PREFACE

Perovskite materials have drawn considerable attention in recent times for optoelectronic applications. Among various perovskite materials, inorganic perovskite $BiFeO_3$ and hybrid perovskite $CH_3NH_3PbI_3$ are widely used for thin-film optoelectronic devices due to their solution-processed low fabrication cost, high field-effect mobility and good optical absorption coefficients. $BiFeO_3$ behaves as an n-type semiconductor while the $CH_3NH_3PbI_3$ is an inherently intrinsic type semiconductor. These perovskites have been widely used in high-efficiency solar cells but have been less explored for photodetector applications. That is why the present thesis has aimed to fabricate and characterize some $BiFeO_3$ and $CH_3NH_3PbI_3$ based wideband photodetectors. The thesis consists of FIVE chapters which are briefly outline below:

Chapter-1 introduces the basic operating principle and key performance parameters of photodetectors. Properties of inorganic and hybrid halide perovskite materials have been briefly discussed. Various fabrication and characterization techniques of perovskite thin films and their devices are also introduced in this Chapter. A detailed literature survey has been carried out to define the scopes of the present thesis at the end of this chapter.

Chapter-2 reports the fabrication and characterization of an ITO/ZnO NPs/$BiFeO_3$ NPs/PEDOT: PSS/Ag structure based white light photodetector where the ITO (indium doped tin oxide) is the substrate, ZnO NPs (nanoparticles) layer acts as the electron transport layer (ETL), $BiFeO_3$ NPs layer is the active layer, PEDOT: PSS layer acts the hole transport layer (HTL) and Ag is the contact electrode on the HTL. The

proposed photodetector is shown to have the maximum responsivity of ~34 mA/W and external quantum efficiency (EQE) of ~8.8% over the specified visible range of 450-650 nm at -2V bias voltage.

Chapter-3 reports an FTO/ZnO/$CH_3NH_3PbI_3$/MoOx/Ag structure based photodetector fabricated on FTO (Fluorine doped tin oxide) coated glass substrate. The hybrid perovskite $CH_3NH_3PbI_3$ is the active material, ZnO layer acts as the ETL, MoOx layer acts as the HTL and Ag is the contact electrode. The proposed device possess the maximum responsivity of ~21.8 A/W and EQE of ~6200% at ~ 436 nm near the blue light spectrum under a low reverse bias voltage of 1 V.

Chapter-4 reports the fabrication and characterization of ITO/$BiFeO_3$ NPs/$CH_3NH_3PbI_3$/Ag based inorganic-organic heterojunction photodiode for operating in the visible-NIR (near-infrared) region. The photodetector shows the maximum responsivity of ~2 A/W, EQE of ~310% and detectivity of ~$7.8x10^{12}$ $cmHz^{1/2}/W$ at ~800 nm under -2 V bias voltage.

Chapter-5 includes the major findings of the thesis along with a brief outline for the future scope of research related to the present thesis work.

----XXX----