Fabrication of poly(vinyl alcohol)-graphene quantum dots coated with poly(3,4-ethylenedioxythiophene) for supercapacitor

ABSTRACT

Conducting nanofiber composed of poly(vinyl alcohol) (PVA), graphene quantum dots (GQDs) and poly(3,4-ethylenedioxythiophene) (PEDOT) was prepared for symmetrical supercapacitor through electrospinning and electropolymerization techniques. The formation of PVA nanofibers with the addition of GQDs was excellently prepared with the average diameter of 55.66 ± 27 nm. Field emission scanning electron microscopy images revealed that cauliflower-like structure of PEDOT was successfully coated on PVA-GQD electrospun nanofibers. PVA-GQD/PEDOT nanocomposite exhibited the highest specific capacitance of 291.86 F/g compared with PVA/PEDOT (220.73 F/g) and PEDOT (161.48 F/g). PVA-GQD/PEDOT also demonstrated a high specific energy and specific power of 16.95 and 984.48 W/kg, respectively, at 2.0 A/g current density. PVA-GQD/PEDOT exhibited the lowest resistance of charge transfer (Rct) and equivalent series resistance compared with PEDOT and PVA/PEDOT, indicating that the fast ion diffusion between the electrode and electrolyte interface. PVA-GQD/PEDOT nanocomposite also showed an excellent stability with retention of 98% after 1000 cycles.

Keyword: Conducting polymers; Electropolymerization; Fibers; Graphene quantum dots; Nanocomposites; Nanofibers; Poly(3,4-ethylenedioxythiophene); Supercapacitor