Poly(3,4-ethylenedioxythiophene) doped with carbon materials for high-performance supercapacitor: a comparison study

ABSTRACT

A comparative study of multiwalled carbon nanotube (MWCNT), graphene oxide (GO), and nanocrystalline cellulose (NCC) as a dopant in the preparation of poly(3,4-ethylenedioxythiophene)- (PEDOT-) based hybrid nanocomposites was presented here. The hybrid nanocomposites were prepared via the electrochemical method in aqueous solution. The FTIR and Raman spectra confirmed the successful incorporation of dopants (MWCNT, GO, and NCC) into PEDOT matrix in the process of formation of the hybrid nanocomposites. It was observed that the choice of the carbon material affected the morphologies and supercapacitive properties of the hybrid nanocomposites. Incorporation of GO with PEDOT produces a paper-like sheet nanocomposite in which the wrinkled surface results in larger surface area compared to the network-like and rod-like structures of PEDOT/MWCNT and PEDOT/NCC, respectively. Owing to larger surface area, PEDOT/GO exhibits the highest specific capacitance (120.13 F/g), low equivalent series resistance (34.44 Ω), and retaining 87.99% of the initial specific capacitance after 1000 cycles, signifying a long-term cycling stability. Furthermore, the high performance of PEDOT/GO is also demonstrated by its high specific energy and specific power.