PREFACE

It is well known that advances in solid state science critically depend on the availability of single crystal specimens. As a result, an enormous amount of labour and care has been lavished on the development of growth techniques. And the synthetic single crystals of various substances have gained considerable practical importance often for the development of scientific knowledge and intensive scientific study but mainly for technological and industrial applications. Good single crystals are essential for a variety of scientific and commercial purposes. They are needed for scientific appraisal of the crystallography, topography and tensor properties of all crystalline materials. They have much better frequency stability, lower acoustic losses, better conductivity and mobility than polycrystalline materials. Piezoelectric crystals can be used as frequency control elements. Ruby crystals $CaWO_4$ crystals can be used as lasers. Some crystals, like sodium chloride, lithium flouride, are needed for optical and X-ray spectrometry, and electron microprobe analysis. Still there are a few problems where research would be benefitted by the availability of crystals which have so far not been at all, or at least not in the right form or with sufficient purity. This thesis describes studies made on the growth of single crystals of potassium dihydrogen phosphate (undoped) and doped potassium dihydrogen phosphate in silica hydrogel. This study includes the use of X-ray diffraction analysis and chemical analysis.

From the literature it is well known that there is a good number of publications on the growth of various single crystals in silica gel which are useful for their ferroelectric studies. However it is observed that there is a little available data regarding the detailed studies on the KDP doped single crystals by gel technique. The potassium dihydrogen phosphate crystals are useful particularly for basic studies of their ferroelectric, pyroelectric, piezoelectric and electrooptic properties; hence the present work has been undertaken.

A brief survey on the growth of various single crystals using different growth methods, in silica gel has been given in the introductory chapter (Chapter 1). And it is reported that silica gel is the best media for growth of various single crystals.

Since the present thesis deals with the growth of undoped and doped potassium dihydrogen phosphate crystals in silica gels, silica gel structure and properties have been mentioned briefly in the chapter 2.

Considering the various applications of single crystals, a systematic work has been carried out to grow potassium dihydrogen phosphate. Preliminary experiments on the growth of KDP (undoped and doped) Single crystals in silica gel using test tubes have been described in the next chapter (Chapter 3). Potassium dihydrogen phosphate (KDP) single crystals have been grown in silica gel by reduction of solubility method. The effect of pH and gel density on nucleation density and quality of the crystals have been studied in detail.

Studies on characterization of KDP crystals doped and undoped has been described in chapter (Chapter 4). The grown crystals have been characterized by chemical analysis and XRD technique. For X-Ray analysis laue transmission method has been used. Laue diffraction pattern contained sharp spots which indicates the single crystallanity of the grown crystals. Doped crystals have been analysed chemically using atomic absorption spectroscopy.

The ferroelectric properties of undoped and doped crystals of potassium dihydrogen phosphate have been presented in chapter 5. The dielectric constant for undoped KDP crystals has been found to be slightly greater than that is mentioned in published data.

General conclusions drawn from these studies and the scope for the future work in gel growth are presented in chapter 6.