OPTIMIZATION OF DYE-SENSITIZED SOLID-STATE AND ELECTROCHEMICAL PHOTO-VOLTAIC CELLS BY TiO_2 FILM MODIFICATION.

By

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Abstract

The aim of this study was to increase the photovoltage and photocurrent of dye-sensitized solid state and electro-chemical photovoltaic cells by TiO_2 film modification. The first chapter of this thesis is a general discussion of historical background and concepts of solar cells as solar energy converters. It also explain the existent of defects in solar cells and ways of over coming these problems to produce cheaper solar cells having high photovoltages and photocurrents with the dye sensitization phenomena.

In the second chapter, experimental procedures followed to fabricate dye-sensitized solid-state and electrochemical solar cells and instrumental techniques used in the characterization of those cells are described. These methods are referred in the thesis at the places when necessary.

The parameters such as band positions of semiconductors, energy states of dyes etc. are calculated for the semiconductors and natural pigments used in this work and thermo dynamical feasibility of construction of dye-sensitized solar cells with these materials are discussed in chapter 3.

Our innovative efforts to increase the out put of dye sensitized solid state photo voltaic solar cell n-TiO_2 / dye/ p- CuI based on TiO_2 film modification is reported in the chapter 4. Under this chapter we have discussed the dependence of the photo voltage and photocurrent on TiO_2 film thickness and on the particle size of TiO_2 collide, consequence of preparing TiO_2 electrode with to different particle sizes etc.

The improvements gained preparing electrodes of dye-sensitized solar cells mixing TiO_2 with other high band gap semiconductors such as ZnO, SnO_2, WO_3 are documented in chapter 5.

With the impressive achievements made under above chapters, we have succeeded to obtain maximum value of photovoltage and photocurrent of 515 mV and 2.5 mA respectively for n - TiO_2 / Cyanidin / p- CuI dye sensitized solid state photo voltaic cell at 800 wm^{-2} simulated sun light. It was clear that the photovoltage and photocurrent is affected by addition of second semiconductor material to TiO_2 electrode. High photocurrents and photovoltages resulted in dye sensitized n-[TiO_2 / WO_3 (SnO_2)] /chlorophyllin / electrolite , electrochemical photovoltaic solar cells is thought to be due to the suppression of electron hole recombination.