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Microwave synthesis of three-dimensional nickel cobalt sulfide nanosheets grown on nickel foam for high-performance asymmetric supercapacitors

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Abstract: A facile and cost-effective microwave method is developed to prepare ternary nickel cobalt sulfide (NiCo_2S_4) interconnected nanosheet arrays on nickel foam (NF). When acting as an electrochemical supercapacitor electrode material, the as-prepared $\text{NiCo}_2\text{S}_4/\text{NF}$ shows a high specific capacitance of 1502 F g^{-1} at a current density of 1 Ag^{-1} , and outstanding cycling stability of 91% capacitance retention after 8000 cycles. In addition, a asymmetric supercapacitor (ASC) is composed of $\text{NiCo}_2\text{S}_4/\text{NF}$ as positive electrode and activated carbon as negative electrode, which exhibits a high energy density of 34.7 Wh kg^{-1} at a power density of 750 W kg^{-1} and long-term cyclic stability (83.7% capacity retention after 8000 cycles). Even at a high power density of 15 kW kg^{-1} , it still remains an energy density of 17.9 Wh kg^{-1} , which is able to light up a light-emitting diode. These findings provide a new and facile approach to fabricate high-performance electrode for supercapacitors.

Keywords: NiCo_2S_4 nanosheet; Microwave method; Asymmetric supercapacitor; High energy density

1. Introduction

In recent years, the rapidly growing commercial markets in electric vehicles and

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