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Self-supported nanoarrays of binary transition metal sulphide (CoNi2S4) for asymmetric supercapacitor device

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The electrode material with nano-structured features is a key point in electrochemical application to enhance the electrochemical activities. Nowadays, more researchers are concentrated on the synthesis of hierarchical nano-structured architecture with smaller particle size employing different synthesis tools. Without the use of an additive binder, hydrothermal route was employed for the synthesis of self-assembled nanostructures of single (Ni3S2) and binary metal sulphides (NiCo2S4) with particle size near about 10 nm for assymmetric supercapacitor application. The prepared samples were used for structural and surface morphological studies using different characterization techniques and then electrochemical measurements were performed. Through the electrochemical measurements, a significant difference in the performances of both electrode materials was observed. Achieving the better electrochemical activities for CoNi2S4-μflower with 2098.95 F g-1 specific capacitance, the asymmetric supercapacitor designed with Ni3S2-nanorod is used as one of the electrodes. The designed hybrid asymmetric supercapacitor, based on Ni3S2-nanorod//CoNi2S4-μflower electrodes, exhibits a specific capacitance of 54.92 F g-1 at a scan rate of 5 mV s-1. The assembled asymmetric supercapacitor has an energy density of 6.6 Wh kg-1 while delivering a power density of 820 W kg-1. The capacitive retention of the initial capacitance remains desirable at 89.13% after 5000 CV cycles at a scan rate of 100 mV s-1. The present work manifests a vision for the fabrication of self-assembled, binder-free electrodes for high-performance hybrid supercapacitor application.

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