Short Communication

Sonoelectrochemical Synthesis of Nanostructured of p-Cu₂O and n-Fe₂O₃ and Their Application for Photoelectrochemical Splitting of Water

P. Grez^{1,*}, R. Henríquez¹, E. Muñoz¹, C. Rojas¹, S. Moreno¹, G. Sessarego¹, C. Heyser¹,
C. Celedón², and R. Schrebler¹

¹Instituto de Química, Pontificia Universidad Católica de Valparaíso, Avda. Universidad 330, Curauma, Placilla, Valparaíso Casilla, 4059 Valparaíso, Chile

²Departamento de Física, Universidad Técnica Federico Santa María, P.O. Box 110-V, Valparaíso, Chile

*E-mail: paula.grez@pucv.cl

doi: 10.20964/2019.06.03

Received: 20 June 2018 / Accepted: 29 January 2019 / Published: 10 May 2019

In the present work, a p-Cu₂O nanostructured electrode and n-Fe₂O₃ nanotubes electrode, were used as photocathode and photoanode, respectively, for study the splitting of water. In this photoelectrochemical cell (PEC) the oxygen evolution reaction takes place in the photoanode and the hydrogen evolution reaction in the photocathode, both from the water decomposition reaction. In this case, the two electrodes were synthesized by ultrasound-assisted anodization (37 kHz, 60 W) in corresponding sheet metallic. The experimental conditions for the formation of p-Cu₂O nanostructures were: 75 V, 75°C and 900 s of polarization in a solution of ethylene glycol with 5% wt of water and 0.5% wt of NH₄Cl [1]. On the other hand, the Fe₂O₃ nanotubes were synthesized at 50 V, 50°C and 180 s of polarization in an ethylene glycol solution containing 3% wt of water and 0.5% wt of NH₄F [2]. In both cases, after the anodization, the sheets were thermally treated at 190°C for 90 min in an argon atmosphere for p-Cu₂O and for n-Fe₂O₃ at 500°C for 180 min in an oxygen atmosphere. Subsequently, the electrodes were characterized by DRS, EIE by Mott-Schottky plots obtaining the diagrams of respective bands. Finally, electrochemical measurements were performed with the system Fe|nanotubes n-Fe₂O₃|0.1 M Na₂SO₄ (pH 10)|p-Cu₂O nanostructured|Cu, where the two electrodes were illuminated. In this context, the system required a bias potential of 0.36 V. This value corresponds to 69.5 kJ/mol, for a current density of 0.3 mAcm⁻². On the other hand, in equal conditions of current density, but using platinum electrodes, a bias potential of 1.50 V (289.5 kJ/mol) was required. In this context, a decrease in the energy cost for the decomposition reaction of water, in an alkaline solution was evidenced.

Keywords: sonoelectrochemical synthesis, nanostructured copper oxides, nanostructured Fe_2O_3 , photoelectrochemical cell.

[FULL TEXT](#)

© 2019 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/>).