

## List of Figures and Tables

Figure 1.1 Plasmonic Solar Cells.

Figure 1.2 PSC using metal nanoparticles.

Figure 1.3 Thin film Solar Cells and typical Solar Cells.

Figure 2.1 Photovoltaic Cell.

Figure 2.2 Energy band diagram of metal, semiconductor and insulator.

Figure 2.3 Plasma Enhanced Chemical Vapour Deposition.

Figure 2.4 polymers used in fourth generation.

Figure 2.5 Global solar spectrum.

Figure 2.6 Steps to photoconductivity.

Figure 2.7 Excitons (bound electron–hole pairs) are generated after light photon absorption in conjugated polymers.

Figure 2.8 Typical shape of the current-voltage curve of a photovoltaic cell showing the open- circuit voltage VOC, short circuit current ISC, and the maximum power point MPP, and the current and voltage at the MPP: IMPP, VMPP.

Figure 3.1 Zinc Sulfide.

Figure 3.2 ZnS Nanoparticle.

Figure 3.3 (a) Sphalerite, more common polymorph of ZnS (b) Wurtzite, less common polymorph of ZnS.

Figure 3.4 A single unit cell of zinc blende.

Figure 4.1 Example of organic photovoltaic materials.

Figure 4.2 Architecture of an organic photovoltaic device.

Figure 4.3 Sketch of a single layer organic photovoltaic cell.

Figure 4.4 Sketch of a multilayer organic photovoltaic cell.

Figure 4.5 Sketch of a dispersed junction photovoltaic cell.

Figure 4.6 Some commonly used conjugated polymers.

Figure 4.7 ITO Glass Substrate.

Figure 4.8 Chemical structure of PEDOT:PSS.

Figure 4.9 Chemical Structure of P3HT.PCBM.

Figure 4.10 Absorption Efficiency vs Wavelength curve.

Figure 4.11 Structure of Organic Solar Cell.

Figure 4.12 Schematic diagrams of a conventional p-n junction solar cell (left) and an organic heterojunction solar cell (right).

Figure 4.13 Layered structure and polymer blend structure based on an electron donating and an electron accepting polymer.

Figure 5.1 Scanning Electron Microscope.

Figure 5.2 Schematic diagram of Scanning Electron Microscope.

Figure 5.3 Advance X-Ray Diffractometer.

Figure 5.4 X-ray reflections from a crystal.

Figure 5.5 Schematic shows the processes that contribute to the generation of X-rays.

Figure 5.6 A commercial AFM setup.

Figure 5.7 Block diagram of atomic force microscope.

Figure 5.8 Schematic shows an UV/Vis spectrophotometer.

Figure 5.9 Temperature VS Wavelength Curve.

Figure 5.10 Schematic diagram of photoluminescence.

Figure 5.11 Energy band diagram.

Figure 5.12 Schematic model of luminescence processes.

Figure 6.1 Patterning of ITO.

Figure 6.2 Vacuum oven.

Figure 6.3 (a) Spin Coater (b) Micro pipette and vials.

Figure 6.4 Glove Box.

Figure 6.5 (a) Mask for electrode deposition (b) Equipment for electrode deposition.

Figure 6.6 (a) Equipment for electrode deposition (b) Characterization of Cells.

Figure 6.7 Spin coating system.

Figure 6.8 Ultrasonic bath.

Figure 6.9 Glove box.

Figure 6.10 Thermal Evaporator.

Figure 6.11 Balance.

Figure 6.12 UV-vis absorption spectra.

Figure 6.13 UV-vis absorption spectra of the (a) PCBM solution (b) P3HT solution.

Figure 6.14 (a) AFM of spin coated ZnS nanoparticles film on ITO/PEDOT: PSS on glass and (b) 3-D AFM of a spin coated ZnS nanoparticles film on ITO glass.

Figure 6.15 (a) AFM image of PEDOT-PSS spin-coated on cleaned ITO and (b) 3-D AFM image of PEDOT-PSS spin-coated on cleaned ITO.

Figure 6.16 AFM of PCBM:P3HT bulk heterojunction solar cell on ITO glass.

Figure 6.17 AFM of ZnS NPs on PCBM: P3HT bulk heterojunction solar cell on ITO glass.

Figure 6.18 X-ray diffraction pattern of PEDOT: PSS layer on glass.

Figure 6.19 X-ray diffraction pattern of ZnS nanoparticles spin-coated on PEDOT: PSS layer.

Figure 6.20 SEM image of ZnS nanoparticles.

Figure 6.21 Photoluminescence spectra for obtained dispersions.

Figure 6.22 (a) TEM image of ZnS nanocrystals (b) Agglomeration of ZnS NPs as observed under TEM image.

Figure 6.23 FTIR spectrum of ZnS nanoparticles.

Figure 6.24 J–V characteristics of the reference device (ITO/PEDOT:PSS/P3HT: PCBM/Al) and control device (ITO/PEDOT:PSS/ZnS/Al) (a) in darkness and (b) in light.

Figure 6.25 Cell characteristics in light.

Figure 6.26 Cell characteristics in dark.

## Tables

Table 2.1 Comparison among different types of solar cell.

Table 3.1 Vital statistics of Zinc Blende structure.

Table 3.2 Properties of ZnS.

Table 6.1 Experimental and standard diffraction angles of ZnS specimen.