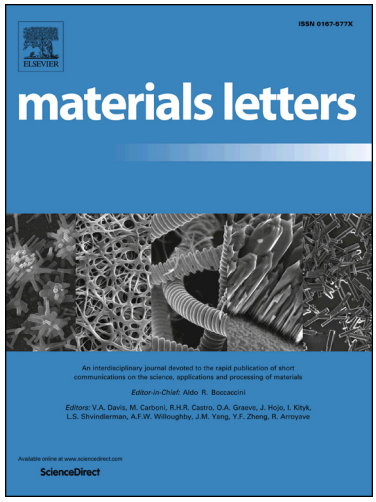

Enhancement of Light Harvesting Capabilities of Titania/Zinc Oxide Nanocomposite Photoanode through Aluminium Plasmon Impregnation

K. Pugazhendhi, Steven D'Almeida, Tenzin Tenkyong, B. Praveen, D.J. Sharmila, J. Merline Shyla

PII: S0167-577X(18)30532-9
DOI: https://doi.org/10.1016/j.matlet.2018.03.160
Reference: MLBLUE 24121

To appear in: *Materials Letters*

Received Date: 17 January 2018
Revised Date: 18 March 2018
Accepted Date: 23 March 2018

Please cite this article as: K. Pugazhendhi, S. D'Almeida, T. Tenkyong, B. Praveen, D.J. Sharmila, J. Merline Shyla, Enhancement of Light Harvesting Capabilities of Titania/Zinc Oxide Nanocomposite Photoanode through Aluminium Plasmon Impregnation, *Materials Letters* (2018), doi: https://doi.org/10.1016/j.matlet.2018.03.160

Enhancement of Light Harvesting Capabilities of Titania/Zinc Oxide Nanocomposite Photoanode through Aluminium Plasmon Impregnation

K. Pugazhendhi, Steven D'Almeida, Tenzin Tenkyong, B. Praveen, D. J. Sharmila and J. Merline Shyla*
Department of Physics, Energy Nanotechnology Centre (ENTeC), Loyola Institute of Frontier Energy (LIFE), Loyola College, Chennai-600034, India.

***Corresponding author:** jmshyla@gmail.com

Abstract

The present work reports the synthesis of Titania/Zinc Oxide (TiO_2/ZnO) nanocomposite and improvisation of its optical properties through Aluminium (Al) plasmon impregnation into ZnO using sol-gel technique. The X-Ray Diffraction (XRD) and Field Emission Scanning Electron Microscopy (FESEM) analysis showed that Al impregnation has not altered the crystallographic and morphological features of TiO_2/ZnO. UV-Vis Diffuse Reflectance Spectroscopy (UV-DRS) revealed the enhanced light harvesting capabilities of Titania/Al impregnated Zinc Oxide (TiO_2/Al-ZnO) as a result of about 95% of diffused reflectance, the highest reported to-date. Field dependent dark and photocurrent measurements showed that impacted by the plasmonic-effect, the photo and dark current values of TiO_2/Al-ZnO are higher than those of TiO_2/ZnO by ~2 and ~1.5 folds respectively. Owing to the improved photo and electrical conductive properties of the nanocomposite due to Al impregnation, the as-prepared TiO_2/Al-ZnO nanocomposite qualifies as a novel and suitable candidate for application as a proficient photoanode in Dye Sensitized Solar Cells (DSSCs).

Keywords: TiO_2/ZnO Nanocomposite, Plasmon, DSSC, UV-DRS, Photoconductivity

1. Introduction

In 1991, Michael Grätzel proposed the concept of a low-cost yet an efficient solar cell based on dye-sensitized Titania (TiO_2)[1]. Since this event, TiO_2 has attracted many researchers across the world and found tremendous application in the field of Photovoltaics. The unique and collective properties of TiO_2 such as chemical stability, non-toxicity, higher surface area, strong light scattering properties and efficient photoconductivity rendered it a preferable material for DSSCs[2]. In fact, the nanostructured-TiO_2 based DSSCs compete equally with the conventional silicon solar cells in the case of production to performance ratio. However, there are constraints such as poor electron mobility and charge recombination which limit the use of DSSCs commercially. As on date, photoanodes based on nanostructured-TiO_2 have recorded