ISSN: 1391-8796
Proceedings of
4th Ruhuna International Science & Technology Conference
University of Ruhuna, Matara, Sri Lanka
January 26, 2017

Influence of cation concentration in the electrolyte on photovoltaic performance of dye sensitized solar cells

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The influence of different concentrations of cations on the photovoltaic characteristics of dye sensitized solar cells (DSSCs) have been investigated. Potassium iodide (KI) with a small size cationand tetrapropylammonium iodide (Pr_4NI) with a bulky cation have been used to prepare liquid electrolytes to be used in DSSCs with I^-/I_3^- (iodine/iodide) redox couple. The cation concentration in the liquid electrolyte wasvaried by preparing a series of electrolyteswith different salt concentrations and the efficiency of DSSCs was optimized.The DSSC configurationused was FTO glass/TiO_2/Ru N719 dye/liquid electrolyte/Pt electrode. The DSSCs fabricated with electrolyte having smaller K^+cationsshowed the optimized efficiency of 7.09 % with short circuit current density (J_{sc}) and open circuit voltage (V_{oc}) as 16.05 mA cm^{-2} and 688.2 mV, respectively at a KI salt concentration of 0.57 mol dm^{-3}. DSSCs fabricated with electrolyte having larger Pr_4N^+cations showed the optimized efficiency of 6.89 % with J_{sc} as 14.44 mA cm^{-2} and V_{oc}, 743.0 mV, at a Pr_4NI salt concentration of 0.57 mol dm^{-3}. These photovoltaic characteristic results indicate that the selection of the type of cations and their concentration in liquid electrolytes affects the electron injection dynamics and the charge transfer processes. Therefore, the results show that the choice of the size and the concentration of cations play an important role in determining the photovoltaic characteristics, and ultimately the overall performance of the DSSCs.

Keywords: *Dye Sensitized Solar cells, electrolyte, cationconcentration,*

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