MnO₂ Density - Dependent Supercapacitive Characteristics of SiO₂/MnO₂ Core-shell Nanostructure

Zhi Qiang Zhang^{1,*}, Cheng Chen¹, Cong Cong Ma¹, Min Li², Hao Chen¹, Zheng Guo Shang²

¹College of Materials Science and Engineering, Chongqing University, Chongqing 400044, PR China

²College of Optoelectronic Engineering, Chongqing University, Chongqing 400044, PR China

*E-mail: zzqiang1963@163.com

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A simple approach has been developed to fine-tune SiO₂ spheres into low-density SiO₂ spheres with the total volume increased by etching in a NaBH₄ solution, followed by the preparation of the SiO₂/MnO₂ and low-density SiO₂/MnO₂ core-shell nanocomposites. The core-shell nanocomposites with uniform diameters from 200 to 350nm can be observed on scanning electron microscopy (SEM) and transmission electron microscopy (TEM). With the reaction time increasing, the thickness of manganese oxide shells around the silica core thickens, while the electrochemical properties are observed to present a parabola style. Interestingly, the low-density SiO₂/MnO₂ core-shell nanocomposites deliver the maximum specific capacitance of 298.3 F g⁻¹ far more than the SiO₂/MnO₂ core-shell nanocomposites (179.8 F g⁻¹), and possess desirable electrochemical stability (5000 cycles retained 86.3%). All of these findings indicate that the low-density SiO₂/MnO₂ core-shell nanostructures appear to be a promising electrode material for supercapacitors application.

Keywords: nanocomposites; silica; manganese dioxide; core-shell structure; supercapacitor

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