

Accepted Manuscript

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Author: Alvira Ayoub Arbab Kyung Chul Sun Iftikhar Ali
Sahito Muhammad Bilal Qadir Sung Hoon Jeong



PII: S0169-4332(15)01065-X
DOI: <http://dx.doi.org/doi:10.1016/j.apsusc.2015.04.199>
Reference: APSUSC 30292

To appear in: *APSUSC*

Received date: 28-1-2015
Revised date: 25-4-2015
Accepted date: 27-4-2015

Please cite this article as: A.A. Arbab, K.C. Sun, I.A. Sahito, M.B. Qadir, S.H. Jeong, Fabrication of highly electro catalytic active layer of multi walled carbon nanotube/enzyme for Pt-free dye sensitized solar cells, *Applied Surface Science* (2015), <http://dx.doi.org/10.1016/j.apsusc.2015.04.199>

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Fabrication of highly electro catalytic active layer of multi walled carbon nanotube /enzyme for Pt-free dye sensitized solar cells

Alvira Ayoub Arbab^a, Kyung Chul Sun^b, Iftikhar Ali Sahito^a, Muhammad Bilal Qadir^a, Sung Hoon Jeong^{*a}

alvira_arbab@yahoo.com,

hytec@hanyang.ac.kr,

iftikhar.sahito@faculty.muett.edu.pk,

bilal_ntu81@hotmail.com,

shjeong@hanyang.ac.kr*

Phone: +821032090498*(corresponding author)

^aDepartment of Organic and Nano Engineering, Hanyang University, Seoul 133-791, Korea

^bDepartment of Fuel cells and hydrogen technology, Hanyang University, Seoul 133-791, Korea

Abstract

Highly dispersed conductive suspensions of multi walled carbon nanotubes (MWCNT) can have intrinsic electrical and electrochemical characteristics, which make them useful candidate for platinum (Pt)-free, dye sensitized solar cells (DSSCs). High energy conversion efficiency of 7.5% is demonstrated in DSSCs, based on enzyme dispersed MWCNT (E-MWCNT) layer deposited on fluorine doped tin oxide (FTO) glass. The E-MWCNT layer shows a pivotal role as platform to reduce large amount of iodide species via electro catalytically active layer, fabricated by facile tape casting under air drying technique. The E-MWCNT layer with large surface area, high mechanical adhesion, and good interconnectivity is derived from an appropriate enzyme dispersion, which provides not only enhanced interaction sites for the electrolyte/counter electrode interface but also improved electron transport mechanism. The surface morphology and structural characterization were investigated using field emission-scanning electron microscopy (FE-SEM), transmission electron microscopy (TEM), x-ray photoelectron spectroscopy (XPS), Raman spectroscopy and electronic microscopy techniques. Electro catalytic activity (ECA) and electrochemical properties of E-MWCNT counter electrode (CE) were investigated using cyclic voltammetry (CV), and electrochemical impedance spectroscopy (EIS) measurements. The high power conversion efficiency (PCE) of E-MWCNT CE is associated with the low charge transfer resistance ($R_{CT}=1.39 \Omega \text{ cm}^2$) and

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