Nanostructured Multilayer Composite Films of Manganese Dioxide/Nickel/Copper Sulfide (MnO_2/Ni/CuS) Deposited on Polyethylene Terephthalate (PET) Supporting Substrate.

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Abstract

Nanostructured multilayer manganese dioxide/nickel/copper sulfide (MnO_2/Ni/CuS) composite films were successfully deposited onto supporting polyethylene terephthalate (PET) substrate through the sequential deposition of CuS, Ni and MnO_2 thin films by chemical bath deposition, electrodeposition, and horizontal submersion deposition techniques, respectively. Deposition of each thin-film layer was optimized by varying deposition parameters and conditions associated with specific deposition technique. Both CuS and Ni thin films were optimized for their electrical conductivity whereas MnO_2 thin film was optimized for its microstructure and charge capacity. The electrochemical properties of nanostructured multilayer MnO_2/Ni/CuS composite films were evaluated by cyclic voltammetry as electrode materials of an electrochemical capacitor prototype in a dual planar device configuration. Cyclic voltammogram in mild Na_2SO_4 aqueous electrolyte exhibited a featureless and almost rectangular shape which was indicative of the ideal capacitive behavior and high cycling reversibility of the electrochemical capacitor prototype. Nanostructured multilayer MnO_2/Ni/CuS composite films on supporting polyethylene terephthalate (PET) substrate could potentially be utilized as electrode materials for the fabrication of high performance electrochemical capacitors.

KEY WORDS: Nanostructured; Multilayer; Composite films; Sequential deposition; Electrochemical properties