PREFACE

Colloidal Quantum Dots (QDs) are widely used for fabricating the low-cost, large-area thin film photodetectors due to the large surface to volume ratio of the QDs. In this thesis, we have investigated the characteristics of CdSe and ZnO colloidal QDs based photodetectors fabricated by low-cost solution processed technique. Mainly two types of photodetectors namely self-powered and spectrum selective photodetectors have been studied in this thesis. The self-powered photodetectors may work without requiring any external voltage source in the photovoltaic mode. On the other hand, the photoresponse of the spectrum selective photodetectors is maximum at a particular wavelength with a very narrow spectral width. The thesis consists of SEVEN chapters which are briefly discussed in the following.

Chapter 1 presents a brief introduction of QDs and their properties for photodetection applications. Various synthesis techniques of QDs have also been briefly discussed. A detailed literature survey has been carried out to define the scope of the present thesis.

Chapter 2 investigates the effects of heat treatment of colloidal ZnO QDs based electron transport layer (ETL) on the performance of ZnO QDs/CdSe QDs/MoO_x/Ag photodetectors (PDs). The electrical and optical characteristics of the device for 250°C, 350°C, and 450°C annealing temperatures of the ZnO QDs based ETL have been studied in this chapter.

Chapter 3 investigates the effect of post-fabrication heat treatment of the solution processed and vacuum deposited MoO_x based ETL on the performance of Ag/MoO_x/

ZnO QDs/ITO heterojunction photodiodes. The electrical and optical characteristics of the two types of MoO_x/ZnO QDs heterojunctions with and without the heat treatment of the MoO_x layer have been thoroughly investigated.

Chapter 4 reports a novel Au/ CdSe QDs/ZnO QDs/n-Si based self-powered Schottky photodiode with ZnO QDs as the ETL and CdSe QDs as the active layer in the device. The electrical and optical characteristics of the photodetector under zero bias condition have been studied in details in this Chapter.

Chapter 5 deals with the fabrication and characterization of a novel Au/ CdSe QDs/PQT-12/ITO structure based dual junction self-powered hybrid photodetector using colloidal CdSe quantum dots (QDs) as active layer and PQT-12 polymer as filter cum charge transport layer. The electrical and optical characteristics have been investigated under zero-bias voltage.

Chapter 6 investigates the effect of Schottky metal electrodes on the performance of a back illuminated metal (Pd, Au)/ CdSe QDs/ZnO QDs/ITO based self-powered spectrum selective photodetector for two metals namely Pd and Au. The effects of reflections from the metal/CdSe QDs and CdSe QDs/ZnO QDs interfaces on the absorption of the CdSe optical cavity as well as on the optical characteristics of the device have been studied in details.

The Chapter 7 includes the major observations and future scopes of work related to the thesis.

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