SUMMARY

Apart from the intensive research still going on primitive elemental semiconductors Ge and Si, at present much more attention is being paid to compound semiconductor, viz, binary, ternary and quaternary ones. Among the binary compounds the group II-IV, IV-VI, III-V and $V_2 - VI_3$, semi conducting compounds have been receiving considerable attention due to their important photoconductivity, photovoltaic, electro-optic and general electronics properties for the study of basic semi conducting properties. For the study of basic semi-conducting properties, it is of primary importance that these properties be measured on bulk single crystals. The single crystals themselves are also most frequently required directly or indirectly for device fabrication. The performance of the devices principally depends on the bulk crystalline characteristics. In most of the applications the semiconductors are used in the form of single crystal or thin films or both at a time. These materials have been subject of study by quite a number of workers. The work reported in the present thesis includes crystal growth, and hardness of crystal, as well as optical band gap, electrical properties of thin films of $Bi_{1-x}Sb_x$(x=0.05 to 0.30). The thesis is presented in two parts.

Part - I of the thesis consist of three chapters. Chapter - 1 gives various aspects of crystal growth in general and of crystal growth from melt in particular.

Chapter -2 deals with the field of hardness of crystals. It gives a qualitative survey of various techniques and empirical theories involved in this

field. Particularly, diversity of results reported in literature has been emphasized to indicate the complexities of this property.

Chapter -3 deals with a brief review of concepts of properties. These include electrical conductivity, Hall coefficient , thermopower and optical absorption. Various methods of measurements are also discussed.

Part - II of thesis consists of six chapters. Chapter -4 gives the general information on Bi-Sb crystals with regard to the structural and various electrophysical properties, available in literature.

Chapter -5 deals with the experimental techniques used during the course of the present work. The techniques include crystal growth, hardness indentation, optical microscopy, thin film preparation and electrical and thermopower measurements.

Chapter-6 deals with the results of growth of $Bi_{0.95}Sb_{0.05}$, $Bi_{0.90}Sb_{0.10}$, $Bi_{0.85}Sb_{0.15}$, $Bi_{0.80}Sb_{0.20}$, $Bi_{0.75}Sb_{0.25}$ and $Bi_{0.70}Sb_{0.30}$ single crystals by Zone melting method. The growth features, dislocation etching and solid-liquid interface studies have been reported.

Chapter -7 deals with the hardness studies. The variation of hardness with applied load has been studied in detail. Both the Vickers and Knoop hardness testing have been done. The observed complex low load dependence of hardness has been subjected to Mayer's law analysis.

Chapter – 8 deals the variations of resistivity and associated activation energy with temperature have been studied. The crystals were also subjected to thermoelectric measurement. The results have been reported in detail in this chapter.

Chapter -9 discusses the results obtained on optical absorption in the cases of both the single crystalline and thin film structures of varied Bi-Sb compositions. The optical absorbance spectra were obtained using FTIR spectrometry. The studies also include the effect of film thickness on optical band gap.