The Short Abstract

The present dissertation contains 9 chapters. The first chapter provides a brief overview of carrier selective contacts, features of MoO_{3-x} and progress in dopant free transition metal oxide/c-Si(n) heterojunction solar cells. Chapter 2 presents an overview of the deposition techniques used for ITO and MoO_{3-x} film deposition and oxygen plasma treatment. This chapter also discusses the characterization techniques used to investigate the various properties of MoO_{3-x} and ITO films. Chapter 3 discusses studies on the structural and optoelectronic properties of MoO_{3-x} films prepared by rf-sputtering technique. The deposition conditions of MoO_{3-x} films are optimised sequentially to prepare coloured and highly conducting MoO_{3-x} films, as well as transparent and resistive MoO_{3-x} films. Chapter 4 discusses the impact of deposition temperature on the structural, optical and work function properties of MoO_{3-x} films deposited by thermal evaporation technique. In addition, post-deposition heat treatment of MoO_{3-x} films deposited at room temperature is performed to investigate its influence on work function and compositional properties of MoO_{3-x}. Chapter 5 focuses on the utilisation of oxygen plasma treatment (OPT) to increase work function of thermally evaporated MoO_{3-x} films. OPT was first performed on thick MoO_{3-x} films, but because we were interested in using MoO_{3-x} for solar cell fabrication, we also performed OPT on thin MoO_{3-x} films and examined its effect on MoO_{3-x}'s work function. Chapter 6 presents the influence of process pressure and substrate temperature on microstructure, morphology, optical and electrical properties of Indium tin oxide (ITO) thin films prepared by rf Sputtering technique. Chapter 7 presents the fabrication of dopant free single sided MoO_{3-x}/c-Si(n) solar cells. The effect of deposition conditions on solar cell performance for the fabrication of transparent conducting oxide layer (ITO) and hole selective layer (MoO_{3-x}) is investigated. In addition, the influence of multiple heat treatments on the properties of MoO_{3-x} and performance of solar cells are also studied in this chapter. Chapter 8 presents the simulation studies carried out using the AFORS-HET software to investigate the effect of MoO_{3-x} work function on the performance of MoO_{3-x}/c-Si(n) solar cells. This chapter also investigates the role of carrier transport through thin SiO_x layer and few pin holes on various solar cell parameters. Chapter 9 presents the overall conclusions and summary of the present thesis work and future scope of this research work.