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Study the Properties of Dye Sensitized Solar Cells under Effect of the Ionizing Radiation

A thesis submitted

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BY

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ABSTRACT

Dye-Sensitized Solar Cells (DSSCs) are a technology that falls under of the category of future technologies. In the first part of this study, pure titanium oxide (TiO_2), was prepared using the doctor's blade method and used as an anode for Dye-Sensitized Solar Cells (DSSCs). that exposed of these thin films to Alpha radiation from an alpha particle americium source for varying time, ranging from st, 30 and 60 minutes. These films were examined with UV-VIS spectroscopy, and through absorption, the direct and indirect energy band gaps were calculated using Tauc's relations. It is observed that the direct and indirect energy gaps decrease with increasing irradiation time. The study revealed that an irradiation time of 60 minutes resulted with the minimal energy band gaps where the values of the energy band gap were (3.01,2.90 and 2.77) eV for irradiation times (st,30,60) minutes in contrast, the Urbach energy increases with increasing irradiation time, where the values were (0.66, 1, 1.25) eV. The FTIR of these films is also measured, and it was determined that the scattering occurs in the region of 500–3000 nm, which means that TiO_2 exists in a different chemical environment. After that, a Scanning Electron Microscope examined these films, observing a uniform and homogeneous distribution of TiO_2 particles with a spherical shape. The films displayed a spherical shape due to an increase in surface energy as the irradiation time increased.

In the second part of this work, DSSCs were prepared using titanium oxide (TiO_2) as a semiconductor material, where two types of counter electrodes (Carbon and Aluminum) were used. the electrolyte solution KI, and two types of dyes: synthetic dye (methylene blue) and natural extract (blackberry, greenberry), divided this part into several sections based on the counter electrodes and Dyes, and assembled three solar cells in each section. The first solar cell was composed of (ITO/TiO_2/ MB/ KI/Carbon). The second cell is (ITO/TiO_2/Dye/KI/AL), using the dyes used in the research. (FTO/TiO_2/Dye/KI/AL) makes up the third cell. The best result were obtained using a synthetic dye and an Aluminum electrode for the FTO glass at 60 minutes under irradiation. For a solar cell. (FTO/TiO_2/MB/KI/AL). obtained the results before irradiation: V_{oc} = 0.62 V, J_{sc} = 1.6 mA/cm^2, FF = 0.34, η = 0.7. The results indicated that irradiated TiO_2 for 30 minutes. A higher level of energy conversion efficiency by 0.9% with values of V_{oc} = 0.63 v, J_{sc} = 4.41 mA/cm^2, and FF = 0.17.the Exposure to titanium oxide for 60 minutes showed increased Solar Cell efficiency of 1% with values of V_{oc} = 0.69 V, J_{sc} = 5.85 mA/cm^2, and FF = 0.15.