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The photovoltaic performance of CdS quantum dots sensitized solar cell using Ag/TiO_2 photoanode

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

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

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

[3]*Department of Physical Sciences, South Eastern University of Sri Lanka, Sammanthurai, Sri Lanka* [4]*Department of Chemistry, The Open University of Sri Lanka, Nawala, Nugegoda, Sri Lanka*

Quantum dot sensitized solar cells (QDSSCs) with titanium dioxide (TiO2) photoanode are attracting considerable attention among the third-generation photovoltaics due to their low cost and simple fabrication techniques involve. It is proved that strong light absorption in the visible region due to the surface plasmon resonance (SPR), of metal nanoparticles (NP) can enhance the photoresponses of these QDSSCs by acting as an agent for light trapping and providing electron traps for facilitating charge separation. In this study, the effect of in-cooperation of Ag nanoparticles in CdS quantum dot-sensitized TiO_2 photoanodes towards the efficiency enhancement in QDSSCs was studied. CdS deposition on porous TiO_2 films was carried out by successive ionic layer adsorption and reaction method. Silver NPs, synthesized by a facile one-pot chemical reduction method, were incorporated with TiO_2 photoanode. QDSSCs with FTO/TiO_2-CdS/Pt/FTO configuration were fabricated with polysulfide liquid electrolyte. QDSSCs fabricated with pristine TiO_2 photoanode exhibited an overall power conversion efficiency of 1.09%, whereas solar cells made with 0.3 w/v% Ag nanoparticle in-cooperated photo anode exhibited 1.37% efficiency under 100 mW cm^{-2} (AM 1.5) light illumination. This is an impressive 26% increase in the overall power conversion efficiency which is mainly attributed to the significant enhancement of the light harvesting capacity of the QDSSCs resulted by ultra-broadband SPR of the Ag NPs.

Key words: *CdS, quantum dots, sensitization, solar cells*

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* Corresponding author: ishara.we@nifs.ac.lk