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Mesoporous Carbon Sphere/Nickel Cobalt Sulfide Core-Shell Microspheres for Supercapacitor Electrode Material

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Abstract : The depletion of non-renewable sources had led to the continuous development of various energy storage systems in order to cope with the world's demand in energy. Supercapacitors have attracted considerable attention because they can store more energy than conventional capacitors and have higher power density than batteries. The combination of carbon-based material and metal chalcogenides are now being considered in response to the search for active electrode materials exhibiting high electrochemical performance. In this study, a hierarchical mesoporous carbon sphere@nickel cobalt sulfide (CS@Ni-Co-S) core-shell was synthesized using a simple hydrothermal method. The CS@Ni-Co-S core-shell microstructures exhibited a high capacitance of 724.4 F g−1 at 2 A g−1 in a 6 M KOH electrolyte. Good specific retention of 86.1% and high Coulombic efficiency of 97.9% was obtained after 2000 charge-discharge cycles. The electrode exhibited a high energy density of 58.0 Wh kg−1 (1440 W kg−1) and high power density of 7200 W kg−1 (34.2 Wh kg−1). The reaction involved green synthesis without further sulfurization or post-heat treatment. Through this study, a cost-effective and facile synthesis of CS@Ni-Co-S as an active electrode showed favorable electrochemical performance.

Keywords : carbon sphere, electrochemical, hydrothermal, nickel cobalt sulfide, supercapacitor
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