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Fabrication of Sugar-Coated $CoNi_2S_4/Ni_3P$ Nanostructure with Ultrahigh Electrochemical Performance for Supercapacitor Application

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Designing a novel hierarchically structured transition-metal sulfide and transition-metal phosphide composite electrode material is an effective way to improve the energy storage performance of supercapacitors (SCs). Herein, the $CoNi_2S_4/Ni_3P$ (CNSP-500) nanocomposite material has been prepared via the two-step anion exchange method, in which the nanocomposite material of Ni_3P coated $CoNi_2S_4$ forms the unique sugar-coated nanostructure exhibiting excellent electrochemical performance as the electrode material. The optimized CNSP-500 electrode material achieves a superhigh area-specific capacitance of 8.86 F/cm^2 (mass-specific capacitance of 3100 F/g) at the current density of 3 A/g, which is approximately seven times higher than the precursor of Cobalt-Nickel carbonate hydroxides (CN). Moreover, the area-specific capacitance of 6.44 F/cm^2 can be obtained even at the high current density of 20 A/g, which indicates excellent rate capability of the CNSP-500 electrode material. This preparation strategy provides a fine method for designing high-performance SCs based on transition-metal sulfides and transition-metal phosphides.

Keywords: Electrode materials; Nanostructure; Capacitance; Energy storage; Supercapacitors

FULL TEXT