Facial Synthesis of 3D MnO₂ Nanofibers Sponge and Its Application in Supercapacitors

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Mesoporous Al₂O₃ template was facially constructed by hydrolysis of aluminum nitrate solution, and 3D MnO₂ foam was fabricated by redox reaction of Mn²⁺ and MnO₄⁻ in the nanoholes of Al₂O₃ template, followed by sacrificial dissolution of the Al₂O₃ matrix. The as-prepared 3D MnO₂ sponge is composed of cross-linked worm-like nanofibers which promise enhanced charge transfer capability. The specific surface area and porosity of the MnO₂ sponge is affected by the concentration of Mn²⁺ ion when the pores of Al₂O₃ template were immersed, and higher specific surface area, higher pore volume and hence better electrochemical performance were developed at lower Mn²⁺ concentration. When 0.02 mol L⁻¹ of Mn²⁺ solution was used to immerse the Al₂O₃ template, a specific capacitance of 215.3 F g⁻¹ can be achieved for the resultant 3D MnO₂ sponge in 1 mol L⁻¹ Na₂SO₄ aqueous electrolyte at 2 mV s⁻¹ scan rate, and all as-prepared 3D MnO₂ sponges provide good long-term charging/discharging stability with approximate 96% retention of capacitance at 5 mV s⁻¹ scan rate after 2000 cycles, showing that the facially synthesized 3D MnO₂ sponge is a promising electrode material for supercapacitor.

Keywords: 3D MnO₂ sponge; nanofiber; mesoporous Al₂O₃ template; supercapacitor.

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