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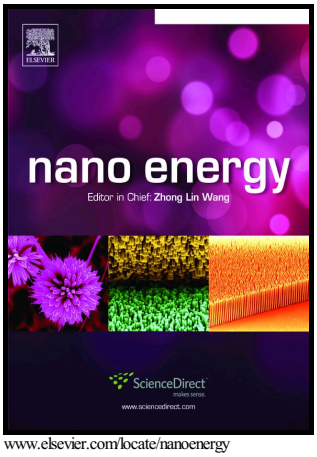

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Graphene-wrapped nickel sulfide nanoprisms with improved performance for Li-ion battery anodes and supercapacitors

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Abstract

Nickel sulfide and graphene-wrapped nickel sulfide nanoprisms were synthesized using a facile one-pot method and evaluated as anode materials for Li-ion batteries, and as supercapacitor electrodes. Graphene wrapping significantly improved the performance of nickel sulfide both as Li-ion battery anode and supercapacitor electrode. As Li-ion battery anode, graphene-wrapped nickel sulfide nanoprisms achieved an excellent specific capacity of over 1200 mAh/g after 100 cycles, and showed improved rate capability. As supercapacitor electrode, nickel sulfide nanoprisms achieved a specific capacitance of over 1000 F/g at a current density of 5 A/g, which is one of the best results reported for nickel sulfide. However, specific capacitance was much lower at 10 and 20 A/g. Introducing graphene significantly improved the specific capacitance of nickel sulfide at high current densities.

Keywords: Li-ion battery; supercapacitor; nickel sulfide; graphene; nanoparticles; nanoprisms

Introduction

Energy conversion and storage are a major global challenge due to issues associated with fossil fuels, such as pollution and non-sustainability [1, 2]. To tackle this problem, it is necessary to reduce fossil fuel consumption and shift to renewable and environmentally friendly energy sources. Energy storage devices are needed to store renewable energy, such as for electric