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CeO_2/MnO_2 COMPOSITE MATERIAL FOR ASYMMETRIC SUPERCAPACITOR APPLICATIONS

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Supercapacitors have attracted significant attention to play prominent roles in resolving the energy crisis, global warming, and environmental pollution. MnO_2 is the most abundant material on earth, with high theoretical capacitance. It has multiple oxidation states that contribute to redox reactions. CeO_2 is a good redox stability, which can help to improve the conductivity of MnO_2. CeO_2 helps to improve the cyclic stability of the composite material. In the present study, the composite material consisting of CeO_2 nanoparticles decorated with MnO_2 nanowires was synthesized using the low-cost, wet chemical hydrothermal technique. The synthesized materials were characterized and analyzed by Raman spectroscopy, XRD, SEM, and XPS. XRD pattern and Raman spectroscopy analysis of CeO_2 nanoparticles decorated MnO_2 nanowires revealed the presence of tetragonal α- MnO_2 phase. The electrochemical supercapacitor performance of pristine MnO_2, CeO_2, and CeO_2 nanoparticles decorated MnO_2 nanowires are analyzed by cyclic voltammetry, galvanostatic charge-discharge, and electrochemical impedance spectroscopy. The specific capacitance of the composite material was approximately 145.19 F/g. The combination of these two materials in a composite can lead to synergistic effects, resulting in improved electrochemical performance, and it can be an outstanding active electrode material for supercapacitor applications.

Keywords: Asymmetric device, CeO_2, MnO_2, Supercapacitor.