

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 F g⁻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