Fabrication of Dye Sensitized Solar Cells on Conducting Plastic Substrates

W.A.K.C. Wijesuriya,A.J.M.H.L.Senevirathna, P.M. Sirimanne
Department of Science and Technology, Uva Wellassa University, Badulla, Sri Lanka

Ninety percent of the energy consumption in the world is fulfilled by fossil fuels. As a result of unending usage, all kinds of fossil fuels will be depleted within next few decades. Therefore finding alternative energy sources is the prime scientific goal which has many challenges associated to it. In this context, solar energy has received a greater attention as an alternative and viable energy source. Several types of solar cells have been designed and fabricated by researchers to harness the solar energy. Dye-sensitized solar cell is one such device that belong to the $3r^d$ generation solar cells and has roused significant attention due to its easy fabrication and low cost. Highest efficiency has been achieved from dye-sensitized solar cells using ruthenium based metal complexes. However, ruthenium metal complexes cause environmental issue and so does the weight of the glass substrates. Therefore reduction of the weight of the solar cells and finding an efficient organic sensitizer are essential scientific hurdles. In this study, an environmental friendly dye, 1-(2-hydroxycarbonyl-phenyl)-5-(2-hydroxy-5-sulfopheny1)-3-phenylformazan (zincon) is used as a dye (sensitizer) to fabricate a solar cell. Zincon dyes have their own conjugatedp-orbitals with delocalized electrons in the compounds thus absorbing unique portion of the visible light and giving an intense color. Zincon dye exhibits solvatochromic behavior due to enforcement of Van der Waals interaction between dye molecules and solvents depending on their polarity. Zincon was coated on titanium coated conducting plastic substrate, which was prepared by doctor blade method and then was pressured using a hydraulic pressure instrument. Zincon dye has different surface chelating groups and making bonds easily with metal oxides. Coupling of zincon dye by COOH group with Ti^{4+} was confirmed by FTIR measurements. A platinum coated plastic substrate is attached to the dye coated film and the space was filed by the electrolyte by capillary action. I-V characteristics were measured under 1 Sun. Current-voltage characteristics of the cell were studied under simulated one sun. Photocurrent of 1.6 $mAcni^2$, photo-voltage of 395 mV, fill factor 26.5 % and efficiency of 0.2 % were observed as the best performances of the cell. The photo-performances of the cell are much lower than those sensitized with ruthenium metal complexes based dyes.

Keywords: Zincon, Dye sensitized solar cells, Conducting polymers, Solvatochromic behavior