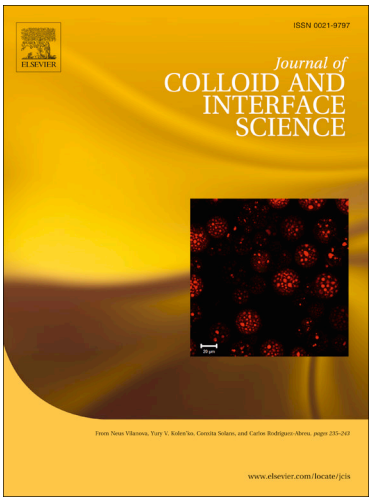

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Two-dimensional porous (Co, Ni)-based monometallic hydroxides and bimetallic layered double hydroxides thin sheets with honeycomb-like nanostructure as positive electrode for high-performance hybrid supercapacitors

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Abstract

CoNi layered double hydroxides (LDH) and related monometallic hydroxides ($Ni(OH)_2$ and $Co(OH)_2$) were synthesized by a facile, simple and inexpensive method under mild condition (50 °C). The resulting products displayed a unique honeycomb-like nanoflakes array assembled two-dimensional (2D) thin sheets structure. Among them, CoNi-LDH thin sheets delivered higher specific capacity (394.5 $C \cdot g^{-1}$ at 1 $A \cdot g^{-1}$) with superior cyclic performance (92.3% capacity retention over 10000 cycles) than Co/Ni monometallic hydroxides owing to the synergistic effect of cobalt and nickel. Afterward, hybrid supercapacitors (HSC) devices were fabricated using the as-obtained products (CoNi-LDH, $Co(OH)_2$ and $Ni(OH)_2$ thin sheets) and activated carbon (AC) as the positive and negative electrode, respectively. The operating voltage of the devices can be extended to 1.6 V. What's more, the assembled CoNi-LDH HSC device exhibited a maximum energy density of 20.38 $Wh \cdot kg^{-1}$ at the power density of 800 $W \cdot kg^{-1}$. Consequently, these outstanding electrochemical performances of the CoNi-LDH thin sheet endow it with great potential to be implemented in HSCs or other energy storage systems.

Keywords: 2D materials, CoNi-LDHs, Hybrid supercapacitor, Electrochemical energy storage

1. Introduction

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