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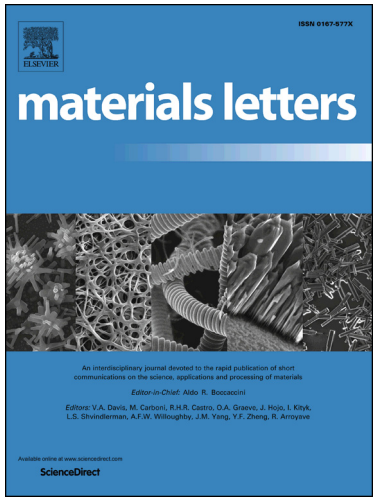

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Enhanced pseudocapacitance of $NiSe_2/Ni(OH)_2$ nanocomposites for supercapacitor electrode

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Abstract

We report a novel $NiSe_2/Ni(OH)_2$ nanocomposites (NNCs) synthesized using facile hydrothermal method followed by ultrasonication and employed it as electrode for supercapacitor. The structural and compositional analysis confirmed the presence of $NiSe_2$ and $Ni(OH)_2$ in the synthesized NNCs. The NNCs electrodes delivered an ultrahigh specific capacitance (2212 F g^{-1}) than pristine $NiSe_2$ (326 F g^{-1}) at a current density of 2 mA cm^{-2} with capacitance retention of 95% after 5,000 cycles. The enhanced performance is due to the positive synergetic effect between $NiSe_2$ and $Ni(OH)_2$, which provides a free diffusion pathway for the fast ion transport and facile ion accessibility to storage sites.

Keywords: Nanocomposites; Two dimensional dichalcogenide; $NiSe_2/Ni(OH)_2$; Supercapacitor; Energy storage and conversion.

1. Introduction

Day by day the growth of advanced electronic devices has raised the demands of high-performance energy storage devices [1]. As an outcome, tremendous efforts have been devoted to expand new versatile and flexible electrode materials as substitutes to the materials used in existing batteries and supercapacitors [2]. Supercapacitor, also known as electrochemical capacitors, have been renowned as the most proficient energy storage device which has mesmerized considerable interest due to its high power density, excellent rate capability and long cycle life [3]. The electrochemical performance of the supercapacitor is mainly reliant upon the electrode material. Recently, transition metal compounds (ex. oxides, sulfides, hydroxides) have become spotlight due to its rich electrochemical faradic reaction but they suffer from poor conductivity which increases the sheet resistance as well as charge transfer resistance of the electrode resulting in the interior resistance loss at high current density [4]. Therefore, developing the electrode material with high electrical conductivity remains as the essential factor in obtaining the high performance supercapacitors.

Nowadays, metal selenide based nanomaterials have been reported as excellent electrode material than metal sulfides for supercapacitor application due to its high electronic conductivity ($\Omega_{Se}=1\times10^{-3}$ S m^{-1} >