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# Facile synthesis of $\text{Ni}_3\text{S}_2$ and CoS composite on nickel foam for high performance supercapacitor electrode materials

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## Abstract

A facile and cost effective way has been developed to fabricate a unique structure of  $\text{Ni}_3\text{S}_2$  and CoS (CNS) composite. CNS composite are synthesized on the surface of nickel foam (NF) using a hydrothermal process. NF acts as both a substrate and Ni source for composite. CNS are directly applied as the electrode for supercapacitors. XRD results indicate the presence of  $\text{Ni}_3\text{S}_2$ , CoS, and Ni phases in the sample. SEM results show that the CNS consist of interweaved nanoplates with average diameter of 15  $\mu\text{m}$  and a thickness of 250 nm. Electrochemical measurements indicate the CNS have the specific capacitance of 4.73  $\text{F m}^{-2}$  at a current density of 1  $\text{mA cm}^{-2}$ . When the current density increases from 1  $\text{mA cm}^{-2}$  to 20  $\text{mA cm}^{-2}$ , 63.4% capacitance is retained. Thus, the facile, low-cost and novel synthesis method and outstanding performance make the CNS an ideal electrode material for the electrochemical energy storage devices.

**Keywords:** Supercapacitor; Electrochemical properties; Energy storage and conversion

## 1. Introduction

Recently, with the development of novel energy conversion and storage systems, more and more people pay attention to nanoscience and nanotechnology as alternative energy sources to achieve a clean and sustainable world due to the depletion fossil fuels[1]. Supercapacitors, also called electrochemical capacitors, have been recognized as the most important part of various energy storage technologies[2]. Compared with traditional process, the electrochemical supercapacitors are safe and

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