Extended Spectral Photo Response utilizing TCO-less Tandem DSSC

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Dye Sensitized Solar cells (DSSCs) are alternative and economical source of clean energy for realization of low carbon society. Recently DSSCs has achieved 13% efficiency. Further DSSCs performance improvement is possible by enhancing the photo harvesting region to higher wavelength. Series-stacked DSSCs (Tandem DSSCs) covering NIR region are capable to enhance the photoharvesting region and so photovoltaic performance (1). Four TCO based Tandem DSSCs are very common and theirs performance has limitation in terms of optical loss by intermediate TCO glasses. In order

to avoid the intermediate TCO optical loss by approximately 20%, TCO-less Tandem DSSC utilizing

TCO-less bottom electrodes has been proposed and photovoltaic performance has been observed.



Figure 2 shows the IV characteristics of top cell, bottom cell, and Tandem cell. Photovoltaic parameters of TCO-less Tandem DSSCs has 6.58 % efficiency (greater than sum of

10.0 Bottom cell 8.0 Tandem cell sc(mA/cm²) Top cell 6.0 4.0 2.0 0.0 0.00 0.30 0.60 0.90 1.20 1.50 Voltage(V) Figure2: IV characteristics under simulated solar irradiation

top cell as well as bottom cell), 1.2V Voc (equal to sum of bottom cell & top cell), 0.63 FF. On the other hand Top cell with HT/SP nanoporous TiO₂ stained with N719 dye shows 4.47 % efficiency, 0.76V Voc, 0.73 FF. Bottom cell with nanoporous PST-30 NRD TiO₂ utilizing PC25 dye shows 2.10 % efficiency, 0.44V Voc, 0.67 FF. Obtained 6.58% efficiency is comparable to 6.88% efficiency of TCO-Tandem DSSC (Mechanically stacked cell) and shows the future aspect of this architecture. Here we will discuss the TCO-less Tandem DSSC fabrication process and the details.

References:

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