Preface

The main aim of this thesis has been to synthesize and characterize (Cd-Zn)S films doped with rare earths and to study their electro-optical properties. Both CdS and ZnS are efficient photosensitive materials and mixed base (Cd-Zn)S finds wide applications in solar cells, phosphors etc. Incorporation of rare earths as impurities into such materials enhances their photosensitivity and such behaviour has been widely investigated. However, the prospects of synthesizing (Cd-Zn)S films doped with rare earths such as holmium and terbium has not been explored earlier. The present work is mainly concerned with photoconductivity studies of (Cd-Zn)S: CdCl₂: Ho / Tb films prepared by chemical deposition technique. The films were prepared by taking (Cd-Zn)S as base material, CdCl₂ as flux and Ho and Tb separately as impurities. These films are also found to show quite intense photoluminescence. Results of such studies are included in this thesis. Such studies impart information about energy levels and transitions in levels due to impurities and host. A brief description of different chapters included in this thesis is given in the following lines:

The first chapter involves the introduction of the subject. Brief discussion of various parameters affecting photoconductivity and photoluminescence are included. Problem undertaken for the present investigation is also discussed in this chapter.

The second chapter deals with the theories used in understanding the phenomenon of photoconductivity and photoluminescence. Different models used to explain these phenomena are covered in this chapter.

The third chapter deals with the various experimental techniques and various measuring arrangements used in the present investigation. This chapter is divided into following parts:

1) Preparation of photoconducting and photoluminescent materials.
The fourth chapter describes the different studies made on photoconductivity of (Cd-Zn)S: CdCl₂: Ho / Tb films. Nature of dark current, photo current and the ratio \( \frac{I_{pc}}{I_{dc}} \) (gain) with respect to various preparative conditions are described. Values of instantaneous lifetime and mobility of carriers and the trap depths are evaluated from rise and decay curves of photoconductivity. The nature of variation of such parameters is also discussed. The conditions under which maximum photoconductivity appear have been studied and discussed.

The fifth chapter presents results of various spectral studies made on such films. From the results of photoconductivity excitation spectra, band gaps of the materials are evaluated and the nature of excitation spectra is discussed. From the results of optical absorption spectra, the absorption coefficients are evaluated as a function of wavelength and from the plots of \((\alpha \nu)^2\) vs \(\nu\), the band gaps are determined. Thus, from such studies, the nature and values of band gaps of different materials are determined and discussed. These values are also compared with those of photoconductivity excitation spectral studies. Specular reflectance spectra of films deposited on Al substrate are studied and the results are compared with the absorption spectra of films prepared on glass substrate. Photoluminescence emission spectra have given the nature of the spectral studies for undoped and doped materials. The conditions under which maximum PL appears is also observed and discussed.

The sixth chapter describes the results of SEM, EDX and XRD studies. SEM studies have been used to study the topographical features. Particle sizes and thickness of atomic layers are also estimated. XRD studies have been used to
evaluate the crystal structure and lattice constants. Particle size, strain and dislocation densities are also determined and their nature discussed. The elemental analysis of the materials prepared is obtained from EDX measurements. The nature of the compositions is also discussed.

In the end, future scope of the present work is also discussed.