INDIAN INSTITUTE OF TECHNOLOGY GUWAHATI
SHORT ABSTRACT OF THESIS

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Thesis Title	:	Fabrication and Studies of $MAPbI_3$ Perovskite Thin Films and Solar Cells
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The present thesis contains seven (07) chapters. Chapter 1 introduces metal halide perovskite (MHP) material and MHP based solar cells. Chapter 2 describes the deposition process of $MAPbI_3$ thin films and the fabrication of solar cells. This chapter also briefly describes different characterization techniques used to study different properties of $MAPbI_3$ thin films and the performance of fabricated solar cells. This chapter also details optimizing absorber layer parameters for $MAPbI_3$ perovskite solar cells using the Sentaurus-TCAD simulation tool. Chapter 3 presents studies on the structural, optical, and electrical properties of the $MAPbI_3$ perovskite thin films deposited using a one-step solution method. A detailed study of luminescence features of $MAPbI_3$ perovskite thin films was carried out using photoluminescence (PL) and photoluminescence excitation (PLE) spectroscopy at varying excitation wavelength (λ_{ex}) and emission wavelength (λ_{em}) are also discussed in this chapter. Chapter 4 contains studies on the structural, optical, and electrical properties and stability of the $MAPbI_3$ perovskite thin films deposited using the two-step method TE&DC (thermal evaporation and dip coating) and SC&DC (spin coating and dip coating). In addition, transient photocurrent measurements were done to study the charge transport and carrier recombination process in $MAPbI_3$ perovskite thin films at different illumination time duration (30-90 s) and temperatures (25-70 °C) at varying illumination intensity (100-1000 Wm^{-2}). Chapter 5 presents the fabrication and studies on p-i-n planar heterojunction $MAPbI_3$ PSC. The influence of absorber layer thickness variation on the performance of one-step deposited PSC (FTO/PEDOT:PSS/$MAPbI_3$/PCBM/BCP/Ag) and the role of a thin ITO layer as a passivation layer in the two-step deposited PSC (ITO/PEDOT:PSS/$MAPbI_3$/PCBM/ITO/Ag) are discussed in this chapter. Chapter 6 presents the optimization of absorber layer parameters for high-efficiency $MAPbI_3$ solar cells with n-i-p (FTO/SnO_2/$MAPbI_3$/Spiro-OMeTAD/Ag) and p-i-n (FTO/PEDOT:PSS/$MAPbI_3$/PCBM/Ag) structures using Sentaurus-TCAD simulation software. Chapter 7 is the final chapter of the thesis, which summarizes the contents of each chapter and gives the conclusion of the work reported in the thesis. The thesis work is concluded with the scope for future work from the present investigation.