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Optical Characterization of Compounds for Dye-Sensitized Solar Cell Applications

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The dye-sensitized solar cell 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 has 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. The aim of this research is to contribute to the optical characterization of compounds required in TiO_2 based dye sensitized solar cells. To achieve this, several dyes will be used as the electron donating species. These dyes will be adsorbed onto a nano-porous titania substrate. The nano-porous TiO_2 will be prepared by sol-gel process and its layer will be mounted on a glass substrate by employing screen printing technique. Using DUV3700 spectrophotometer the TiO_2 layer will be characterized to obtain its optical properties which are transmittance and reflectance when in both un-sensitized and sensitized. An I^-/I_3^- electrolyte solution will be used as the redox couple. This solution will be made of potassium iodide saturated with iodine. The solar cell parameters will then be determined as a way of characterizing the solar cell. They will include open circuit voltage (Voc), short circuit current (Isc), fill factor (FF), efficiency (η) and power at maximum power point (P_{max}) of the solar cell. Finally, comparison and appropriate conclusions will be made as to which type of DSSC is the best as per the dyes used.