

Contents

Acknowledgement	i
Abstract	ii
Chapter I Introduction and Literature Survey	
(I.1) Introduction.....	1
(I.2) Aim of the work.....	4
(I.3) Literature survey	5
Chapter II Theoretical Review	
(II.1) Chemical structure of polymers.....	22
(II.2) The band models of amorphous solids.....	22
(II.2.1) Cohen-Fritzsche-Ovshinsky (CFO) model	23
(II.2.2) Davis and Mott model.....	24
(II.2.3) Street and Mott model.....	24
(II.3) The mobility edge.....	25
(II.4) Conduction mechanisms in amorphous solids.....	25
(II.4.1) Hopping conduction.....	25
(II.4.2) Conduction in extended states.....	27
(II.5) AC conduction in amorphous solids.....	27

Contents

(II.5.1) Quantum mechanical tunneling model.....	29
(II.5.2) Correlated barrier hopping model.....	29
(II.6) Dielectric properties of polymers.....	30
(II.6.1) Sources of polarizability.....	30
(II.6.2) Dielectric behaviour of ideal polar polymers.....	31
(II.6.3) Dielectric relaxation in solid polymers	33
(II.6.4) Thermal activation of dipolar relaxation.....	34
(II.7) Optical properties of amorphous solids.....	35
(II.8) Optical absorption spectroscopy.....	39
(II.8.1) Beer Lambert law.....	40
(II.8.2) Light absorption by organic laser dyes.....	41
(II.9) Fluorescence.....	43
(II.9.1) Processes which affect fluorescence spectra.....	43
(II.9.2) Fluorescence quantum yield.....	45
(II.9.3) Stokes shift.....	45
(II.9.4) The fluorescence intensity.....	46
(II.10) Fluorescent solar collectors.....	47
(II.10.1) Photon flow diagram of a single dye FSC.....	48
(II.10.2) Factors affecting the performance of FSCs.....	50

Chapter III Experimental Technique

(III.1) Sample preparation54

(III.1.1) Thermal polymerization method..... 54

(III.1.2) Solvent casting method.....54

(III.2) Thermal analysis.....54

(III.3) FT-IR analysis.....55

(III.4) DC conductivity measurements.....55

(III.5) AC conductivity and dielectric measurements.....56

(III.6) Optical absorption57

(III.7) Dye photostability and polymer degradation.....57

(III.7.1) Indoor testing.....57

(III.7.2) Outdoor testing.....57

(III.8) Fluorescence58

(III.9) The fluorescent solar collectors.....58

Chapter IV Results and Discussion

Section A Characterization of PMMA/perylene

(IV.A.1) Differential scanning calorimetry (DSC).....59

(IV.A.2) FT-IR measurements.....60

Section B Electrical Conductivity of PMMA/perylene

(IV.B.1) DC conductivity.....62
(IV.B.2) AC conductivity.....64

Section C Dielectric Properties of PMMA/perylene

(IV.C.1) Dielectric permittivity.....67
(IV.C.2) Dielectric loss.....69
(IV.C.3) Relaxation time.....72

**Section D Spectroscopic properties and optical efficiency of
PMMA/perylene FSCs.**

(IV.D.1) Optical properties.....75
(IV.D.2) Stability and degradation.....78
(IV.D.3) Fluorescence measurements.....81
(IV.D.4) Field performance of FSCs.....83

Conclusions.....87

References.....89

Appendix103

Summary in Arabic