In this thesis the preparation and properties of thin films of certain semiconducting sulphides (sulphides of tin, copper and indium) are reported. As single source evaporation does not yield satisfactory films of these compounds for a variety of reasons, reactive evaporation of the metal in a sulphur atmosphere has been used for film preparation. It was found that for each metal sulphide a stoichiometric interval of fluxes and substrate temperature exists for the formation of the compound in accordance with the analysis of Guenther.

As the particles used for film formation in reactive evaporation are of low energy, chemical reaction rate is low and also because a high partial pressure of the volatile component is used, there is the possibility of the volatile component getting entrapped in the film which will adversely affect its properties. To avoid these difficulties the particles for film formation have been activated using a low pressure electric discharge obtained with the help of a low voltage electron gun and a magnetic field. This process known as
activated reactive evaporation increases chemical reactivity so that high deposition rates are possible and also eliminates the possibility of unreacted volatile component getting entrapped in the growing film. Activated reactive evaporation hitherto used only when the reactive substance is in a gaseous state at room temperature (eg. O₂ and C₂H₂) has been successfully extended to the case of a solid reactive substance like sulphur and sulphide films used in this study have been prepared using this technique also. Films with very good optical quality have been obtained by this method.

The formation of compound films in these evaporation techniques which is not well understood, has been discussed in terms of the kinetic energy of the particles used for film formation.

The films were characterized with respect to their structure and morphology by X-ray diffraction, scanning electron microscopy, and optical microscopy. It has been found that these films when deposited on to room temperature substrates are amorphous in nature. As the substrate temperature is increased, crystalline films with certain particular orientation have been obtained. It can be said that these methods of preparation of the films are very efficient for the preparation of amorphous sulphides.
Optical properties of the films have been studied in the UV-Vis-NIR region. Refractive index, absorption coefficient, and absorption edge of these films has been determined. The nature of the transition leading to the fundamental absorption is also discussed. It was found that the amorphous films crystallized when heated and their optical transmission changed due to crystallization. This was manifested as a shift in the absorption edge in the case of tin disulphide and in the case of CuS the golden yellow colour of the amorphous CuS changed to deep green.

Electrical conductivity, conductivity type, carrier concentration, activation energy for conduction etc. of these films have been studied. The effect of heating of this as prepared films, where the resistivity changes by different orders of magnitude due to crystallization, has also been discussed in detail.

Transparent conducting films of tin dioxide has been prepared by heating the as prepared tin disulphide films in air and their optical and electrical properties studied. It is found that the oxidation of these films obey an exponential rate law. Films of Cu₂O and CuO has also been prepared by heating CuS films in air.