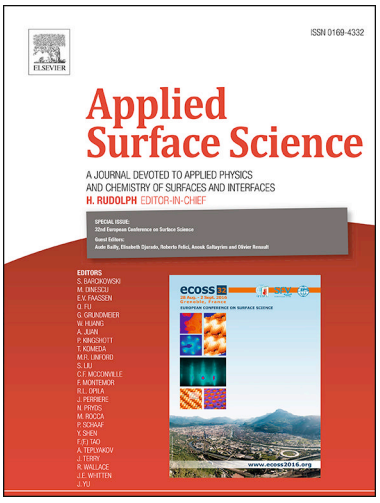
Accepted Manuscript



Full Length Article

Simply tuned and sustainable cobalt oxide decorated titania nanotubes for photoelectrochemical water splitting

Shervin Qarechalloo, Naimeh Naseri, Farshad Salehi, Alireza Z. Moshfegh

PII: S0169-4332(18)32425-5
DOI: https://doi.org/10.1016/j.apsusc.2018.09.014
Reference: APSUSC 40318

To appear in: *Applied Surface Science*

Received Date: 12 April 2018
Revised Date: 11 July 2018
Accepted Date: 2 September 2018

Please cite this article as: S. Qarechalloo, N. Naseri, F. Salehi, A.Z. Moshfegh, Simply tuned and sustainable cobalt oxide decorated titania nanotubes for photoelectrochemical water splitting, *Applied Surface Science* (2018), doi: https://doi.org/10.1016/j.apsusc.2018.09.014

Simply tuned and sustainable cobalt oxide decorated titania nanotubes for photoelectrochemical water splitting

Shervin Qarechalloo [a], Naimeh Naseri [a*], Farshad Salehi [b] and Alireza Z. Moshfegh [a,c]

[a] *Department of Physics, Sharif University of Technology, P.O. Box 11555-9161, Tehran, Iran*

[b] *Department of Materials Science, Sharif University of Technology, P.O. Box 14588-8969, Tehran, Iran*

[c] *Institute of Nanoscience and Nanotechnology, Sharif University of Technology, P.O. Box 14588-8969, Tehran, Iran*

*** Corresponding author: naseri@sharif.edu**

Abstract

Effective utilization of solar energy is an urgent global issue for solving current environmental problems and the energy crisis. A challenging issue in water splitting for solar fuel production is developing high performance and scalable photo/electro catalysts using low cost approach. Here, CoO_x nanostructures were grown on anodized TiO_2 nanotube arrays (TNAs) by amperostatic electrodeposition method as oxygen evolution reaction (OER) photoanodes. The effects of electrodeposition current density and deposition time on the growth of so-called nanostructures were investigated based on photoelectrochemical (PEC) measurements and structural characterizations. X-ray diffraction patterns of the photoanodes revealed formation of stoichiometric anatase TiO_2 as well as cobalt oxide on the surface. Based on scanning electron microscope, by increasing the electrodeposition current, the morphology of CoO_x nanostructures changed which makes electrodepostion current of 0.1 $mA.cm^{-2}$ resulting in optimum distribution of cobalt oxide electrocatalysts with average size of 35 nm which exhibit the highest photocurrent density due to efficient and uniform distribution of electrocatalysts with no screening effect. Electrodeposition time was found to have a linear relationship with the surface coverage of TNAs by the electrocatalyst, and 2000s, having long charge carrier lifetime and successfully adjusted electrocatalyst to photocatalyst amount ratio turned out to be the optimum electrodeposition time.