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EFFECT OF FILM THICKNESS OF REDUCED GRAPHENE OXIDE COUNTER ELECTRODES ON PHOTOVOLTAIC PROPERTIES OF DYE SENSITIZED SOLAR CELLS

J.M.K.W. Kumari[12*], M.A.K.L. Dissanayake[12], G.K.R. Senadeera[13]

[1]National Institute of Fundamental Studies, Kandy. Sri Lanka
[2]Postgraduate Institute of Science, University of Peradeniya, Sri Lanka
[3]Department of Physics, The Open University of Sri Lanka

The role of the counter electrode (CE) in dye sensitized solar cells (DSSCs) where wet cell is concerned, is to transfer electrons from the external circuit back to redox electrolyte and to catalyze the reduction of tri-iodide (I_3^-) to iodide (I^-). Generally, Pt has been used as the preferred CE material in DSSCs due to its excellent electro-catalytic activity and corrosion resistance to iodide ions (I^-) present in the redox electrolyte. However, Pt is a precious metal and it increases the cost of DSSCs. Recently, Pt free materials mainly based on carbon materials with lower cost and good stability have been investigated as catalysts for DSSCs. Out of these, reduced graphene oxide (RGO) has been mostly used as the CE material for DSSCs, due to its easy synthesis process, outstanding electrical, optical and mechanical properties needed for potential applications. In this study, RGO based CEs were prepared by spray method and deposited on FTO conducting glass substrate. To investigate the effect of CE film thickness on DSSC performance, a series of RGO based CEs were prepared by varying the amount of RGO and these CEs were sintered at 250 ^oC for 45 minutes. Photovoltaic performances of liquid electrolyte based DSSCs were tested by using RGO CEs with different thicknesses. Results revealed that with increasing the CE film thickness, the photovoltaic performances also increased up to a certain thickness, but further increment of the CE film thickness showed a decrease in the DSSC performance. The best DSSC performance was exhibited by 15 mg of RGO/per 6 cm^2 area of the CE which corresponds to a RGO film thickness of 27.7 μm. The highest efficiency of 4.70 % was observed for this optimized RGO CE based DSSC. This low-cost RGO CE exhibits good stability and acceptable efficiency compared to the efficiency of 7.82 % exhibited by DSSC with Pt CE operating under similar conditions. The thicknesses of the prepared RGO CEs were measured by scanning electron microscopy. Results suggest that the RGO based CE can be one of the alternatives to replace the expensive Pt-based CEs in DSSCs.

Keywords: Counter electrode, Dye sensitized solar cells, Film thickness, Photovoltaic properties, Reduced graphene oxide

[*]*Corresponding author: kalpani.ku@nifs.ac.lk*