The effect of first step anodization time on morphology and photocurrent response of TiO2 nanotube arrays for application in backside illuminated dye-sensitized solar cells

Amin Pourandarjani, Farzad Nasirpouri

PII: S0040-6090(17)30602-8
DOI: doi: 10.1016/j.tsf.2017.08.022
Reference: TSF 36164

To appear in: *Thin Solid Films*

Received date: 18 March 2017
Revised date: 8 August 2017
Accepted date: 11 August 2017

Please cite this article as: Amin Pourandarjani, Farzad Nasirpouri , The effect of first step anodization time on morphology and photocurrent response of TiO2 nanotube arrays for application in backside illuminated dye-sensitized solar cells, *Thin Solid Films* (2017), doi: 10.1016/j.tsf.2017.08.022

The effect of first step anodization time on morphology and photocurrent response of TiO_2 nanotube arrays for application in backside illuminated dye-sensitized solar cells

Amin Pourandarjani[a], Farzad Nasirpouri[a,*]

[a] *Faculty of materials engineering, Sahand University of Technology, Tabriz, Iran*

* *Corresponding author. Tel. +98 9123145539. E-mail address: f_nasirpouri@yahoo.com*

Abstract

We report on the effects of the first step anodization time on the morphology of TiO_2 nanotube arrays grown by the two-step anodization and their photocurrent response in the backside-illuminated dye-sensitized solar cells. Results show a remarkable increase of tube ordering by increasing the first step anodization time. The Fill factor and open circuit voltage of all dye-sensitized solar cells were approximately 60% and 0.77V respectively, for a range of first step anodic oxidation from 0.5 to 6 h, whereas the short circuit current increased from 0.94 to 1.57 mA/cm^2 leading to an enhanced photo-to-current efficiency by 73%. According to open circuit voltage decay and electrochemical impedance spectroscopy (Nyquist and Bode plots), we attributed such an enhanced cell performance to lower recombination rates due to higher ordered TNAs associated with the actual surface area and coherency of the cells' components.

Keywords: Two-step anodization, Nanotube arrays, Backside-illuminated dye-sensitized solar cells, Electrochemical impedance spectroscopy, Atomic force Spectroscopy