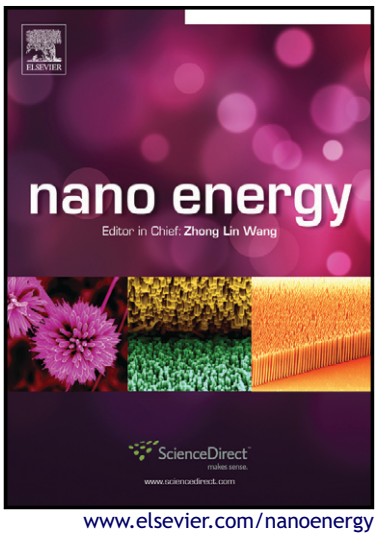

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From Flour to Honeycomb-Like Carbon Foam: Carbon Makes Room for High Energy Density Supercapacitors

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Abstract

An easy, one-step carbonization of alkali-treated wheat flour is proposed for the synthesis of three-dimensional (3-D) interconnected honeycomb-like porous carbon foam (HPC) with an excellent performance as supercapacitor electrodes. Due to its interconnected porous structure with narrow pore size distribution, high specific surface area (1313 $m^2 g^{-1}$), and heteroatom doping (N: 1.1 at.%, O:11.2 at.%), the HPC electrode exhibits high specific capacitance of 473 F g^{-1} at 0.5 A g^{-1} in 6 M KOH and outstanding electrochemical stability with capacitance retention up to 94.5% after 10,000 cycles. More interestingly, the assembled HPC//HPC symmetric supercapacitor delivers an ultrahigh energy density of 29.3 Wh kg^{-1} (based on the total mass of the active materials of the two electrodes), much higher than most of carbon-based supercapacitors. Additionally, the HPC//MnO_2/HPC asymmetric supercapacitor exhibits high energy density of 63.5 Wh kg^{-1} (based on the total mass of the active materials of the two electrodes) and excellent cycle stability (93.4% of initial capacitance retention after 5000 cycles).

Keywords: honeycomb-like porous carbon, high energy density, excellent cycle stability, supercapacitors