MnO_2-Carbon Nanotube Electrodes for Electrochemical Supercapacitor

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Extensive efforts have been done to make advanced nanostructured electrodes for electrochemical supercapacitor (EC). Manganese dioxide (MnO_2) was reported to be one of the most promising materials as electrodes for the EC. It was known to have a high predicted specific capacity of 1370 F/g due to the fast surface redox reaction. A thick MnO_2 electrode, however, was reported to show low capacitance due to the poor electrical conductivity. To enhance electrical conductivity of the electrode, porous active carbon (AC) and carbon nanotube (CNT) were used as substrates. The combination of AC and CNT gives a high electrical conductivity and a solid structural matrix. It was reported to be depended on the dispersion conditions such as surfactant, solvent and ultrasonication, which affect the debundling level of CNT. They were also reported to be important in preparing a uniform MnO_2/ carbon nanocomposite electrodes from the MnO_2 nanoparticles and the carbon matrix without agglomeration of either CNT or MnO_2. A universal dispersant was reported to be able to disperse and adsorb on CNT and MnO_2 nanoparticles and cause a binding force between them. In this study, we report on the synthesis of MnO_2/ carbon nanotube composites under various dispersion conditions. The composites were further consolidated by microwave heating. Physical and chemical properties of the composite materials were characterized by transmission electron microscopy (TEM), X-ray diffraction analysis (XRD), N_2 sorption analysis (BET surface area). Their electrochemical activities were evaluated using three electrode system in various solutions by means of cyclic voltammetry (CV), galvanostatic charge/discharge, and electrochemical impedance spectroscopy (EIS). Detailed synthetic procedure, electrochemical and structural properties of MnO_2/ carbon nanotube composite will be presented at the meeting in terms of formation of metal oxide, and specific capacitance of the nanocomposites.

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