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# CTAB-assisted Cathodic Electrosynthesis of $MnO_2$ ultra-fine Nanoparticles and Investigation of Their Charge Storage Performance

*Mustafa Aghazadeh*[1], *Mohammad Reza Ganjali*[2,3,*] *and Mohammad Ghannadi Maragheh*[1]

[1] Material and Nuclear Research School, Nuclear Science and Technology Research Institute (NSTRI), P.O. Box 14395-834, Tehran, Iran
[2] Center of Excellence in Electrochemistry, School of Chemistry, University of Tehran, Tehran, Iran
[3] Biosensor Research Center, Endocrinology and Metabolism Molecular-Cellular Sciences Institute, Tehran University of Medical Sciences, Tehran, Iran
[*]E-mail: ganjali@khayam.ut.ac.ir

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Cathodic electrodeposition of $MnO_2$ was performed from 0.005M $MnCl_2$ in the presence of cetyl trimethylammonium bromide (CTAB). The electrosynthesis experiments were done at a simple direct current (DC) mode by applying current density of 0.5 mA $cm^{-2}$ and RT conditions. The obtained brown deposit was then calcined at 300$^{o}$C for 2h to form the final manganese oxide. Thermal behavior of deposited hydroxide was investigated via thermogravimetric data i.e. DSC-TGA. The structural analysis through XRD and FTIR revealed that the prepared $MnO_2$ is composed of both α and γ phases. Morphological observations by SEM and TEM exhibited that the prepared and final oxide are composed of completely uniform spherical particles with fine sizes of about 10 nm. The charge storage performances of the prepared $MnO_2$ nanoparticles were measured by cyclic voltammetry and charge-discharge techniques, which revealed that the produced $MnO_2$ nanoparticles are capable to deliver specific capacitance as high as 232 and 181 F $g^{-1}$ at current loads of 0.5 and 2 A $g^{-1}$ and capacity retentions of 91.89% and 88.25% after 2000 cycling at these current loads. The electrochemical data proved the suitability of the manganese oxide fine particle for use in supercapacitor as electrode material.

**Keywords:** $MnO_2$; cathodic electrodeposition; Nanoparticles; Charge storage

FULL TEXT