The prevention of leakage current in graphene-polyaniline-BST based electrodes

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Electrochemical capacitors are electric energy storage devices that are used in transportation and portable electronic applications due to higher power densities than rechargeable batteries but higher energy than conventional capacitors. Various electrode materials such as conducting polymers (polyanilines, polypyrroles, polythiophenes), RuO_2, SnO_2, NiO, Bi_2O_3, V_2O_5, Ni/Fe_3O_4, SWCNT, MWCNT, activated carbon, graphene (G), carbon nanotubes, and composite or hybrid materials that use both a metal oxide and a conducting polymer have been used in supercapacitor applications. Recently, we have fabricated supercapacitors from highly conducting nanocomposite materials by chemically synthesizing graphene (G)-polypyrrole (PPY), G–polyaniline (PANI), G–polyethylenedioxythiophene (PEDOT), and G-polythiophene (PTH) conducting nanocomposite materials [1-4]. Specific capacitances of 500 F/g (G-PANI), 374 F/g (G-PEDOT), 160 F/g (G-PPY) and 150 F/g (G-PTh) were experimentally determined using symmetric electrode structures for supercapacitor applications [1-4]. We have also addressed the issue of leakage current on graphene-polyaniline by depositing barium strontium titanate (BST) dielectric layer through both electrophoretic and sol-gel techniques [5].

This paper is devoted to the development of an understanding of the prevention of leakage current in supercapacitor structures by thin coatings. They are characterized using Transmission Electron Microscopy (TEM), Scanning Electron Microscopy (SEM), FTIR spectroscopy, X-ray-diffraction (XRD), Electrochemical Impedance spectroscopy (EIS) and cyclic voltammetry (CV) techniques. BST on graphene-polyaniline electrodes were prepared by electrophoretic and sol-gel techniques to compare the specific capacitance, charging/discharging, stability and life cycle of supercapacitors fabricated using graphene-polyaniline-BST nanomaterials. Our proposed research is transformative where supercapacitor behaves likes a rechargeable battery.

References:

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