High Photoconversion Efficiency Obtained from Novel TiO₂ Photoanodes

T. A. Aljohani^{1,2,*}, Abdulaziz K. Almutairi²

¹ National Centre for Advanced Materials Technology, King Abdulaziz City for Science and Technology (KACST), Riyadh, 11442 Saudi Arabia.

² Excellence Centre for Advanced Materials and Manufacturing, King Abdulaziz City for Science and Technology (KACST), Riyadh, 11442 Saudi Arabia

*E-mail: taljohani@kacst.edu.sa

doi: 10.20964/2016.08.22

Received: 3 May 2016 / *Accepted:* 29 May 2016 / *Published:* 7 July 2016

High photoconversion efficiency for photoelectrochemical water splitting was obtained using nanocaves TiO₂ and highly uniformed TiO₂ nanotubes. The photoanodes were synthesized via electrochemical anodization of a titanium foil in a glycerol-based solution containing NH₄F at 10 V. Pulse electrodeposition was used to incorporate Cu ions into the uniform TiO₂ nanotubes. The photoconversion efficiency performance was examined under simulated visible light illumination ($\lambda \geq 380$ nm) in a 1 M solution of NaOH. The photocurrent density, the Mott-Schottky, the EIS, and the photoconversion efficiency measurements were determined. The highest photocurrent density i.e. 5.77 mA cm⁻² at 1.23 V vs. RHE was obtained from nanocaves TiO₂ photoanode. The incorporation of Cu resulted in a reduction in photocatalytic activity of the oxygen evolution reaction (OER) and an increase of the hydrogen evolution reaction (HER).

Keywords: Anodization, Titanium dioxide nanotubes, Photoelectrochemical, Photocurrent density, water splitting.

[FULLTEXT](#)

© 2016 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/>).