Electropolymerization of poly(3,4-ethylenedioxythiophene) onto polyvinyl alcohol-graphene quantum dot-cobalt oxide nanofiber composite for high-performance supercapacitor

ABSTRACT

Fabrication of highly conductive nanofiber by coating polyvinyl alcohol-graphene quantum dot-cobalt oxide (PVA-GQD-Co_3O_4) nanofiber composite with a conductive material, poly(3,4-ethylenedioxythiophene) (PEDOT) for supercapacitor was successfully prepared via two-step technique i.e. electrospinning and electropolymerization. The prepared electrode materials were characterized using FTIR, Raman and XRD analysis to confirm the structure of the electrospun nanofiber composite. The presence of cauliflower-like structure studied by FESEM revealed that PEDOT was uniformly coated on PVA-GQD-Co_3O_4 electrospun nanofibers. The PVA-GQD-Co_3O_4/PEDOT nanofiber composite exhibited a specific capacitance of 361.97 F/g, low equivalent series resistance (ESR) and excellent stability with retention of 96% after 1000 cycles. The PVA-GQD-Co_3O_4/PEDOT nanofiber composite also demonstrated a high specific energy and excellent specific power ranged from 16.51 to 19.98 Wh/kg and 496.10–2396.99 W/kg, as the current density increased from 1.0 to 5.0 A/g.

Keyword: Supercapacitor; Graphene quantum dots; Cobalt oxide; Nanofiber; Electropolymerization