In situ encapsulation of tin oxide and cobalt oxide composite in porous carbon for high-performance energy storage applications

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ABSTRACT

Herein, we report the preparation of porous carbon from palm kernel shell and loading of tin oxide-cobalt oxide in its pores using a facile in-situ encapsulation synthesis strategy. The as-synthesized SnO_2/Co_3O_4@C composite was characterized by powder X-ray diffraction, X-ray photoelectron spectroscopy and field-emission scanning electron microscopytechniques. This composite was used as an electrode for supercapacitors. Electrochemical charge storage capabilities of the composite were measured using cyclic voltammetry, charge-discharge cycling and electrochemical impedance spectroscopy in aqueous 6 M KOH and 1 M Na_2SO_4 electrolytes. The SnO_2/Co_3O_4@C composite showed over 70% higher specific capacitance (177 F g^{-1}) than the pure porous carbon (106 F g^{-1}) in 6 M KOH. Among these electrolytes, the composite exhibited an enhanced electrochemical performance in KOH electrolyte due to its smaller hydrated ion radius, high ionic mobility and lower equivalent series resistance than Na_2SO_4.

KEYWORDS:

Electrochemical double layer capacitors; Pseudocapacitors; Hybrid Capacitors; Renewable Energy; Charge Storage Materials