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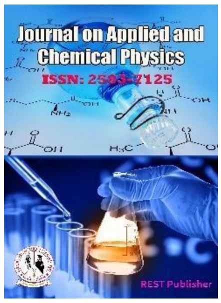

Material Synthesis and Growth of Zinc Sulphate Doped Potassium Hydrogen Phthalate

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Abstract. *crystallization is the process through with the atoms, molecules icon arranges themselves in a repeating pattern. There are numerous methods to obtain crystal, any number which may be applicable to a given compound. When sometimes it may see that crystallization is more of an art than a science. There are several methods that generally produce crystals. For small molecules. These methods are typically based on reducing the solubility of the sample. The solubility of most compound decreases as the temperature is lowered thus the cooling of a saturated solution will often produce crystals. Since rapid cooling may cause the precipitation of amorphous solid or microscopic crystals. It is often to wise to surround the flask with an insulating medium to slow the rate of cooling.* ***Keywords:*** *Diffusion, Solubility, Hydrothermal crystal Growth, Topotaxy*

1. INTRODUCTION

Crystal growth technology and epitaxial technology had developed along with the technological development in the 20th century. Orientation control during bulk crystal growth is one of the important developments targets for crystal growers. Due to the fact that many of today's technological depend critically on the availability of suitable crystals with tailored properties, their fabricataion-crystal growth-has become an important technology. The characterization of materials is also covered within the series in as much as it is impossible to develop new materials without the proper characterization of their structure and properties.

Crystal Growth Methods: Crystal growth needs the careful control of a phase change. Thus we may define three main categories of crystal growth methods. Growth from solid : process involving solid - solid phase transitions Growth from liquid : process involving liquid - solid phase transitions Growth from vapor : process involving vapor - solid phase transitions There were different methods being adopted around the world for growing crystals. They are broadly classified into. Melt growth, Solution growth and Vapor growth

Growth From Solutions: Growth from solution is more widely used than growth from the melt or from the vapor phase, A saturated solution of the material in an appropriate solvent is used for this process. The solution is supersaturated by evaporating the solvent (isothermal methods) or by lowering the solution temperature (nonisothermal methods) and hence the growth takes place. Growth from solution is used more broadly than growth from the melt as it requires lower temperatures that lead to lower density of lattice defects. In general, solution growth is simple and inexpensive. However, it becomes complex, when rigid specifications on the purity and size of the crystals are imposed and the properties of the solvent increases the requirements for instrumentation and control of the growth parameters. The general classifications of the solution growth are,

1. Low temperature solution growth
2. High temperature solution growth
3. Hydrothermal growth

Solution And Solubility: The term solution is most commonly used to describe the liquid which is the result of dissolving a quantity of a given substance in a pure liquid. In solution, solute is the component, which is present in a smaller quantity. Solubility of the material in a solvent decides the amount of the material, which is available for the growth and hence defines the total size limit. For a given solute, there may be different solvents solubility gradient is an another important parameter, which dictates the growth procedure. It will be seen that the saturation of a given solvent by a series of values which can be plotted as abscissae. For every given solvent, such a succession of points can be plotted for every substance soluble in it; the curves are often referred to as solubility curves or curves of saturation. Neither a flat nor a steep solubility curve will enable the growth of bulk crystals from solution; while the level of supersaturation could not be varied by reducing the temperature in the former. Even a small fluctuation in the temperature will affect the supersaturation to grow the good quality bulk crystals in both cases. The solubility data at various temperature are essential to determine the level of supersaturation, Hence, the solubility of the solute in the chosen solvent must be determined before starting solvent must be determined before starting the growth process. When the solubility gradient is very small, slow evaporation of the solvent is the option for crystal growth to maintain the supersaturation in the solution. If solubility gradient is very small, slow evaporation of the solvent is the option for crystal growth to maintain the supersaturation in the solution. If solubility of a material increases with increase in temperature, it is called positive temperature coefficient material and if it decreases with increase in temperature it is called negative temperature coefficient material. Majority of the materials are positive temperature coefficient materials.

Saturation And Supersaturation: A solution that is in equilibrium with the solid phase is said to be saturated with respect to that solid. A solution containing more dissolved solid than the represented by saturated condition is said to be supersaturated solution. Uncontaminated solutions is clear containers, cooled slowly without disturbance in a dust free atmosphere, can readily be made to show appreciable degrees of supersaturation. Supersaturation is an important parameter for the solution growth process. The crystal grows by the accession of a solute in the solution as a degree of saturation is maintained. The solubility data at various temperatures are essential to determine the level of supersaturation. Hence, the solubility of the solute in the chosen solvent must be determined before starting the growth process. A typical solubility diagram is shown. The lower continuous line is the normal solubility curve for the material concerned. Temperatures and concentrations at which spontaneous crystallization occurs are represented by the upper curve, generally referred to as the supersolubility curve, This curve is not so well defined as the solubility curve and its position in the diagram other things, such as the degree of agitation of the solution. A region of metastability exists in the supersaturation region above the solubility curve. The diagram is therefore divided into three zones . 1. Region I corresponds to the stable (unsaturated zone), where crystallization is not possible. This region is thermodynamically state. The region II between the supersolubility curve and the solubility curve is termed as metastable(supersaturated) zone where spontaneous crystallization is improbable. However, if a crystal seed were placed in such metastable solution. Growth would occur on it. 1. The unstable or labile (supersaturated) zone, where spontaneous crystallization is probable is termed as region III

Crystallization By Slow Cooling Of Solution: In this method, supersaturation is produced by change in temperature usually through out the whole crystallizer. The crystallization process is carried out in such a way that process is carried out in such a way that the point on the temperature dependence of the concentration moves into the metastable region along the saturation curve in the direction of lower solubility. Since the volume of the crystallizer is finite and the amount of substance placed in it is limited, the supersaturation requires systematic cooling. The main disadvantage of this method is the need to use the range of temperature.

Crystallization by solvent evaporation: In this method the temperature is fixed constant and provision is made for evaporation. With nontoxic solvents like water, it is permissible to allow evaporation into atmosphere. An excess of a given solute is established by utilizing the difference between rates of evaporation of solvent and the solute. In this method, volume the solution decreases but total mass of the system remains constant in slow cooling method.

Seed preparation: Seed crystals are prepared by self-nucleation under slow evaporation form a saturated solution. Seeds of good visual quality, free form any inclusion and imperfections are chosen for growth . since , strain free refaceting of the seed crystal results in low dislocation content, a few layers of the seed crystal are dissolved before initiating the growth defects present in an imperfect seed propagate into the bulk of the crystal, which decreases the quality of the crystal.

2. NONLINEAR OPTICS

The field of non linear optics emerged nearly five decades ago with the development of the first operating laser and the demonstration of frequency doubling phenomena. These milestone discoveries not only created much interest in laser science, but also set the scope for future work in non-linear optics. The extraordinary growth and development of nonlinear optical materials during the past decade has rendered photonic technologies, an indispensable part of our daily life. With the emerging demand for information systems, nonlinear optical material have been considered as the key element for the future photonic technologies of optical computing, telecommunications, , high density data storage, sensors, image processing, switching optical interconnects, etc.

3. NONLINEAR OPTICAL CRYSTALS

Material in crystalline form have good optical and electrical properties, by and large improved properties over randomly oriented material. Many organic and inorganic materials are highly polarizable and are good candidate for NLO study. However, the net polarization of a material depends on its symmetry properties, with respect the orientation of the impinging fields.

4. MATERIAL SYNTHESIS AND GROWTH OF ZINC SULPHATE DOPED POTASSIUM HYDROGEN PHTHALATE

In the recent years,the research in focused on semi organic NLO material crystal in order to obtain superior NLO crystal by combining the advantages of organic and inorganic materials. The semiorganic NLO materials have been attracting due much attention due to high nonlinearity, chemical flexibility, high mechanical and thermal stability and good transmittance. Among the semiorganic NLO materials,metal-complexes of thiourea family have been investigated actively.Zinc sulphate is an intresting semiorganic nonlinear optical (NLO) material. Metal ions doped materials are currently receiving a great deal of attention due to the rapid development of laser diodes. Doping influences the mechanical, electrical, optical properties and surface morphology depending upon the nature of the host material and the dopant. The effect of metal doping on the physical and NLO properties of potassium hydrogen phthalate (KHP) and zinc sulphate crystals have been studied. Crystals with high transparency and large defect free size were selected and used for the electrical measurements. The grown crystals have been subjected to various characterizations such as single crystal XRD,FTIR,SEM,UV is spectroscopy. Zinc sulphate is a metal sulfate compound having zinc(2+) as the concenterion. It is a metal sulfate and a zinc molecular entity. It contains a zinc(2+). Zinc sulfate is the inorganic compound with the formula znso4 and historically known as “white vitriol”. It is on the world health organizations List of essential medicines a list of the most important medication needed in a basic health system.

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