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Thick, Binder-Free Carbon Nanotube-Based Electrodes for High Power Applications

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In this study, synthesis and characterization of thick carbon nanotube (CNT) electrodes with impressive electrically conductivity, mechanical properties, and large surface area is presented. The electrodes are made by effectively cross-linking the CNT's with graphitic carbon particles. The random network of cross-linked CNTs results in a bulk conductivity of >600 S/cm, large Young's Modulus (1 GPa), and high surface area (>500 m^2/g). Electrochemical characterization of these thick CNT electrodes (125 μm) showed a capacitance of 90 F/g (40 F/cm^3) in aqueous electrolyte (5M KOH). Furthermore, much of this capacitance was maintained at fast scan rates up to 1000 mV/s. This high rate performance led to a simultaneous display of large energy densities (>10 Wh/kg) and power densities (>40 kW/kg) for the thick, binderless CNT electrode.

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