MnO₂/CdS/N-doped Graphite Nanocomposite for High-Performance Supercapacitors

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To improve the electrochemical performance of supercapacitors, the reaction mechanism and structural design should be examined simultaneously. In this work, an N-doped graphite (NG) layer was self-assembled directly on a Ni matrix and acted as an active interlayer between the current collector and the active material. For the first time, ultrafine CdS nanoparticles were synthesized on an NG layer directly as the electrode active material. Subsequently, MnO₂ nanowires penetrated the gaps between the CdS particles and tightly anchored the CdS nanoparticles on the surface of the NG. The presence of the MnO₂ nanowires was demonstrated to prompt charge transfer into the interior CdS and facilitate the redox reaction at the MnO₂-CdS@NG electrode. In addition, due to the synergy of the N-doped interlayer and the novel reinforced structure, the chemical activity and cycling stability were improved. From the electrochemical measurements, the specific capacitance of the MnO₂-CdS@NG electrode was 1497 F g⁻¹ at the current density of 2 A g⁻¹. In addition, the MnO₂-CdS@NG//rGO asymmetric supercapacitor exhibited a superior energy density (33.8 W h kg⁻¹ at a power density of 776 W kg⁻¹) and a great cycling stability (87% at a current density of 10 A g⁻¹ for 5000 cycles).

Keywords: supercapacitors, solvothermal method, CdS nanoparticles, MnO₂ nanowires, N-doped graphite

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