Abstract

In order to handle the energy difficulties of the modern world, electrochemical energy storage is an existing research field. The supercapacitor, electrode material based on transition metals oxides ($MgO/ZrO_2/Fe_2O_3$) along with reduced graphene oxide (rGO) and conducting polymer Polyvinylpyrrolidone (PVP) as a capping agent were synthesized using the Green Synthesis method with Magnesium oxide, Zirconium oxide and iron nitrate 9-hydrate as precursor materials. Among these materials, three samples were prepared i.e. $MgO/ZrO_2/Fe_2O_3$, $MgO/ZrO_2/Fe2O3/rGO$, $MgO/ZrO_2/Fe_2O_3/rGO/PVP$ nanocomposites via green synthesis method. Out of all these material, rGO based nanocomposites reveal enhanced capacitive properties because of the addition of transition metals along with the addition of conducting polymer, which characterize less resistance, thus shows excellent conductivity which is analyzed by CV analysis by depicting current value of 100mA at 100mV/sec (scan rate). Due to the large area under the curve from CV analysis, rGO based composites reveal a large specific capacitance of 718.42 Fg^{-1} at 3mV/sec scan rate and energy density of 35.92 Wh/Kg. GCD analysis characterize good charging and discharging retainability and gives discharging time of 652 secs at 0.1A/g current density which enhances its good capacitive results due to porosity and extraordinary conductivity of reduced graphene oxide. These all parameters highly enlighten this nanocomposite electrochemical properties and act as a best electrode material in Hybrid type of supercapacitor fabrication.