PREFACE

For the last few decades synthetic single crystals of various substances have gained increasing practical importance, often for scientific investigations but principally for technological and industrial applications. Hardly any solid state physical investigation is made now-a-days without an attempt to use well controlled single crystals. There are still obvious problems where research would benefit by the availability of crystals which have so far not been grown at all or at least not in right form or with sufficient purity. This thesis describes detailed studies made on the growth of single crystals of Calcium Sulfite ($CaSO_3$) in silica gel by changing a variety of parameters. The study also includes the characterization of the grown $CaSO_3$ single crystals by X-ray diffraction techniques such as powder and rotational methods, and Scanning Electron Microscopy.

From the literature it is known that there is a good number of publications on the gel growth of a variety of single crystals which are being used for their electroptical studies. However there is little data available regarding the detailed studies on the gel growth and characterization of $CaSO_3$ single crystals. These crystals are useful for basic studies of their electronic, optical and other pertinent characteristics. Hence the present work has been undertaken.

Since the thesis deals with growth of crystals in gels, a brief survey on the growth of various single crystals using different growth methods has been given in introductory Chapter (Chapter 1).

As the thesis deals with the growth of $CaSO_3$ crystals in silica gel, gel preparation, properties, gelling mechanism and structure of silica hydrogel have been described in Chapter 2.

Considering the various applications of single crystals, a systematic work has been carried out to grow Calcium Sulfite single crystals. Preliminary experimental results on the growth of $CaSO_3$ crystals using beaker, test tubes and U tubes are given in Chapter. 3. The characterization, lattice parameter measurements and different morphologies of the grown crystals are also presented in the same chapter (Chapter 3).

The effect of gel density, gel pH, concentration of feed solution, gel ageing, intermediate neutral gel and concentration programming on nucleation and growth of these crystals has been studied in detail and the results are presented in Chapter 4. It has been observed that while high density and high pH gels have been found to produce opaque crystals, good quality single crystals have been obtained in low density and low pH gels. It is observed that the intermediate neutral gel column and gel ageing considerably reduce the number of nucleation sites. A single procedure to control nucleation sites in gels has been adopted which has resulted an increase in the size of the crystals.

Studies of microstructures on the habit faces of $CaSO_3$ crystals are given in Chapter 5. Various types of growth features such as

growth layers, overgrowth and, oriented and random liquid inclusions have been observed using optical and Scanning Electron Microscopy techniques.

The general conclusions drawn from these studies and the scope for future work in gel growth are presented in Chapter 6.

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