Influence of substrate temperature on electrochemical supercapacitive performance of spray deposited nickel oxide thin films

Abhijit A. Yadav, U.J. Chavan

PII: S1572-6657(16)30526-4
DOI: doi: 10.1016/j.jelechem.2016.10.006
Reference: JEAC 2873

To appear in: *Journal of Electroanalytical Chemistry*

Received date: 7 September 2016
Revised date: 1 October 2016
Accepted date: 4 October 2016

Please cite this article as: Abhijit A. Yadav, U.J. Chavan, Influence of substrate temperature on electrochemical supercapacitive performance of spray deposited nickel oxide thin films, *Journal of Electroanalytical Chemistry* (2016), doi: 10.1016/j.jelechem.2016.10.006

Influence of substrate temperature on electrochemical supercapacitive performance of spray deposited nickel oxide thin films

Abhijit A. Yadav*, U.J. Chavan

Thin Film Physics Laboratory, Department of Physics, Electronics and Photonics,
Rajarshi Shahu Mahavidyalaya, Latur (Autonomous), 413512, Maharashtra, India

Abstract

Nickel oxide (NiO) has been considered widely as an electrochemical capacitor or supercapacitor electrode material. NiO thin films are successfully deposited at various substrate temperatures. Influence of substrate temperature on various physical and electrochemical properties has been studied. X-ray diffraction analysis confirms cubic phase of polycrystalline nickel oxide. SEM images show porous surface having inhomogeneous randomly shaped heaps. Optical band gap energy is found to be in the range of 3.04-3.28 eV. Electrical resistivity confirms the semiconducting behavior of NiO with room temperature activation energies 0.30-0.38 eV. Electrochemical characterization is carried out by testing the NiO electrodes for cyclic voltammetry, galvanostatic charge-discharge and electrochemical impedance spectroscopy. Specific capacitance of 405 Fg^{-1} at the scan rate of 5 mVs^{-1} is observed. Galvanostatic charge-discharge study confirmed the pseudocapacitive nature. Furthermore, the specific capacitance of the NiO can still keep a good retention of 92.10% after 1000 cycles at 1 Ag^{-1}, demonstrating the outstanding long-term electrochemical stability. This work offers useful reference for supercapacitor applications in the future.

Keywords: Spray pyrolysis; NiO thin film; Electrical resistivity; Supercapacitor; Electrochemical impedance spectroscopy;

*Corresponding author: aay_physics@yahoo.co.in,
Phone: +919975213852 Fax: +912382253645