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Characterization of TiO_2 Based Dye-Sensitized Solar Cell Prepared by Screen Printing Method

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The dye-sensitized solar cells can provide an economically credible alternative in mitigating the challenges presented by the current convectional photovoltaic devices. Whereas the semiconductor assume both the task of light absorption and charge carrier transport, the two functions are separated. Light is absorbed by a sensitizer which is anchored to the surface of a wide band semiconductor. Charge separation takes place at the interface via photo-induced electron injection from the dye into the conduction band of the semiconductor. Carriers are transported in the conduction band of the semiconductor to the charge collector. The use of sensitizers in conjunction with oxide films of nano-crystalline morphology provides a broad absorption band and permits to harvest a large fraction of sunlight. Nearly quantitative conversion of incident photon into electric current is achieved over a large spectral range extending from the UV to the near IR region. Overall solar energy to electrical energy conversion efficiencies of over 10% has been reported. In addition, there are good prospects to produce these cells at lower cost than conventional solar cells. This research aims at contributing to the foregoing research on characterization of low cost TiO_2 based dye sensitized solar cells. To achieve that, black berry dye was used as the electron donating species. Blackberry dye was extracted from blackberry fruit and adsorbed onto a nano-porous titania substrate. The nano-porous TiO_2 was prepared by sol-gel process and its layer was mounted on a glass substrate by employing screen printing technique. Using DUV3700 spectrophotometer, the TiO_2 layer was characterised to obtain its optical properties which are transmittance and reflectance. Graphite coated glass was used as the counter electrode. An I^-/I_3^- electrolyte solution was used as the redox couple. This solution was made of potassium iodide saturated with iodine. The solar cell parameters were determined as a way of characterising the solar cell. They included open circuit voltage (Voc), short circuit current (Isc), fill factor (FF), power at maximum power point (Pmax) of the solar cell and efficiency (η).

Key Words Dye-Sensitized, Amorphous Silicon, Complementarity, Outdoor Performance