Electrodeposition of Nanostructured ZnO Photoanodes for Their Application in the Oxygen Evolution Reaction

F. D. Ruiz-Ocampo¹, J. M. Zapien-Rodríguez¹, O. Burgara-Montero¹, E. A. Escoto-Sotelo¹, F. A. Núñez-Pérez^{1,*}, and J. C. Ballesteros-Pacheco^{1,*}

¹ Universidad Politécnica de Lázaro Cárdenas, Laboratorio de Sustentabilidad Energética, Av. Galeanas S/N, Colonia Las 600 Casas S/N, C.P. 60950, Lázaro Cárdenas, Michoacán, México.

*E-mail: jballesteros_pacheco@yahoo.com.mx, phd_paco@hotmail.com

doi: 10.20964/2017.06.74

Received: 22 February 2017 / Accepted: 12 April 2017 / Published: 12 May 2017

In this work it is reported by first time the galvanostatic electrodeposition of nanostructured ZnO films on indium tin oxide (ITO) substrates from oxygenated-neutral solution containing $\text{Zn}(\text{CH}_3\text{COO})_2$ and $\text{K}(\text{CH}_3\text{COO})$ at different temperature from 50 to 70°C. Morphological, structural, UV-vis spectra, photoluminescence spectra and photoelectrochemical tests of the electrodeposited ZnO films were measured. The synthesis conditions studied were the parameters temperature and applied current density. SEM results show ZnO films with grains of hexagonal shape, which present different grain size (150-600 nm) as a function of the studied parameters. The optical properties of ZnO films show absorption in the UV-visible region with band gap energy values from 2.92 to 3.15 eV. Through a XRD analysis, we show that the electrodeposition conditions also have an effect in the intensity of (002) polar and (100) no polar planes of electrodeposited ZnO films. Additional results by photoluminescence indicate presence of oxygen vacancies in the electrodeposited ZnO films, which is a factor considered as responsible of enhance electroactivity of ZnO films for oxygen evolution reaction in visible region. Calculations of overall solar to hydrogen efficiency for electrodeposited ZnO films indicate a maximum value of approximately $\eta = 0.65\%$ for ZnO film obtained at $j = -1.0 \text{ mA cm}^{-2}$ and 70°C.

Keywords: Oxygen Evolution Reaction; Zinc Oxide; Electrodeposition; Electrocatalyst.

[FULL TEXT](#)

© 2017 The Authors. Published by ESG (www.electrochemsci.org). This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution license (<http://creativecommons.org/licenses/by/4.0/>).