Fabrication of PEDOT coated PVA-GO nanofiber for supercapacitor

ABSTRACT

Conducting nanofibers comprised of poly(vinyl alcohol) (PVA)-graphene oxide (GO) nanofiber coated with poly(3,4-ethylenedioxythiophene) (PEDOT) for supercapacitor application was prepared through integrated techniques i.e. electrospinning and electrodeposition. The formation of smooth cross-linking nanofibers without beads proved that GO has uniformly distributed into PVA with an average diameter of 117 ± 32 nm. Field emission scanning electron microscopy (FESEM) images revealed that cauliflower-like structure of PEDOT grew well on the surface of PVA-GO nanofibers with high porosity. Fourier transform infrared spectroscopy (FTIR) and Raman spectroscopy proved the existence of PVA, GO, and PEDOT. PVA-GO/PEDOT nanocomposite showed the highest specific capacitance (224.27 F/g) compared to PEDOT (167.92 F/g) and PVA/PEDOT (182.73 F/g). PVA-GO/PEDOT nanocomposite exhibited 1.8 V wide operating potential windows which significantly can enhance its capacitive behaviour. PVA-GO/PEDOT nanocomposite has also demonstrated superior performance with the energy density and power density of 9.58 Wh/kg and 304.37 W/kg, respectively at 1.0 A/g current density. PVA-GO/PEDOT nanocomposite revealed the smallest resistance of charge transfer (Rct) and equivalent series resistance (ESR) indicating excellent charge propagation behaviour at the interfacial region. The composite exhibits a good capacity retention of 82.41% after 2000 CV cycles and further drops 11.27% after 5000 cycles caused by the swelling and shrinkage of the electrode material during the charging and discharging processes.

Keyword: PVA nanofibers; Graphene; Poly(3,4-ethylenedioxythiophene); Electrospinning; Supercapacitor