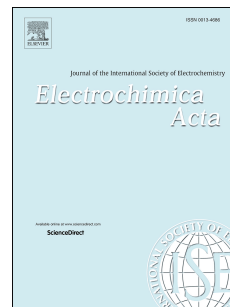


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# Synthesis and characterization of polypyrrole/nickel hydroxide/sulfonated graphene oxide ternary composite for all-solid-state asymmetric supercapacitor

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## Abstract

The polypyrrole/nickel hydroxide /sulfonated graphene oxide (PPy/Ni(OH)<sub>2</sub>/SGO) ternary composite is prepared as supercapacitor electrode material by stepwise loading of Ni(OH)<sub>2</sub> and PPy into SGO through hydrothermal and chemical oxidative polymerization process. The PPy and Ni(OH)<sub>2</sub> are incorporated into composite to act as pseudocapacitive electrode with low cost and high capacitance. The SGO obtained by the surface modification of graphene has a higher hydrophilic property and larger specific surface to provide charge transfer path. The creative PPy/Ni(OH)<sub>2</sub>/SGO (P-N-S) ternary composite shows a high specific capacitance of 1632.5 F g<sup>-1</sup> at a current density of 1 A g<sup>-1</sup> in 6 M KOH solution. A capacitance retention of 86% after 1000 cycles proves that the P-N-S has a good cycling stability. The all-solid-state asymmetric supercapacitor (ASC) is assembled with P-N-S cathode material and activated carbon (AC) as anode material to exhibit a high special capacitance of 224 F g<sup>-1</sup> at 1 A g<sup>-1</sup>, a large energy density (79.6 Wh Kg<sup>-1</sup>) and power density (0.8 kW Kg<sup>-1</sup>), and a stable cycle life (the capacitance retention rate of 60 % after 5000 cycles at 10 A g<sup>-1</sup>). Two ASCs in series can lighten up a green LED indicator.

**Keywords:** Ni(OH)<sub>2</sub>; sulfonated graphene; supercapacitor; electrode material.

## 1. Introduction

Supercapacitors (SC)[1] are now synonymous with the “new energy”; almost every reference to the chemistry makes some mention of its future prospect, both economic

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