Energy Storage Using Carbon Nanotube Electrodes

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We have investigated the key factors determining the performance of supercapacitors and secondary battery using carbon nanotubes (CNT), carbon fibers, and their composites with various polymers. Several parameters such as compositions of the binder, annealing temperature, Fluorine doping, KOH treatment, and exfoliation are optimized for the best performance of the energy density and power density. We find that most of the BET surface area of the CNT electrode contributed to the theoretically estimated specific capacitance. A maximum specific capacitance of 180 F/g and a measured power density of 20 kW/kg at the energy density of 7 Wh/kg in a solution of 7.5 N KOH was obtained in the pristine singlewalled nanotube. Nanocomposites of nanotubes with polymers and metal oxides give rise to a capacitance values larger than activated carbons. A series of methods of modifying the nanotube structures to maximize the capacitance of the materials will be further discussed.