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Nanostructured Transition Metal Oxides Doped Graphene for High Performance Solid-State Supercapacitor Electrodes

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Abstract : A series of Transition Metals Oxides (TMOs) doped graphene were synthesized and successfully used as supercapacitor electrode materials. The as-synthesized materials exhibited exceptional electrochemical properties owing to the combined properties of its constituents; high surface area and good conductivity were achieved. Several analytical characterization techniques were employed to investigate the morphology, crystal structure atomic arrangement and elemental chemical state in the materials for which scanning electron microscopy (SEM), X-ray diffraction (XRD) and X-ray photoelectron spectroscopy (XPS) were conducted, respectively. Moreover, the electrochemical properties of the as-synthesized materials were examined by performing cyclic voltammetry (CV), galvanostatic charge-discharge (GCD) and electrochemical impedance spectroscopy (EIS) measurements. Furthermore, the effect of doping concentration on the interlayer distance of the graphene materials and the charge transfer resistance are investigated and correlated to the exceptional current density which was multiplied by a factor of ~80 after TMOs doping in graphene. Finally, the resulting high capacitance obtained confirms the contribution of grapheme exceptional electronic conductivity and large surface area on the electrode materials. Such good-performing electrode materials are highly promising for supercapacitors and other energy storage devices.

Keywords : energy density, graphene, supercapacitors, TMOs
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