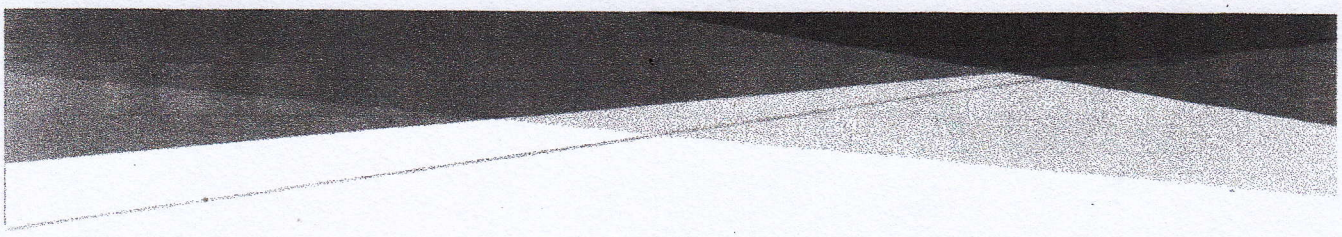

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ABSTRACT PROCEEDINGS

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Effect of Surface Modification of Photoanode on the Performances of Cds Quantum Dot Sensitized Solar Cells

G.K.R. Senadeera[1,2,*], W.I. Sandamali[1,2], M.A.K.L. Dissanayake [2], T. Jaseetharan [2,3], V.P.S. Perera[1], J.C.N. Rajendra[1], N. Karthikeyan[1] and Lahiru A. Wijenayaka [4]

[1]*Department of Physics, The Open University of Sri Lanka, Nawala Nugegoda, Sri Lanka*

[2]*National Institute of Fundamental Studies, Hanthana Road, Kandy, Sri Lanka*

[3]*Department of Physical Sciences, Faculty of Applied Sciences, South Eastern University of Sri Lanka, Sammanthurai, Sri Lanka*

[4]*Department of Chemistry, The Open University of Sri Lanka, Nawala, Nugegoda, Sri Lanka* *Corresponding author: *gksen@ou.ac.lk*

Abstract. Among the third generation photovoltaic devices, quantum dot sensitized solar cells (QDSSCs) have been attracting great attention in recent past due to their unique properties existing in the quantum dots. These devices mainly consist of a layer of porous, oxide wideband semiconductor (photoanode), covered by semiconducting quantum dots (QDs) as a sensitizer and a counter electrode (Pt) sandwiched using an electrolyte. The adherence of the QDs to the semiconducting surface is one of the crucial factors determining the efficiency of these cells and due to the poor adherence between them the efficiencies of these devices are much lower than that of the other third-generation solar devices. One of the solutions to overcome this is the surface modification of these wide band gap semiconducting materials by so-called ligands. This study has explored the possibility of surface modification of high band gap semiconductor, TiO2, using simple and low-cost citric acid molecules and obtained an impressive 60% enhancement in photocurrent density of CdS sensitized TiO2 QDSSCs with sulfide electrolyte with 34% overall photo-conversion efficiency. Tethering of QDs having an average size of ~ 4.5 nm with TiO2 through citric acid molecules was confirmed by High-resolution transmission electron microscopic studies and by Fourier Transform Infrared Spectroscopy technique. Further confirmation of the existence and the uniform distribution of Cd, S, C, Ti, and O elements in the composite photoanode were confirmed by the Energy Dispersive X-Ray Spectroscopy measurements. Electrochemical impedance studies revealed that surface treatment by citric acid molecules improved the both the electron injection to the conduction band of the TiO2 from the CdS as well as the overall charge transfer of the device while decreasing the recombination of the photogenerated electrons with their holes in the electrolyte.

Keywords: CdS capping, quantum dots, citric acid, sensitization, solar cells

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