International Journal of ChemTech Research
CODEN (USA): IJCRGG ISSN: 0974-4290
Vol.8, No.10 pp 272-275, 2015

An overview of novel NLO Succinate crystals

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Abstract: This is a review and an overview of Synthesis, Characterisation and applications of a Novel NLO Succinate crystals. In this paper we analyse various succinate crystals papers and give an overview of that crystals nature. These crystals were synthesized by any one of the technique of slow evaporation technique, gel diffusion technique or hydrothermal method etc., Some of the characterisation of X-ray diffraction, TGA, DTA, FTIR,UV-Visible, Dielectric constant and NLO studies are done for this Succinate crystals.
Key words: Succinate, NLO, Synthesis, Characterisation.

Introduction

In recent years there has been considerable interest in the synthesis and characterisation of NLO crystals, because of their wide applications in the area of Laser Technology, Optical communication, Optical information processing and Optical data storage technology. In the last decade, Organic NLO crystals with aromatic rings have attracted much attention because of their high non-linearity fast response and tailor made flexibility. However the short comings of aromatic crystals, such as poor physico- chemical stability, low hardness and clevage tendency hinder their device applications. In order to keep the merits and overcome the short coming of organic materials, semi organic crystals have been developed. [1-12] Based on this the synthesis and growth of organic or semiorganic crystals shows a very good NLO properties.

Synthesis

Organic and semi organic NLO succinate crystals were grown from aquous solution by slow evaporation method, gel diffusion method or hydrothermal method.

Slow evaporation method

Some of the Succinate crystals like Potassium-Succinate-Succinic acid(KSSA)[13], 2-Amino Pyridinium Succinate-Succinic acid (2-APS)[14], L-Proline Succinate[15], L-Alaninium Succinate [16],L-Tyrosine Succinate hydrobromide[17]

Gel diffusion method

some of the Succinate crystals like Barium Succinate[18], Lead Succinate[19] are prepared by this method.

Hydrothermal method

Ln(III)-Succinate (Ln=Eu,Tb) are some of the crystals prepared by this method.[20]

Characterisation

X-Ray diffraction studies

From the X-ray diffraction studies it is confirmed that the crystal structure of Barium Succinate is tetragonal. Potassium-Succinate-Succinic acid(KSSA), Lead succinate, L-proline succinate, Copper(II) complex of Succinate and 2,2' bi pyridyl[21,] Potassium boro succinate(KBS)[22] is monoclinic.

Powder X-Ray diffraction analysis

Degree of crystallinity can be identified by using powder XRD analysis. Succinate crystals shows high degree of crystallinity in nature. Crystallinity refers to the degree of structural order in a solid . In a crystal https://en.wikipedia.org/wiki/Crystal, the atoms or molecules are arranged in a regular, periodic manner. The degree of crystallinity has a big influence on hardness, density, transparency and diffusion. Succinate crystals shows high degree of crystallinity.

FTIR analysis

In order to analyse the presence of functional groups qualitatively in the grown crystal, the FTIR spectrum used.

UV-Visible spectral analysis

Optical property of the crystal can be identified by UV-Visible spectral analysis. Succinate crystals shows a very good transmittance in the visible region, which enables it to be a good material for the opto-electronic application.[23-24]

Thermal Studies

Thermal stability of a crystal can be identified by Thermo gravimetric (TG) and differential scanning calorimetry(DSC) studies. Succinate crystals shows a very good thermal stability.

S.No	Name of the crystal	Decomposition Temperature	Reference
1	2-APS	165°C	Spectrochimica Acta Part A: Molecular and Biomolecular Spectroscopy 150 (2015) 765–77
2	Lead Succinate	300 °C	Journal of Crystal Growth 319 (2011) 96–101
3	KSSA	168 °C	Journal Material Science
4	Potassium boro succinate	305.2 °C	Optics & Laser Technology 43 (2011) 1229–1232
5	Copper(II) complex of succinate	270 °C	Journal of Molecular Structure 970 (2010) 75–78

Dielectric studies

The variation of dielectric constant and dissipation factor with frequency of the applied field at different temperature measurement is called dielectric studies.[25] Barium succinate, L-Proline succinate, KBS single crystals etc shows low value of dielectric loss at high frequency suggests that the grown crystals possess good quality in terms of purity. These type of crystals are important for the fabrication of materials for ferroelectric, photonic and electro-optic devices. The value of dielectric constant at higher frequencies can be used to calculate penn gap, fermi energy and polarisability.[26]

NLO studies

The SHG property of crystals can be studied by using a Q-Switched Nd-YAG laser by employing Kurtz-powder test.[27-28] It is a popular method to evaluate conversion efficiency of a non-linear material. KDP was used as a reference material.

S.No	Name of the crystal	SHG efficiency(KDP as reference)	Reference
1	Lead succinate	3.5 times greater	Journal of Crystal Growth 319 (2011) 96–101
2	Potassium boro succinate	1.5 times greater	Optics & Laser Technology 43 (2011) 1229–1232
3.	L-Tyrosine succinate	1.2 times greater	International Journal of Engineering Research & Technology (IJERT) Vol. 2 Issue 11, November - 2013
4	L-Proline succinate	2.2 times greater	Journal of Materials Physics and Chemistry, 2013, Vol. 1, No. 1, 4-8
5	L-Alaninium succinate	2.3 times greater	Spectrochimica Acta Part A 72 (2009) 753–756

Conclusion

Succinate crystals are grown by slow evaporation method, gel diffusion method or Hydrothermal method. The crystal structure is mostly Tetragonal or monoclinic in nature. Powder XRD results shows succinate salts shows high degree of crystallinity. UV-Visible spectral studies clearly explains the succinate crystals shows very good optical property. so no doubt it will be use in opto-electronic devices. Thermal analysis shows succinate crystal shows high thermal stability. Its low value dielectric loss at high frequency property is important for fabrication of material and also it shows very good NLO property.

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