Novel poly (3, 4-ethylenedioxythiophene)/reduced graphene oxide incorporated with manganese oxide/iron oxide for supercapacitor device

ABSTRACT

A new composite namely PEDOT/RGO/MnO_2/Fe_2O_3 was successfully developed from mixed metal oxides (MnO_2 and Fe_2O_3) incorporated with poly(3,4-ethylenedioxythiophene) (PEDOT) and reduced graphene oxide (RGO). The surface morphology of the prepared composite revealed that MnO_2 and Fe_2O_3 particles were successfully coated on the wrinkles and curly like-sheets of PEDOT/RGO in order to prevent aggregation of RGO layers and the composite was able to retain 80% of its initial specific capacitance in 1 M KCl. The PEDOT/RGO/MnO_2/Fe_2O_3 composite with Mn:Fe molar ratio of 2:3 displayed the highest specific capacitance of 287 F/g indicating that Mn:Fe molar ratio gives significant effect on the super capacitive performance of the composite. The specific capacitance of PEDOT/RGO/MnO_2/Fe_2O_3 was higher than the composites with monometallic oxide i.e. PEDOT/RGO/MnO_2 and PEDOT/RGO/Fe_2O_3. The PEDOT/RGO/MnO_2/Fe_2O_3 composite also revealed the lowest charge transfer resistance that leads to the superior supercapacitive performance. The specific energy and specific power of PEDOT/RGO/MnO_2/Fe_2O_3 composite were 11 Wh/kg and 1900 W/kg at 4 A/g, respectively. The results showed that the PEDOT/RGO/MnO_2/Fe_2O_3 composite is a promising electrode material for high-performance supercapacitor.