxides, graphene, carbon nanotubes, carbon aerogels, and conductive polymers. Although some of these materials show high performance, the cost may be high or the synthesis may involve using toxic or corrosive chemicals. Activated carbon materials for ECs were hydrothermally synthesized from a variety of low cost biomass precursors such as packaging peanuts, cellulose, pistachio shells, rayon fibers, starch, and bourbon waste. Carbon materials synthesized via hydrothermal dehydration of sugar were subjected to a one-step physical activation. The activation process was carried out in one-step from green to activated carbons with short activation times (30-60 minutes), and high material yields (30-50%). The activated carbon electrodes exhibited excellent packing density (1 g/cc), and electrode wettability. The activated CNs exhibited higher volumetric capacitances than any other activated carbons in the market in both organic (80 F/cc) and aqueous electrolytes (200 F/cc). The gravimetric capacitances of activated CNs were as high as 180 F/g and 275 F/g in organic and aqueous electrolytes, respectively.

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