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Metal-organic framework templated synthesis of porous $NiCo_2O_4/ZnCo_2O_4/Co_3O_4$ hollow polyhedral nanocages and their enhanced pseudocapacitive properties

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Abstract:

A novel composite porous $NiCo_2O_4/ZnCo_2O_4/Co_3O_4$ hollow polyhedral nanocage is prepared by etching and the coprecipitation mechanism using the zeolitic imidazolate framework-67 as template. The use of the organic ligand in the template can prevent the agglomeration of the metal caused by high temperature calcination, which is beneficial to obtain the metal oxide nanocages composites with uniform particle size. The unique hollow nanocage structure of the composite material has a complex shell and shows a porous network-like structure which can provide more active sites, and promote the redox reaction of electrode material. At the current density of 1 A g^{-1} and 10 A g^{-1}, the nanocage exhibits the specific capacitance of 1892.5 F·g^{-1} and 1135 F·g^{-1}, respectively. After the 2000 cycles, the nanocage shows 66% of the capacitance retention rate and good cycle stability. Moreover the assembled $NiCo_2O_4/ZnCo_2O_4/Co_3O_4$ //AC hybrid device can be reversibly cycled in a large potential range of 0-1.6 V and can deliver high energy density of 83.11 Wh kg^{-1} as well as the maximum power density of 8006.67 W kg^{-1}. This study provides insight into the synthesis of other composites and more possibilities for constructing more desirable electrode materials.

Keywords: Supercapacitor; Nickel; Cobalt; Zeolitic imidazolate framework-67; Nanocage.

1.Introduction

The development of energy storage system is crucial to meet the increasing demands of energy and power. Supercapacitors (SCs), also known as electrochemical

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