Preface

Gas sensitivity of nanostructured ZnO thin films to ethanol vapour, LPG and biogas were studied and compared. Pure ZnO and ZnO doped with Sn, Al and Cd, at three different doping concentrations were used for the study. High energy electron beam irradiation was given to Al-ZnO, Sn-ZnO and Cd-ZnO and the effects of irradiation on gas sensing properties of these samples were investigated. The gas sensitivity of the samples were compared between samples doped with different elements, different doping concentrations, samples with and without irradiation and between the three different gases.

The whole thesis is arranged in seven chapters. First chapter contains the introduction for the work and a review of related literature. This chapter discusses about semiconductor thin films and their various deposition techniques. Major physical and chemical deposition techniques are explained. All samples used in the present work were deposited by SILAR method and therefore the method is explained in detail. The advantages of SILAR method over other methods are also discussed. Gas sensing properties of thin films and the effect of electron irradiation on different properties of the film are discussed at the end of the chapter.

Chapter 2 deals with the fabrication of three different custom made lab equipment designed for the present study. The design and working of SILAR dip-coating unit is explained. The construction and working of the annealing chamber is explained. The design and fabrication of the gas sensing unit is also explained. The comparison between the arrangements for the sensing of different gases is explained at
The optimum film preparation conditions for gas sensing applications is the first part of chapter 3. Variation in electrical and structural properties of ZnO due to three different doping elements at three different doping concentrations were investigated. Effect of annealing atmosphere on the structural and electrical properties of ZnO thin films were studied and a comparison was made between three different annealing atmospheres. Chapter 3 concludes with the studies on the effect of repeated heating and aging on the electrical properties of the films.

Sensitivity studies of ZnO doped with Al, Cd and Sn to ethanol vapour is the content of chapter 4. comparison has been made between the sensitivity of ZnO samples with the above mentioned doping elements at doping concentrations 3 atomic percentage, 5 atomic percentage and 7 atomic percentage. The effect of electron irradiation on gas sensing properties at two different dosages of irradiation was also studied and compared.

Chapter 5 contains LPG sensing properties of Al, Sn and Cd doped ZnO thin films along with the effect of electron irradiation on LPG sensing properties of these films at three different doping concentrations. Sensitivity, response time and recovery time of the samples were also compared and the results are included in the chapter.

Biogas sensing properties of ZnO thin films are included in chapter 6. ZnO thin films deposited by SILAR at three different doping concentrations and three different doping elements were used for the study. The effect of electron irradiation on the sensitivity, response time and recovery time of the samples were also investigated and reported.

The whole work is concluded in chapter 7 and a comparison is given between the sensitivity of Al-ZnO, Cd-ZnO and Sn-ZnO to ethanol vapour, LPG and biogas.
Comparison between the sensitivity of the samples according to doping concentration was also made and the results are included. High energy electron beam irradiation was given to samples at two different dosages of irradiation. The sensitivity, response time and recovery time of these samples were compared between that of non-irradiated samples and are reported.