

The facile one-step hydrothermal method for the preparation of MnO₂ nanoparticles: Structural and electrochemical properties

K. Tangphanit¹, N. Boonraksa¹, S. Maensiri², E. Swatsitang³ and K. Wongsaprom^{1,*}

¹Department of Physics, Faculty of Science, Mahasarakham University, 44150, Mahasarakham

²School of Physics, Institute of Science, Suranaree University of Technology, 30000, Nakhon Ratchasima

³Institute of Nanomaterials Research and Innovation for Energy (IN-RIE), NANOTEC-KKU RNN and Nanomaterials Research and Innovation for Energy, Khon Kaen University, 40002, Khon Kaen

*E-mail: wkwanruthai@gmail.com

Abstract. MnO₂ nanoparticles were synthesized by the facile one-step hydrothermal method. The structural and morphological properties of the samples were investigated by X-ray diffraction (XRD) and field emission scanning electron microscopy (FE-SEM). Brunauer-Emmett-Teller (BET) was used to study the surface area and pore structure of MnO₂ nanoparticles. The XRD results confirmed the formation of pure phase MnO₂ with orthorhombic crystal structure. FE-SEM analysis revealed the combination of massively small spherical particles with average particle size 54.8 nm. The electrochemical performance of MnO₂ nanoparticles was evaluated using cyclic voltammetry (CV) and galvanostatic charge-discharge (GCD). The electrochemical results showed that the MnO₂ nanoparticles delivered the specific capacitance of 200.83 F/g at a current density of 1 A/g with the rate capability of 30% after 500 cycles charge and discharge test at a current density of 5 A/g.