7.1 SUMMARY

Crystal growth is an important field of science and technology which finds immediate application in the development of technologically important materials for device applications. The synthesis of newer materials and the growth of these materials in single crystalline forms and studying their physical properties comprises a vital role played by a crystal grower to meet the growing demands of crystals with stringent physical properties. Thus crystal growth has gained enormous importance for both academic research and industrial applications. Although a variety of crystals can be grown from various methods, the particular choice of the growth method is dictated by the size and the quality of the crystal to be grown as well as the response due to the external conditions such as pressure, temperature etc. Growth and characterisation of $A^V B^V I^C V^II$ group compounds, an important class of materials possessing interesting physical properties, forms the subject of this thesis.

To highlight the importance of the crystals of this group of compounds a brief survey of the reports available on these materials since 1950s has been presented. A brief
survey of the crystal growth methods with emphasis on the vapour growth has been presented with a view to understand the criteria of selecting a particular method for crystal growth. Although considerable research has been done on $A^V_B^VII$ group compounds by the scientists over the years, less is found in the literature regarding growth and characterisation of oxyhalides of group V compounds. Therefore interest was taken to grow these crystals. The BiOI, BiOCl and AsOCl have been successfully grown from vapour. Growth of AsOCl crystals has been reported for the first time. The difficulty in growing these crystals lies in the tendency of this compound to form glass.

Single crystals of SbTeI and BiTeI have been grown from melt by Bridgman technique. Large size BiSeI crystals have been grown from vapour by controlling the nucleation by adopting temperature oscillation method.

The grown crystals have been characterised by x-ray, thermal analysis and the morphological features are investigated by optical and scanning electron microscopy. Interesting surface morphological features which throw light on the crystal growth mechanism have been presented.

The etching study using chemical etchants such as methanol and ethanol have been done. The etch pits retained their geometrical shape with continued etching showing that the etch pits are due to dislocations.
The measurement of dielectric properties of the crystals requires large size crystals. Dielectric study on some of the large size crystals carried out using GR 1620 bridge both as a function of frequency and temperature has been presented.

The Electron Spectroscopy for Chemical Analysis (ESCA) is basically an analytical tool to investigate the incorporation of the constituent elements into the crystal. It also provides information regarding the chemical shifts of the various atomic energy levels excited by the Mg Kα X-ray. The material related to the analysis of the crystals by ESCA and the results obtained on the chemical shifts of the constituent elements has been presented in chapter 6.

7.2 SUGGESTIONS FOR FUTURE WORK

There is a lot of scope for continuing research in the growth and characterisation of $\text{AV}_3\text{VBVI}_2\text{CVII}$ group compound crystals. Although research in this field of crystal growth has been pursued since 1950, with the advent of sophisticated instruments and as a result of enormous continued research in the field of instrumentation, better quality crystals can be grown by adopting suitable growth conditions from very many methods which were hitherto impossible. The up-to-date theoretical knowledge available will be complementary in an effort to deal with these
physico-chemical systems in practice. The characterisation of these crystals using the sophisticated instruments will be more rigorous in the years to come.

Detailed investigations on crystal growth of compounds containing chlorides and bromides of antimony and bismuth in bulk and thin film forms will be useful for locating new ferroelectric materials having $T_C$ above room temperature.