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Fish bladder-based activated carbon/Co3O4/TiO2 composite electrodes for supercapacitors

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Abstract

Cobalt oxide/titanium dioxide/activated carbon (Co3O4/TiO2/Ac) composite was synthesized using simple sol-gel method before annealing at 300 °C. Fish bladder derived porous carbon used for the composite was synthesized by pyrolysis followed by chemical activation. Both scanning electron microscopy (SEM) and X-ray diffraction displayed Co3O4 and TiO2 phases well embedded onto the carbon matrices. Cyclic voltammetry in 6 M KOH electrolyte demonstrated that the composite has an excellent specific capacity of 946 Fg-1 for Co3O4/TiO2/Ac as compared to Co3O4/Ac, TiO2/Ac, and Ac with specific capacitances of 845, 340, and 308 F g−1, respectively at 5 mVs−1. Impedance spectroscopy reveals that the composite has good capacitive behavior with a series resistance of 0.6 Ω. Besides, Co3O4/TiO2/Ac maintains 89.7% of the initial capacitance after 2000 cycles. This study shows that the synergistic effect of the metal oxides and the carbon in the composite can enhance capacitance for practical supercapacitor applications.

Keywords
Fish bladder activated carbon; Supercapacitor; Specific capacitance; Cobalt oxide; Titanium dioxide