ZINC OXIDE THIN FILMS FOR DYE-SENSITIZED SOLAR CELL APPLICATIONS

A PROJECT REPORT PRESENTED BY

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to the Board of Study in Chemical Sciences of the

POSTGRADUATE INSTITUTE OF SCIENCE

in partial fulfilment of the requirement

for the award of the degree of

MASTER OF SCIENCE IN NANOSCIENCE & NANOTECHNOLOGY

of the

UNIVERSITY OF PERADENIYA

SRI LANKA

2010

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The sun is an abundant, continuous and clean source of energy that can be tapped at liberty to produce electricity using many different photovoltaic designs. This research project probes into ZnO based dye sensitized solar cells (DSSCs), which are the most promising amongst the new class of nanostructured solar cells that offer the potential for high efficiency at low cost. As against Conventional DSSCs, which use a TiO_2 nanoparticle film sensitized with a monolayer of dye molecules to transport electrons to the anode by a hopping mechanism, this study was focused on ZnO as a more efficient alternative to TiO_2.

Here TiO_2 film is replaced with ZnO. For comparison, ZnO particles were used in three sizes; 30 nm, 90 nm and 140 nm. Most of the DSSCs have given best results with Ruthenium dye complexes, and in this study in addition to Ruthenium N719, Indoline D102 was also used separately. Besides semiconductor and the dye, electrolyte was also altered in two types; liquid electrolyte and the Polymer electrolyte. Using all these combinations, 12 types of sample solar cells were designed for the study.

Study was conducted as a laboratory research by preparing electrolytes, dyes and standard cell model as per schematic diagram in figure 2 using appropriate materials tools and equipments. Japanese Solar simulator PECCELL model PEC-L01 was used to simulate the solar energy source at 0.1 W m^{-2} throughout the study. Readings were recorded soon after setting the cell appropriately for each replicate, within a voltage range of -0.2 to 0.7 V.

ZnO (30 nm) gave the best results with the Polymer Electrolyte and the Dye Indoline D102, with a short circuit current density (J_{SC}) of 44.5 A m^{-2}, an open circuit voltage (V_{OC}) of 0.67 V and a fill factor (FF) of ~0.70 resulting in a final overall efficiency (η) of 2.1%.