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金属メッシュを用いたタンデム型色素増感太陽電池の擬固体化に関する研究

Study on Quasi-Solid Tandem Dye-Sensitized Solar Cell Using Metal Mesh

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INTRODUCTION

To improve the Power Conversion Efficiency (PCE) of the DSC a new approach was investigated. In our laboratory we fabricated a tandem DSC with Platinum (Pt)-coated mesh used as the counter electrode with a liquid electrolyte. The PCE of 5.52% and J_{SC} of 13.1mA/cm^2 were achieved. However, due to the volatilization problem of the liquid electrolyte a quasi-solid electrolyte was adopted. For the quasi-solid materials, poly (9,9-dioctylfluorene) (F8) and poly(3-hexylthiophene) (P3HT) were added to two different electrolyte solutions with o-dichloro benzene (DCB) been used as the solvent. The electrolyte solution of o-DCB+F8 produced an overall PCE of 0.94% while that of o-DCB+P3HT was 0.2%.

RESULTS & DISCUSSION

An electrolyte solution of 0.1mol/L (lithium iodide (LiI)), 0.05mol/L (iodine (I_2)), 0.5mol/L (4-tert –butyl pyridine (4-TBP)), and 0.5mol/L (tetra butyl ammonium iodide) in 1ml o-DCB solvent were prepared in a bottle. Later about 20mg of F8 and 20mg P3HT were added into the prepared electrolyte solution, respectively. Mixtures were stirred and heated until they were properly dissolved. In Figs. 1 and 2 the solid red line represents the tandem cell Pt-mesh counter electrode (CE), the front and back are represented with the blue and green broken line respectively. However, in the Fig.1 o-DCB+F8 produced a PCE of 0.94% while in Fig.2 o-DCB+P3HT a PCE of 0.2%. These efficiencies when compared with the single DSC they are much lower. In our previous experiment, the PCE the single DSC with o-DCB+F8 were 1.53% and tetrahydrofuran (THF) +F8 produced the highest PCE of 2.51%.

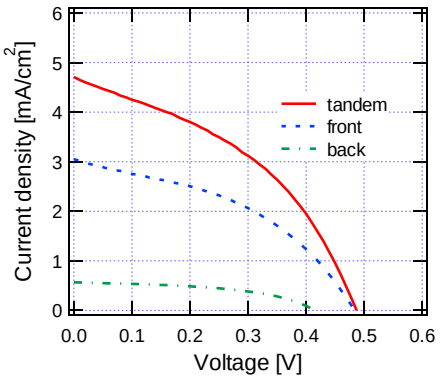

Fig. 1 J-V characteristics

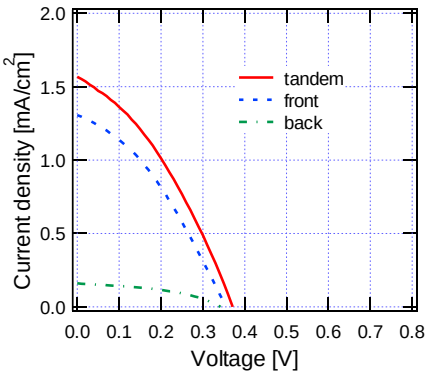

Fig. 2 J-V characteristics

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Refs. [1] F. Inakazu et al., *Appl. Phys. Lett.*, **93** (2008) 099304 [2] M. Murayama, et al.*16th Int'l Conference on Photochemical Conversion and storage of Solar Energy*, **W4-P-16**, (2006); M. Murayama, et al. *J. Phys. D*, **40** (2007) 1664. [3] K. Uzaki et al., *Jpn. J.Appl.Phys.*, **49** (2010) 082301.