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Activated Microporous Carbon Derived from Almond Shells for High Energy Density Asymmetric Supercapacitors.

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Abstract

Via the activation treatment of carbonized almond shells with HNO3 and KOH, activated microporous carbon (AMC-3 and AMC-2) was successfully synthesized. These two AMC electrodes demonstrate remarkable electrochemical behaviors such as high rate capability, high specific capacitance, and excellent cycle stability when serving as electrodes for supercapacitors.

More importantly, through the use of a Zn-Ni-Co ternary oxide (ZNCO) positive electrode and the AMC negative electrode, asymmetric supercapacitors (ASC) were assembled that deliver superior energy density (53.3 Wh kg(-1) at a power density of 1126.1 W kg(-1) for ASC-2 and 53.6 Wh kg(-1) at a power density of 1124.5 W kg(-1) for ASC-3) and excellent stability (82.7% and 83.4% specific capacitance retention for ZNCO//AMC ASC-2 and ZNCO//AMC ASC-3, respectively, after 5000 cycles).

Through these two methods, low-cost, renewable, and environmentally friendly electrode materials can be provided for high energy density supercapacitors.