

**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 chloride (FeTPPCL) Thin Films and Their Photovoltaic Application

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

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Contents

Acknowledgment	i
List of Figures	ii
List of Tables	VIII
Abstract	X

Chapter 1

Introduction and Literature Review

1.1 Organic Semiconductor	1
1.1.1 Basic Properties of Organic Semiconductors	2
1.1.2 Deposition Techniques	2
1.1.3 Semiconducting Properties of Organic Materials	3
1.2 Background of Porphyrins	6
1.3 5,10,15, 20-tetraphenyl -21H, 23H- porphine iron (III) chloride (FeTPPCL)	9
1.4 Literature review	10

Chapter 2

Theoretical Background

2.1 Optical properties of organic semiconductors	21
2.1.1 Mechanisms of optical absorption	22
2.1.2 The absorption coefficient and the optical band gap	24
2.1.3 Dispersion in semiconductor materials	26
2.2 Electric properties	31
2.2.1. Dc electric conductivity	31
2.2.1.1 Dc analyses	31
2.3 I-V characteristics of metal/semiconductor contacts	33
2.3.1 Electronic structure of organic / metal interfaces	33
2.4 Photovoltaic of organic materials	35
2.4.1 The Ideal Solar Cell	37
2.4.2 The components of ideal solar cell	39
2.4.3 Short Circuit Current, Open Circuit Voltage and Fill Factor	40
2.4.4 Photoresponsivity, External Quantum Efficiency and Power Conversion Efficiency	42
2.4.5 Device Architectures	43

Chapter 3

Experimental techniques

3.1 Preparation of FeTPPCL thin films	52
3.1.1 Substrat cleaning	53
3.1.2. Method of thin films preparation.	54
3.2 Film thickness measurements	55
3.2.1 Quartz crystal thickness monitor	55
3.2.2 Interferometric method	56
3.3 Structural investigation of FeTPPCL	58
3.3.1 X-ray diffractometry (XRD) technique	58
3.3.2 <i>Transmission electron microscope (TEM)</i>	59
3.3.3 Infrared spectroscopy technique	60
3.4 Optical measurements	61
3.4.1 Film transmittance and reflectance	61
3.4.2 Determination of the optical constants	63
3.5 Electrical measurements	64
3.5.1 Planar thin film samples preparation	64
3.5.2 Devices preparation and measurements	65
3.5.2.1 Hybrid organic–inorganic device preparation and measurements	65
3.5.2.2 Current density-voltage (J-V-T) Measurements	65

Chapter 4

Result and disscution

4.1 Structural investigation of FeTPPCL in powder and thin film forms.	67
4.1.1 X-ray diffraction studies of FeTPPCL in powder form	67
4.1.2 Transimation electron microscope studies (TEM)	69
4. 2 Optical properties of FeTPPCL thin films	71
4.2.1 Influence of γ - irradiation on the optical prorties of FeTPPCL thin films.	72
4.2.2 Influence of illumination on the optical properties of FeTPPCL thin films .	80

Chapter 5

Vibrational spectroscopic analysis of FeTPPCL experimental and theoretical (DFT methode) study

5.1Computational Physic	89
5.2Computational model	89

5.2.1Molecular Mechanics	89
5.2.2 Electronic Structure Method	90
5.2.2.1 Semi-Empirical Method	90
5.2.2.2 ab Initio Method	90
5.3 The ab Initio Modeling Program Package	90
5.3.1Gaussian 03 Package	90
5.4 Computational Details	90
5.4.1 Vibrational Assignments	92
5.4.1.1 C–H Vibrations	93
5.4.1.2 C=C Vibrations	94
5.4.1.3 C=N Vibrations	95
5.4.1.4 Fe-Cl Vibrations	95
5.4.2 Other Molecular Properties	96

Chapter 6

Electrical properties

6.1 DC electrical conductivity investigation of thin films	99
6.2 Electrical properties of FeTPPCl on p- Si heterojunction	101
6.2.1 Dark current – voltage characteristic	101
6.2.2 Current – Voltage characteristics of Au/FeTPPCl/p-Si under illumination	109
Conclusion	111
References	113
Arabic summary	1

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List of Figures

Fig. 1.1. Different hybridizations for the carbon atom.	4
Fig. 1.2. Schematic representation of the splitting of two 2p orbitals into a bonding molecular π -orbital and an anti-bonding molecular π^* -orbital. Increasing the number of carbon atoms, leads to more degeneration and the formation of quasi-continuous bands of occupied and unoccupied states.	6
Fig. 1.3 The molecular structure of FeTPPCL.	9
Fig. 1.4 Model of the statistically averaged molecule of FeTPPCL according to Hoard et al.	17
Fig. 1.5 The asymmetric unit of FeTPPCL. On the left is an enlargement in which one can see the apparent torsional motion of C8 and C9. On the right are shown the intramolecular bond lengths and angles.	18
Fig 2.1. Schematic sketch of the typical behavior of light passing through a thin film on a substrate.	22
Fig 2.2. The incoming radiation I_0 results in reflectance R and transmittance T.	23
Fig. 2.3 Schematic illustration of semiconductor interband transitions: (a) direct transition and (b) indirect transition.	25
Fig. 2.4. Models of organic/metal interfaces. Both take account of the interfacial dipole layer. As for band bending (a) assumes band bending leading to Fermi level alignment, while observed results (b) show no such band bending.	34
Fig. 2.5. Schematic diagrams of a conventional p-n junction solar cell and organic heterojunction solar cell.	37
Fig. 2.6. The Equivalent circuit of an ideal solar cell (full lines). Non-ideal components are shown by the dotted line.	38
Fig. 2.7. Graph of current versus voltage for photovoltaic devices. The figure shows how the device characteristics change upon illumination.	41

Fig. 2.8. Metal-insulator-metal (MIM) picture of organic diode device function.

- (a) Closed circuit condition: under illumination photogenerated charges drift toward the contacts.
- (b) Flat band or open circuit condition: the current becomes zero.
- (c) Reversed bias: photogenerated charges drift in strong electric fields, the diode operates as a photodetector.
- (d) Forward bias larger than V_{OC} : the injection increases and the diode open up.

45

Fig. 2.9. Schematic of a single layer device with a Schottky contact at the aluminum contact. Photogenerated excitons can only be dissociated in a thin depletion layer W , and thus the device is exciton diffusion limited.

46

Fig. 2.10. Representation of donor/acceptor interface architecture possibilities:

- (a) a planar heterojunction, formed between thin films of donor and acceptor materials, (b) an optimal bulk heterojunction, where there is complete phase separation of donor to one side and acceptor to the other side of the device structure; and (c) a non-ideal bulk heterojunction, where isolated regions of donor and/or acceptor phases prevent the collection of photogenerated charges. Dashed (solid) lines correspond to hole (electron) transport, and the arrow ("×") represents continuing (terminated) charge carrier flow.

47

Fig. 2.11. Schematic energy level diagram of an organic heterojunction between a donor (D) and an acceptor (A) layer. Here IP (or highest occupied molecular orbital (HOMO)) and EA (or lowest unoccupied molecular orbital (LUMO)) are the ionization potential and electron affinity, respectively. The exciton binding energy (EB) of each material is equal to the difference between the transport gap (E_{tran}) and optical gap (E_{opt}). The vacuum energy (E_{vac}) is shown and is the point of zero energy, with the y-axis defined as the energy axis. The process of charge transfer of an exciton from $D \rightarrow A$ is also illustrated.

48

Fig. 2.12 Schematic of a bulk heterojunction device. The donor (D) is blended with the acceptor (A) throughout the whole film. Thus, photogenerated excitons can be dissociated into charges at any place

49

Fig.2.13 Donor and acceptor materials may be blended together to yield a dispersed heterojunction. If the domain size in the blend is similar to the exciton diffusion length, then the probability that an exciton will reach the interface and dissociate is high. For efficient photocurrent collection, each material must provide a continuous path for the transport of separated charge to the contacts. Isolated domains can trap charges, causing recombination. (a) A blend of two polymers. (b) A blend of one polymer with electron accepting nano particles or fullerenes. The concentration of nano particles should be sufficient to allow percolation.	51
Fig.3.1 The molecular structure of FeTPPCL	53
Fig. 3.2 Thermal evaporation process	55
Fig. 3.3.(a) Schematic diagram of the interferometer; (b) Schematic diagram showing the optical set-up for film thickness measurements; (c) Fizeau fringes.	57
Fig. 3.4 Schematic of an FTIR system	60
Fig. 3.5 Schematic diagram showing the spectrophotometer	61
Fig. 3.6 Measurements of film transmittance where the reference is clean substrate.	62
Fig. 3.7 Measurements of film reflectance according to the reference (Al- mirror)	63
Fig. 3.8 Schematic representation of measuring configuration used for electrical measurements of FeTPPCL films in planar configuration.	64
Fig. 3.9 Schematic structure of Au/FeTPPCL/p-Si/Al cell	65
Fig.3.10 (a) Circuit for monitoring the I-V characteristics using CRO. (b) Circuit for measuring the I-V characteristics point by point in dark and under illumination	66
Fig. 4.1. XRD of FeTPPCL in: (a) the powder form, (b) as-deposited (c) γ -irradiated thin film.	68

Fig.4.2 TEM micrograph for (a) the as-deposited (b) γ -irradiated (10 kGy) FeTPPCL thin films.	70
Fig. 4.3 The spectral dependence of the normal incidence transmittance, T and reflectance, R for the as-deposited and γ -irradiated (1,5,10 kGy) FeTPPCL thin film of thickness 130 nm.	72
Fig. 4.4 The spectral dependence of the real part of refractive index, $n(\lambda)$, for the as deposited and γ -irradiated (1,5,10 kGy) FeTPPCL thin film of thickness 130 nm	73
Fig 4.5.The spectral dependence of the imaginary part of refractive index, $k(\lambda)$, for the as-deposited and γ -irradiated (1,5,10 kGy) FeTPPCL thin film of thickness 130 nm	74
Fig. 4.6 Spectral behavior of absorption coefficient, α , for the as-deposited and γ irradiated (1,5,10 kGy) FeTPPCL thin film of thickness 130 nm.	75
Fig. 4.7 Relation between $(\alpha h\nu)^{1/2}$ and photon energy ($h\nu$) for as-deposited and γ Irradiated FeTPPCL thin films.	76
Fig. 4.8 Variation of the energy gaps E_g^{opt} and E_g with γ -irradiation doses of FeTPPCL thin films.	77
Fig. 4.9 Relation between $(n^2 - 1)^{-1}$ and $(h\nu)^2$ for the as-deposited and γ -irradiated FeTPPCL thin films.	79
Fig.4.10 Relation between n^2 and λ^2 for the as-deposited and γ -irradiated FeTPPCL Thin films .	79
Fig 4.11-a Spectral dependences of optical transmittance T calculated for as-deposited and illuminated FeTPPCL thin films	80
Fig 4.11-b Spectral dependences of optical reflectance R calculated for as- deposited and illuminated FeTPPCL thin films	81
Fig. 4.12(a) Spectral behaviour of real part of refractive index, n, for as-deposited and	

Illuminated FeTPPCl thin films.	82
Fig 4.12 (b) Dependences of absorption coefficient α upon the photon energy $h\nu$, as calculated for as-deposited and illuminated FeTPPCl thin films.	82
Fig.4.13 (a,b&c) Dependence of molar extinction coefficient on the wave number obtained experimentally for as-deposited and illuminated FeTPPCl thin films (black circles) and its theoretical fit (red solid line) that assumes four oscillator components with Gaussian profiles. Blue lines correspond to decomposition of the spectrum into these Gaussian components.	84
Fig.4.14 Relation between $(\alpha h\nu)^{1/2}$ and photon energy $(h\nu)$ calculated for as Deposited and illuminated FeTPPCl thin films.	86
Fig.4.15 Relation between $(n^2 - 1)^{-1}$ and $(h\nu)^2$ calculated for as-deposited and Illuminated FeTPPCl thin films.	87
Fig.4.16 Relation between n^2 and λ^2 calculated for as-deposited and illuminated FeTPPCl thin films.	88
Fig. 5.1. Optimized molecular structure of FeTPPCl at B3LYP/6-311g basis set.a) side view b) top view.	92
Fig.5.2 Experimental FT-IR spectrum for FeTPPCl (a) in Powder form, and (b) Thin film form and calculated FT-IR spectrum for FeTPPCl (c) at B3LYP/6-31g basis set and (d) at B3LYP/6-311g basis set.	94
Fig. 5.3. Calculated HOMO-LUMO frontier molecular orbitals for FeTPPCl at B3LYP/6-311g basis set.	98
Fig.6.1:Temperature dependence of σ_{DC} for the as-deposited and γ -irradiated FeTPPCl thin films.	100
Fig.6.2 J-V-T characteristics for Au/FeTPPCl/p- Si/Al at different temperatures in forward and reverse conditions.	101
Fig.6.3 Dark J-Vcharacteristics of Au/FeTPPCl/p-Si/Al at different temperatures in forward bias.	102
Fig.6.4 Variation of $\ln(I_0/T^2)$ versus $1000/T$ for Au/Alq3/p-Si/Al heterojunction .	103

Fig. 6.5 Temperature dependence of the ideality factor, n , and the zero barrier height Φ_{bo} , for FeTPPCL/ p-Si.	104
Fig. 6.6. Junction resistance (R_j) vs. V for FeTPPCL /p-Si heterojunction at 298 K.	104
Fig.6.7 Plot of $[dV/d(\ln I)]$ versus I at different temperatures.	106
Fig.6.8 Plot of $H(I)$ and I at different temperatures for FeTPPCL/p-Si.	106
Fig.6.9 Variation of $\ln(J)$ with $\ln(V)$ at higher forward voltage bias.	108
Fig.6.10. the temperature dependence of $\ln(J)$ at 1.5 V	108
Fig.6.11 Temperature dependence of $\ln(IR)$ for FeTPPCL/p-Si	109
Fig.6.12 I-V characteristics under an illumination (10 mW/cm ²) for FeTPPCL/p-Si	110

List of Tables

Table 4.1. Experimental and calculated data of FeTPPCL compound.	69
Table 4.2 position peak of absorption	76
Table 4.3 position peak of dispersion	76
Table 4.4: Optical parameters for the as-deposited and γ -irradiated FeTPPCL thin films.	80
Table 4.5 position peak of absorption	83
Table 4.6 position peak of dispersion	83
Table 4.7: Peak position, oscillator strengths, f and electric dipole strengths, q^2 , calculated for the three Gaussian peaks, as obtained for as-deposited and illuminated FeTPPCL thin films.	86
Table 5.1. Experimental and selected Calculated Vibrational Wavenumbers (Harmonic Frequency (cm ⁻¹)), IR Intensities and Assignments for FeTPPCL at B3LYP/6-311G basis set.	96
Table 5.2. Optimized calculations of HOMO–LUMO energy gap (eV) for FeTPPCL at B3LYP/6-31G and B3LYP/6-311G basis sets.	97

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-sensitized 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 $a = 13.53 \text{ \AA}$ and $c = 9.82 \text{ \AA}$ 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