

Effects of the catalyst and substrate thickness on the carbon nanotubes/ nanofibers as supercapacitors

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The goal of this work is to investigate the different growth conditions of carbon nanotubes (CNTs)/ nanofibers (CNFs) which lead to different characteristics when used as supercapacitors. A layer of SiO₂ was coated onto the Si substrate, and then a layer of Ti was evaporated as a current collector. CNTs/CNFs were synthesized on the Ti surface via a water-assisted chemical vapor deposition method at 800°C and at atmospheric pressure utilizing iron (Fe) nanoparticles as catalysts, ethylene (C₂H₄) as the precursor gas, and argon (Ar) and hydrogen (H₂) as the carrier gases. The effects of different thickness of catalyst (5, 10 nm) and Ti substrate layer (10, 30, 150 nm) on the specific capacitance of the CNFs were studied and the capacitance of the CNTs/CNFs based device was dependent on CNT/ CNF morphology of the CNFs that varied for different combination of the catalyst and Ti layer thicknesses. The characterization of CNTs/CNFs was carried out using scanning electron microscopy (SEM), electron dispersive spectroscopy (EDS), and transmission electron microscopy (TEM). It was found that the thinner Ti thickness tended to have CNTs growth while the thicker Ti thickness had CNFs growth. The specific capacitances were measured using cyclic voltammetry via a three-electrode system in 2 M of H₂SO₄ aqueous solution. The sample grown with 10 nm of Ti and 5 nm of Fe, which has the CNTs on the surface, has the highest specific capacitance of 60 F. g⁻¹ at the scan rate of 5 mV. s⁻¹.

Biography

Yang GAO has completed his bachelor's and master's degree at mechanical engineering department at Harbin Institute of Technology, China, and is a Ph.D student at mechanical engineering department at State University of New York at Binghamton, USA. His work mainly focus on carbon based (carbon nanotubes, graphene) materials and devices and microfabrication. Some of his previous work was accepted by journal of nanoscience and nanotechnology, and will be published in Dec, 2012.

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