International Journal of Engineering Research & Management Technology
ISSN: 2348-4039
January-2018 Volume 5, Issue-1
Email: editor@ijermt.org www.ijermt.org

STRUCTURAL ELECTRICAL, OPTICAL AND THERMAL PROPERTIES OF CADMIUM, CALCIUM, BARIUM, TARTRATE, CRYSTALS GROWN BY GEL METHOD

Vandana Yadav, Amit Yadav
Research Scholar
Singhgania University, Pacheri Beri
Distt. Jhunjhunu, (Rajasthan)

ABSTRACT: - The availability of suitable single crystals having different applications can give impetus to various technological developments. The quest is always there to develop crystals of newer materials. This has brought the development of various techniques for crystal growth. However, each technique has certain advantages and limitations. As already discussed previously, the growth of crystals from gel is the simplest technique under ambient conditions. This technique is well suited for the crystal growth of compounds, which are sparingly soluble and decomposed at low temperatures.

Key Words: - Electrical, Optical, Thermal, Tartrate, Crystal.

INTRODUCTION

The progress in the science of the solid state and the material science depends upon the availability of the better quality signal crystals. Consequently, tremendous amount of the efforts has been made on the development of the crystal growth techniques, each having it's own importance and potentiality with certain boundaries.

The new firstly developing branches of science and technology, such as quantum electronics, quantum and non linear optics, semiconductor instrumentation, laser and masers etc. all include the use of single crystals and their singular properties. So different techniques has been developed in swift succession to synthesize better and better quality of crystals, which are rare in nature, and not yet grown in laboratory.

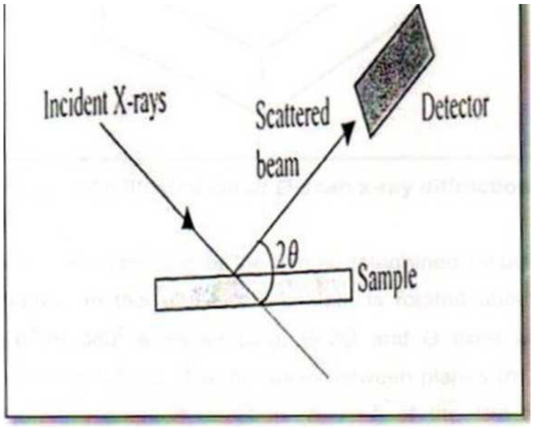
Crystals are the unknown pillars of recent technology. The development of technology depends greatly on the availability of suitable single crystals, where it is for lasers, semiconductors, magnetic devices, optical devices, super conductors and telecommunication etc. In spite of great technological advancement in the recent time, we are still in the early stage with respect to the growth of several important crystals such as diamond, silicon carbide, gallium nitride and so on. Unless the technique of growing these crystals understood precisely, it is impossible to grow them as large single crystals to be applied in modern industry. The large number of crystals is used in electronic, optical and industries. Hence today's demand is to grow large single crystals with high purity and symmetry.

A crustal can include any virtually pure single chemical compound (small impurities can be present which give colours to minerals and mixture of compounds that can co-crystallize, but less common).

EXPERIMANTAL TECHNIQUES

The condition for the constructive interference for the scattered X-ray from the successive atomic planes, formed by the crystal lattice of the material

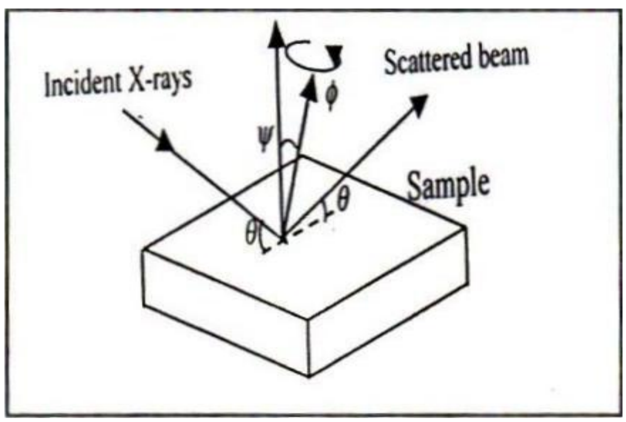
X-rays are diffracted by the oriented crystallites at a particular angle to satisfy the Bragg's condition. Knowing the values of 0 and A, one can calculate the interplaner spacing. Schematic view of XRD .The XRD can be taken in various modes such as 0-20. Scan mode; a monochromatic beam of x-ray is incident on the sample at an angle of 0 with the sample surface. The detector motion is coupled with the x-ray source in such a way that it always makes an angle 20 with the incident direction of the x-ray beam . The resulting spectrum is a plot between the intensity recorded by the detector versus 20.



A representation of x-ray diffraction

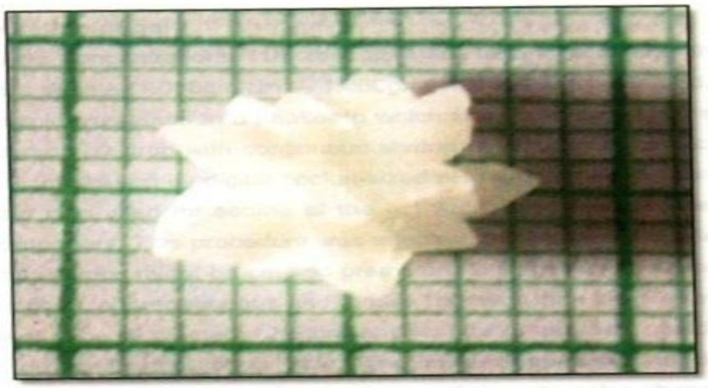
The crystalline quality of the oriented samples can be estimated by using it in rocking curve mode where in a single Bragg s peak is measured as the sample is tilted within diffraction plane. In this arrangement the position of The detector is kept fixed at 2E3 value corresponding to a particular d value and sample is rocked around the 9 value.

The resulting spectrum is a plot between the intensity versus a The full width at half maximum (FWHM) of the plot estimates the disorientation of the grains in the film with respect to the sample normal.



Above Figure illustrates of 0-scan x-ray diffraction

The in- plane orientation of the film is determined by using XRD in *O* scan mode In this mode, the sample is rotated about the surface normal from 0° to 360° while keeping, 9-29 and 9 fixed where Bragg's condition is satisfied. Where Q is the angle between planes *(h?, k;, 1!)* Which is different than the oriented direction *(h. k, 0* of the film and is in the honzontal direction to face the x-ray beam) and *(h. k. 1)*. If the crystal has m t**old** symmetry, it will satisfy the Bragg's condition and m peaks are observed during the 0 scan with peaks separated at an



Magnified needle shaped calcium tartrate crystal.

Transparent, pale yellowish crystals of barium tartrate

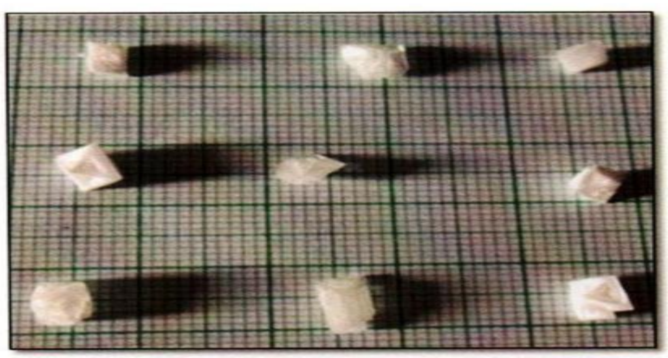
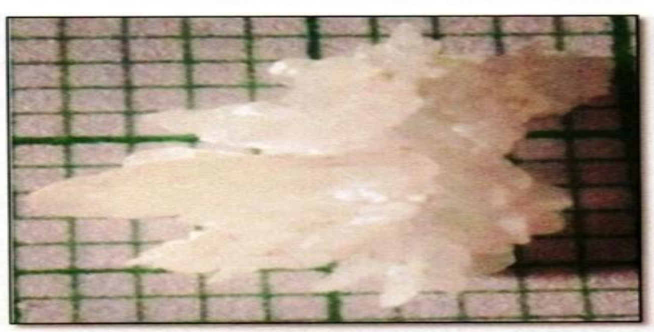
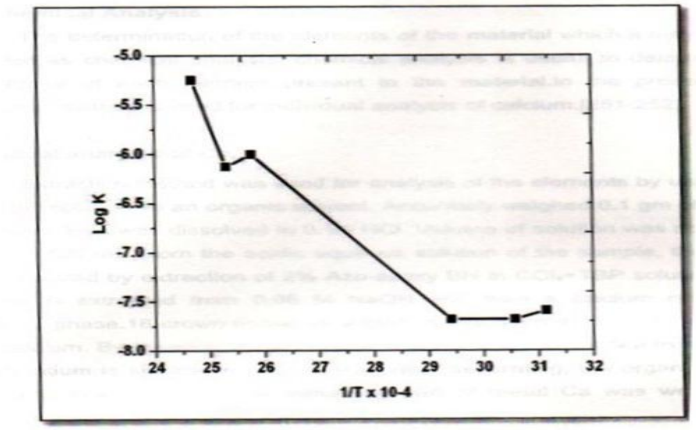


Plate like crystals of cadmium tartrate



Elongated crystals of cadmium tartrate



Ele. Conductivity of CaTr

Type	Method	Chemicals Used	Crystal habits	Quality	Size mm
Calcium tartrate	Gel method using single diffusion technique	Na_2SiO_3, $C_4H_6O_6$ $CaCl_2$	Dendrite, Hopper	Opaque, Semitransparent	5x4x2
Calcium tartrate	Gel method using single diffusion technique	Na_2SiO_3,$C_4H_6O_6$ $CaCl_2$	Prismatic	Transparent, Whitish	4x3x2
Barium tartrate	Gel method using single diffusion technique	Na_2SiO_3,$C_4H_6O_6$ $CaCl_2$	Dendrite	Opaque, Semitransparent	5x4 x2
Barium tartrate	Gel method using single diffusion technique	Na_2SiO_3,$C_4H_6O_6$ $CaCl_2$	Good	Good, Transparent	5x3 x3
Cadmium tartrate	Gel method using single diffusion technique	Na_2SiO_3,$C_4H_6O_6$ $CaCl_2$	Dendrite	Opaque	5x4 x2
Cadmium tartrate	Gel method using single diffusion technique	Na_2SiO_3,$C_4H_6O_6$ $CaCl_2$	Spherulities	Good	5x3 x3

CONCLUSIONS

1. Gel method is found suitable for growing calcium, barium & cadmium tartrate crystals.
2. The growth of calcium, barium & cadmium crystals was finished successfully by allowing diffusion of calcium, barium & cadmium chloride solution through silica gel impregnated with tartaric acid in gel tube system. With all optimum growth conditions; calcium, barium & cadmium tartrate crystals assume transparent, opaque, diamond star shiny morphology.
3. The crystals obtained in silica gel with average size of 6x4x3mm by single diffusion method.
4. By changing parameters like gel density, gel aging, pH of gel, concentration of reactants, various habits of calcium, barium & cadmium tartrate crystals can be gained.
5. The'd' values of grown material obtained from the XRD matched well with the values obtained by POWD Programmed.
6. Different characteristics, features and morphology of grown crystals are observed by the SEM and EDAX studies.
7. The result of thermal analysis suggests that the gel grown calcium, barium & cadmium tartrate is thermally unstable even at low energies. Decomposition starts at about 30°c and process continue up to 1000°c, after which it reduces to its oxide. Calcium, barium & cadmium tartrate decomposes to calcium,

barium & cadmium oxide.

8. It is investigated that Calcium, barium & cadmium tartrate crystals have NLO properties

REFERENCES

1. S. Sahoo, N. Kumar. C. Bhattacharya, S. S. Sagiri, K. Jain, K. Pal. S. S.Ray, B. Nayak, Des. Monomers Polym., 14, 95. (2011).
2. R. G. Jones, Pure Appl. Chem., 79, 1801. (2007).
3. J. P. Van Der Eerden, "Lecture Notes on Fundamentals of Crystal Growth", World Scientific Publishing, Singapore (1993).
4. T. Irusan, S. N. Kalkura, D. Arivuoli, P. Ramasamy, J. Cryst. Growth, 130.217 (1993).
5. 5 . D. T. J. Hurle, "Handbook of Crystal Growth". Vol. 1 to 3, Elsevier Science, Amsterdam (1994).
6. E. Hatschek, Simon, Kolloid Z., 10 265. (1912).
7. P. F. Kurz, Ohio J. Sci..66 349, (1966).
8. J. J. O'Connor. M. A. Dipietro, A. F. Armington and B. Rubin; Nature, 212, 68. (1968).
9. H. K. Henisch, Crystals in Gels and Liesegang Rings, Cambridge Uni.Press, Cambridge, UK (1988).
10. H. J. Scheel, J. Cryst Growth., 211,1. (2000).
11. 11 R. Chandrasekhar, J. Mater. Sci. Lett., 19, 1801. (2000).
12. S. Joseph, Ph. D. Thesis, Saurashtra University, Rajkot, (1997).
13. V. S. Joshi; Ph. D. Thesis, Saurashtra University, Rajkot (2001).
14. R. M. Dabhi, Ph.D. Thesis, Saurashtra University, Rajkot, (2003).
15. K. C. Joseph, Ph.D. Thesis, Saurashtra University, Rajkot, (2005).
16. M.R. Schedam and ARaoVenkateswara., Cryst. Res. Techn. .,(1993).
17. Huang Sheng-Hua,Gong-Du Zhou and C.W. Thomas, J. Crystallographic and Spectroscopic Research,21,127., (1991).
18. A. Majchrowski; "Ed. J. Zielinski, SPIE-Intemational Society for Optical Engineering, (1999).
19. K. Byrappa and T. Ohachi, Eds.; "Crystal Growth Technology: Characterization and Applications", Noyes Publication, (2001).
20. K. Nishioka, J. Harda, A. Sasaki, H. Teiki; "Advances in Understanding of Crystal Growth Mechanism", Elsevier Science, (1997).
21. D. T. J. Hurle; "Handbook of Crystal Growth", Vols.-1 to 3, Elsevier Science, (1999-2000).
22. J. Stangl and J. Stang; "Crystals and Crystal Gardena You Can Grow",