Application of 3DG/CB/MnO₂ Electrode Material in Supercapacitors

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Using a three-dimensional graphene (3DG) prepared by a sol-gel method as skeleton material, and adding commercial carbon black as conductive additive, a novel composite electrode material (3DG/CB/MnO₂) is synthesized by hydrothermal method. The 3DG and 3DG/CB/MnO₂ composite are characterized by SEM and XRD. The SEM results indicate that the thickness of graphene sheets is homogeneous, and the MnO₂ nanoparticles are successfully deposited on the surface of the 3DG and carbon black to form a honeycomb structure, in which numerous pores are constructed by the graphene sheets and carbon nanotubes (CNTs). The XRD result shows that the state of the MnO₂ in the 3DG/CB/MnO₂ composite is δ -MnO₂. The electrochemical test results display that the specific capacitances are 590, 433 and 247 F/g respectively at the current densities of 0.3, 1 and 3 A/g. Whereas, the specific capacitances of the MnO₂ nanoparticles at 0.3 A/g is only 433 F/g. After the 3DG/CB/MnO₂ composite is charge-discharge for 5000 cycles at the big current densities of 30 A/g, its specific capacitance decreases to 38 F/g from 55 F/g. The capacitance retention of the 3DG/CB/MnO₂ composite reaches to 70%, implying this composite is a supercapacitor electrode material which has the prospect of industrialization.

Keywords: Three-dimensional Graphene; MnO₂; Supercapacitor; Electrode Materials

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