SUMMARY

The thesis embodies the results of a systematic study of the growth and etch phenomena in Bismuth-Antimony alloys crystals. It is presented in two parts. Part I contains general information which provides the basic background for the present work and a brief description of the experimental methods used in this work. Part II is devoted to the study of Bismuth-Antimony crystals.

The part I consists of three chapters. The first chapter gives a brief review on the principles and techniques of alloy crystal growth. Chapter II contains brief review on etch phenomena in crystals, the discussion being limited to alloys and metals. The other crystals have been mentioned only when it is necessary to maintain the continuity of discussion. The experimental techniques are presented in chapter III, and being well established are discussed in brief.

The results of a detailed study of the factors controlling the successful growth of homogeneous single crystals of Bismuth-Antimony and the effect
of the growth velocity on the orientation of the alloys crystals are discussed in chapter IV. It has been shown that the purity of the constituent metals (Bismuth and Antimony), proper pre-mixing in the molten state with stirring, proper zone-leveling and slow growth rates during crystal growth technique are the controlling factors for growing fairly homogeneous single crystals. The results on the preferred orientation of Bismuth-Antimony crystals, containing 1 to 12 at.% Antimony are also presented.

The transverse striations observed on the top free surface of single crystals of Bi-Sb containing 1 to 12 at.% Antimony, and the lamellar dendritic growth pattern observed on the cleavage plane have been studied and the results presented in Chapter V. The factors affecting the development of transverse striations are presented in detail. The characteristic triangular features observed on the cleavage plane resulting from the dendritic growth are discussed. A probable correlation between the transverse striations and the lamellar dendritic growth has been suggested.

Chapter VI deals with the detailed study of the etch phenomena in Bismuth-Antimony crystals. The
chemical etchants reported by earlier workers have been used. A new chemical etchant capable of revealing dislocations inclined to the cleavage plane and in the cleavage plane is reported. The reliability of the etchant has been established by simple experiments such as correspondence of etch pits on matched cleavage faces, sequential etching studies and etch pits count along intersecting low-angle boundaries. Dislocation spirals and loops on the quenched specimens are also reported. The important characteristics of the new etchant are discussed. Dislocations in the cleavage plane are studied by diffusing copper in Bi-Sb crystals and subsequently etching the crystals in the new chemical etchant. The results are reported in this chapter.

Chapter VII deals with the electrolytic etching of Bi-Sb cleavages. Three different shaped etch pits are reported. The reliability of the etchant is established and a plausible mechanism responsible for the development of different shaped etch pits has been suggested. The results of electrolytic etching are compared with those of the new chemical etchant developed by the author.
The application of the etch pit technique to study dislocations in crystals deformed in various ways have been investigated into and the results are presented in Chapter VIII. It has been shown that the new chemical etchant is capable of revealing fresh dislocations introduced by plastic deformation. A double modified etch technique is also employed to study the mode of dislocation motion and the glide systems operative at low and high stresses. Various shapes of etch traces observed on the cleavage plane are discussed.