Int. J. Electrochem. Sci., 17 **(2022)** Article Number: 221053, doi: 10.20964/2022.10.48

International Journal of
ELECTROCHEMICAL
SCIENCE
www.electrochemsci.org

Effect of the hydrothermal synthesis temperature on the capacitive performance of α-MnO_2 particles

Alejandra Marin-Flores, Elsa M. Arce-Estrada, Antonio Romero-Serrano, Alonso Rivera-Benitez, Josué López-Rodríguez, Aurelio Hernández-Ramírez

Instituto Politécnico Nacional-ESIQIE, UPALM, CDMX, México, C.P, 07738
*E-mail: romeroipn@hotmail.com

Received: 15 July 2022 / *Accepted:* 26 August 2022 / *Published:* 10 September 2022

A hydrothermal method was used to synthesise α-MnO_2 particles, with manganese sulfate as the metal precursor and potassium permanganate as the oxidising agent. The α-MnO_2 samples synthesised by hydrothermal treatment at 120 °C (α-120) and 140 °C (α-140) for 2 h exhibited different sample morphologies. The sample morphology consisted of a mixture of rose-like microflower and needles, and X-ray diffraction (XRD), scanning electron microscopy (SEM), Brunauer–Emmett–Teller (BET) characterisation and Fourier transform infrared spectroscopy (FT–IR) were carried out on both the α-120 and α-140 samples. The results show that the only MnO_2 phase obtained in the synthesis was α-MnO_2. The electrochemical properties of the samples were analysed by cyclic voltammetry (CV) using a 0.1 M Na_2SO_4 electrolyte solution at scan rates ranging from 5 to 100 mV s^{-1}. The specific capacitance of the system was calculated from the CV curves. The α-120 and α-140 samples had specific surface areas of 128 m^2 g^{-1} and 95 m^2 g^{-1}, respectively, and specific capacitances at a scan rate of 5 mV s^{-1} of 112.8 F g^{-1} and 34.86 F g^{-1}, respectively. The specific capacitance decreased as the scan rate increased for both samples.

Keywords: α-MnO_2 particles, average surface area, specific capacitance behaviour

FULL TEXT