# CONTENTS


| | |
|---|---|
| Dedication | I |
| Acknowledgements | II |
| Abstract Arabic | III |
| Abstract English | IV |
| Contents | V |
| List of figures | VII |
| **CHAPTER ONE (Introduction)** | |
| 1.1 Motivation | 1 |
| 1.1.1 Inorganic solar cells | 2 |
| 1.1.2 Amorphous silicon cells | 3 |
| 1.1.3 Multi junction | 3 |
| 1.1.4 Organic solar cells | 4 |
| 1.2 Objective | 5 |
| 1.3 Outline of the thesis | 6 |
| **CHAPTER TWO (Solar cell theorem)** | |
| 2.1 The PV cell | 7 |
| 2.2 The p-n junction | 7 |
| 2.3 Drift and diffusion current | 11 |
| 2.4 Solar cell efficiency | 16 |
| 2.4.1 Energy conversion efficiency | 16 |
| 2.4.2 Quantum efficiency | 17 |
| 2.5 Maximum power | 18 |
| 2.6 Fill factor | 18 |
| 2.7 The metal-semiconductor junction | 18 |
| **CHAPTER THREE (Organic solar cells)** | |
| 3.1 Introduction | 22 |
| 3.2 Conjugated polymer | 23 |
| 3.3 Organic solar cell | 27 |
| 3.4 Blend cell | 28 |
| 3.5 Metal contact | 31 |
| 3.6 General requirements of the photoactive layer | 33 |
| 3.6.1 Electron Acceptor (PCBM) | 35 |
| 3.6.2 Electron Donor (MDMO-PPV)and(P3HT) | 37 |
| 3.6.3 Indium Tin Oxide ITO) | 41 |
| 3.6.4 (PEDOT:PSS) | 42 |
| **CHAPTER FOUR(Program Simulation -1D)** | |
| 4.1 AMPS and Its Features | 44 |
| 4.2 Poisons equation | 45 |
| 4.2.1 The Delocalized (Band) state populations n and p | 45 |
| 4.3 The continuity equations | 46 |
| 4.3.1 Electron and hole current density | 46 |
| 4.3.2 Direct (Band to band) recombination | 47 |
| 4.3.3 Parameters for representing semiconductor properties | 47 |
| 4.3.4 Parameters for optical properties | 48 |
| 4.4 Procedure for running AMPS | 48 |
| 4.5 How to generate device characteristics | 49 |

| | |
|---|---|
| Fig.2.1 Across section of a p-n junction | 8 |
| Fig.2.2Energy band diagram of a p-n junction in thermal equilibrium | 10 |
| Fig.2.3 Concentration carrier of solar cell | 14 |
| Fig.2.4 Work function, electron affinity and the barrier height of a metal-semiconductor contact. | 21 |
| Fig.3.1 some of the commonly used conjugated organic material | 26 |
| Fig.3.2 Blend solar cell | 30 |
| Fig.3.3 Energy –band diagram of the BHJ solar cell | 32 |
| Fig.3.4 Chemical structure of PCBM | 36 |
| Fig.3.5 Chemical structure of MDMO-PPV | 38 |
| Fig.3.6 Chemical structure of P3HT | 40 |
| Fig.3.7 Chemical structure of PEDOT: PSS | 43 |
| Fig.5.1 Variation of the open circuit voltage with $HOMO_D$-$LUMO_A$ offset | 57 |
| Fig.5.2 Variation of the open circuit voltage with temperature, MDMO-PPV and PCBM | 59 |
| Fig.5.3 Variation of the efficiency with temperature, MDMO-PPV and PCBM | 60 |
| Fig.5.4 Variation of the efficiency with LUMOA-LUMOD, MDMO-PPV and PCBM and P3HTand PCBM | 62 |
| Fig.5.5 Variation of the efficiency with the thickness, MDMO-PPV and PCBM solar cell | 64 |

| | |
|---|---|
| Fig.5.6 Variation of the efficiency with the thickness, P3HTandPCBM solar cell | 65 |
| Fig.5.7 Variation of the efficiency with light intensity, MDMO-PPV and PCBM | 67 |