Supercapacitor with superior electrochemical properties derived from symmetrical manganese oxide-carbon fiber coated with polypyrrole

ABSTRACT

A supercapacitor electrode comprising conducting polypyrrole (PPy) coated on manganese oxide-carbon fiber (CNFMnO2) was successfully synthesized using electrospinning, followed by carbonization and in-situ polymerization. A non-uniform distribution of PPy on the surface of CNFMnO2 was observed via FESEM analysis. The chemical bonding of CNFMnO2/PPy and the valence state of manganese were revealed via FTIR, Raman spectroscopy, XRD and XPS measurements. CNFMnO2/PPy composite possessed high specific capacitance and specific energy of 315.80 Fg−1 and 13.68 Wh/kg, respectively. In addition, good electrochemical reversibility was proven upon CNFMnO2/PPy even at higher sweep rate (5–200 mV/s). Moreover, this one-dimensional electrode achieved an excellent long-term cycling stability (82.46%) over 2000 CV cycles with low charge transfer resistance (4.61 Ω). The modification of CNFMnO2/PPy contributes to good synergistic effects among the material which improve the electrochemical behavior of manganese oxide-based fiber composite for future supercapacitor.

Keyword: Polyacrylonitrile; Manganese oxide; Carbon fiber; Polypyrrole; Supercapacitor