Ain Shams University
College of Women (Arts, Science and Education)
Physics Department

Study of Some Physical Properties of 5,10,15.20-tetraphenyl-21H,23H-porphine iron choloride (FeTPPCl) Thin Films and Their Photovoltaic Application

A thesis submitted for the degree of M.SC Degree in Physics (Solid state physics)

By

Eman Emad El-Dine Mahmoud Abd El-megide El-garhy

Under

Supervision of

Prof. Dr. Hamdia Abd Elhamid Zayed
Professor of Solid State Physics Dept.,
College of Women for Art, Sci., & Educ .
Ain Shams University.

Prof. Dr. Mahmoud Mohamed El-Nahass
Professor of Solid State Physics Dept.,
Faculty of Education,
Ain Shams University.

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APPROVAL SHEET

***Student name*: Eman Emad El-Dine Mahmoud Abd El-megide El-garhy**

Thesis title: Study of Some Physical Properties of 5,10,15.20-tetraphenyl-21H,23H-porphine iron choloride (FeTPPCl) Thin Films and Their Photovoltaic Application .

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Supervisory Committee

Name ***Signature***

1. ***Prof. Dr. HamdiaAbdElhamidZayed***

Professor of Solid State Physics

Physics Dept., *College of Women for Art, Sci., & Educ*.

Ain Shams University

2. ***Prof. Dr.Mahmoud Mohamed El-Nahass***

Professor of Solid State Physics

Physics Dept., Faculty of Education, Ain Shams University

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Abstract

Solar energy is widely believed to be the most promising renewable energy source to fulfill the ever-increasing energy demand from human society now and into the future. Innovation in solar cell design is required to reduce cost and compete with traditional power generation. Current innovative solar technologies include nanostructured dye- sensitised solar cells and polymer solar cells, which both contain organic materials. One these groups of materials, organic molecules with conjugated π electron systems, such as porphyrin molecules, have created a new materials that offer a new applications in solar cell technology. One of these materials is 5,10,15, 20-tetraphenyl -21H, 23H- porphine iron (III) chloride (FeTPPCl).Organic solar cells have been explored as a potentially low-cost alternative to silicon solar cell due to their lower fabrication costs compared to crystalline.

This thesis is focused on the study of the structural , optical and Dc electrical properties of FeTPPCl in thin film form which prepared by thermal evaporation technique. The structural of powder and as-deposited and irradiated thin films of FeTPPCl are investigated by X-ray diffraction technique and Transmation electron microscope (TEM). The results indicate the polycrystalline nature of the powder form and as-deposited and irradiated films. The analysis of XRD diffraction pattern indicates that FeTPPCl has a tetragonal structure with lattice constants of a = 13.53 Å and c= 9.82 Å and with space group (I4/m, Z=2). The transimation electron microscope (TEM) showed spherical nanoparticles with average diameter 16 nm of the as- deposited thin films. Aggregation of the FeTPPCl nanoparticles is observed with different shapes as a result of γ-irradiation.

The optical transmittance, T, and the reflectance, R, spectra of the as-deposited , irradiated and illuminated thin films will measured in the spectral range 200–2500 nm. The obtained data of optical constants (refracted index n, extinction coefficient , k and absorption coefficient(α)were used to determin types of transition and the optical energy gaps $E_g^{opt.}$,and the fundamental bandgap $E_g$for thin films before and after **γ**-irradiation and illumination . It was found that all films exhibited indirect allowed inter-band transitions .The indirect energy gap were affected by the dose of **γ**-irradiation and the time of illumination. It was found that the values of