CdSe/ZnS Quantum Dot (QD) Sensitized Solar Cell Utilizing a Multi-Walled Carbon Nanotube Photoanode on a Stainless Steel Substrate

Junthorn Udorn^{1,*}, Shengwen Hou¹, Chaoyang Li^{1,2}, Akimitsu Hatta^{1,2}, Hiroshi Furuta^{1,2,*}

¹Electronic and Photonic Systems Engineering, Kochi University of Technology, Tosayamada-cho, Kami, Kochi 782-0003, Japan

²Center for Nanotechnology, Research Institute, Kochi University of Technology, Tosayamada-cho, Kami, Kochi 782-0003, Japan

*E-mail: 178002a@gs.kochi-tech.ac.jp, furuta.hiroshi@kochi-tech.ac.jp

doi: 10.20964/2017.05.64

Received: 9 Decemeber 2016 / Accepted: 18 March 2017 / Published: 12 April 2017

Multi-walled carbon nanotube (MWCNT) forests grown on a stainless steel substrate were used as a photoanode in CdSe/ZnS (core/shell) quantum dot (QD) sensitized solar cells (QDSSCs). QD-treated MWCNTs on the conductive metal stainless steel substrate showed a higher power conversion efficiency (PCE) of 0.015% than those grown on a doped silicon substrate with a PCE of 0.005% under AM 1.5 sunlight intensity (100 mW/cm²). This higher efficiency can be attributed to the lower sheet resistance of 0.0045 Ω/sq for the metal substrate than that for doped silicon of 259 Ω/sq. The relationship between the total reflectance of the as-prepared CNT photoanode and the PCE was investigated for CNTs of various heights and amounts of QDs. A QDSSC fabricated using a CNT photo anode with a height of 25 μm showed the highest efficiency of 0.014%, while a pristine CNT forest showed the lowest total reflectance of 1.9%, which indicates a higher surface area of CNTs and a larger amount of QDs. The as-grown 25-μm CNTs treated with QDs containing in a toluene solution of 25-μL of exhibited the highest PCE of 0.015%, due to the larger surface area of the CNTs and the higher light absorption from the large amount of QDs on the CNTs.

Keywords: Multi-walled carbon nanotubes (MWCNTs), Quantum dots (QDs), Quantum dot sensitized solar cells (QDSSCs), Power conversion efficiency (PCE)

[FULL TEXT](#)

© 2017 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/>).