Effect of electrolytes on the electrochemical performance of nickel cobaltite–titania nanotubes composites as supercapacitive materials

ABSTRACT

The effects of electrolytes on the electrochemical performance of nickel cobaltite–titania nanotubes composites as electrochemical capacitors were evaluated. Four types of electrolytes were selected to assess their effects on the prepared composites, namely aqueous electrolytes of 1.0 M KCl, 1.0 M HCl, 1.0 M KOH; and an organic electrolyte, 0.27 M tetra-*n*-butylammonium tetrafluoroborate (TBATFB) ionic liquid salt in acetonitrile. The composites performed better in 1.0 M HCl and 1.0 M KOH, than in 1.0 M KCl and 0.27 M TBATFB, which suggested that aqueous electrolytes with non-neutral pH would improve the specific areal capacitance values of the composites. Results have shown optimal performance in 1.0 KOH, which endowed the composite with excellent rate capability up to 200 mV s^{-1}. Cyclic voltammogram of the composite analysed in 1.0 M KOH produced a leaf-shaped like profile, with higher current densities towards more positive potentials. Charge–discharge analyses in 1.0 M KOH has shown that the composite possessed specific areal capacitance of up to 214.76 µF cm^{-2} when it was evaluated at the current density of 350 µA cm^{-2}. The composite also retained up to 97.79% of its specific areal capacitance when current density was increased to 400 µA cm^{-2}. This material has demonstrated potential application for electrochemical capacitors through its facile fabrication technique.

Keyword: Electrolytes; Electrochemical performance; Nickel cobaltite–titania nanotubes composites; Supercapacitive material; Electrochemical capacitor