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Synthesis and Characterization of L-Alanium Oxalate Crystal

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ABSTRACT

L-Alanium Oxalate single crystals are grown from aqueous solution by slow evaporation technique. The grown crystals were subjected to powder X-ray diffraction analysis, confirming the crystalline nature of the crystal. The optical properties of the grown crystals have been studied using spectrophotometer.

1. Introduction

Nonlinear optics is playing a major role in the emerging photonic and optoelectronic technologies. Efforts have been taken to synthesize new materials for a variety of nonlinear optical (NLO) applications such as optical signal processing, parametric amplification, optical phase conjugation, etc [1, 2]. Organic crystals have large nonlinear susceptibilities compared to inorganic crystals. Most organic NLO crystals have usually poor mechanical and thermal properties and are susceptible to damage during processing. It is difficult to grow large optical quality crystals of these materials for device applications [3-5]. In order to keep the merits and overcome the short comings of organic materials, some new classes of NLO crystals such as metal organic or semiorganic crystals have been developed [6]. Combining the high optical nonlinearity and chemical flexibility of organics with the temporal and thermal stability and excellent transmittance of inorganics, semiorganic materials have been proposed and are attracting a great deal of attention in the nonlinear optical field [7-8]. NLO material L-histidine teterafluoroborate single crystal has been grown [9]. Recently the growth and characterization of NLO material L-histidinium bromide, L-histidine perchlorate and L-histidine hydrofloride dehydrate crystals were also reported [10,11,12]. In this work we report the growth of L-Alanium Oxalate single crystal. The grown crystals were characterized by PXRD, UV studies.

2. Experimental Procedures

L-Alanium Oxalate crystals are prepared by simple slow evaporation method. 1M of L-Alanine was dissolved completely in 20 ml of deionised water. Similarly, 1M of Oxalic acid is dissolved in 20 ml of deionised water. The two solutions are mixed together and stirred well using the magnetic stirrer for about 4 hours. Then the solution was filtered using whatmann filter paper. After filtering the beaker containing the solution is covered using plastic paper with some holes on the paper. The nucleation begins after 7days. After 15 days a well transparent L-Alanium Oxalate critical size single crystal is obtained.

2.1 Characterization Studies

Powder X-ray diffraction (PXRD) data were collected by employing a XPERT-PRO diffractometer with Cukα radiation (λ=1.54056Å) scanned over the 2θ range of 0^{o} - 80^{o} at the rate of 1^{o}/min to understand the crystallization of the crystals grown and characterized structurally. The UV analysis of the prepared L-Alanium Oxalate crystal was done by using double beam spectrophotometer.

3. Results and Discussion

3.1. Powder XRD Result

The grown crystal belongs to orthorhombic system. The observed PXRD pattern recorded are shown in Figure 1. The well defined peaks at specific 2θ values show high crystallinity of the grown crystal.All the reflections of powder XRD pattern of the crystal of this work were indexed using unit cell software.

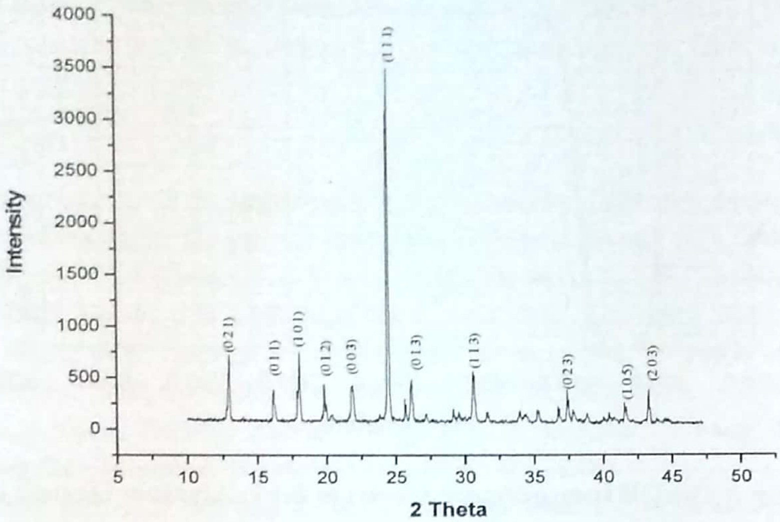

Fig: 1.The XRD spectrum for L-Alanium Oxalate crystal

3.2. UV Result

From the absorption Spectrum the L-Alanium Oxalate crystal shows the optical absorption maximum value of 2.551% at wavelength 236 nm. From UV spectra it was found that the crystal has a wide optical transmission window. It has a good transparency which is used for lasser applications.

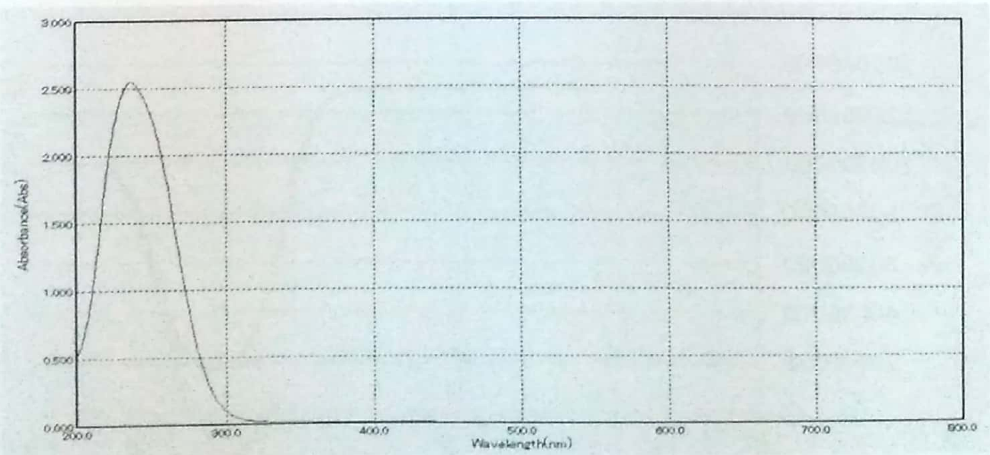

Fig:2. The UV absorption spectrum for L-Alanium Oxalate crystal

The optical band gap of the as prepared sample was calculated using the formula $E_g = hc/\lambda$

Where h is the plank's constant (6.626×10^{-34} J/s), c is the velocity of light (3×10^{8} m/s), λ is the wavelength. The cut-off wavelength was estimated as 236 nm and the forbidden energy gap calculated is about 5.26 eV.

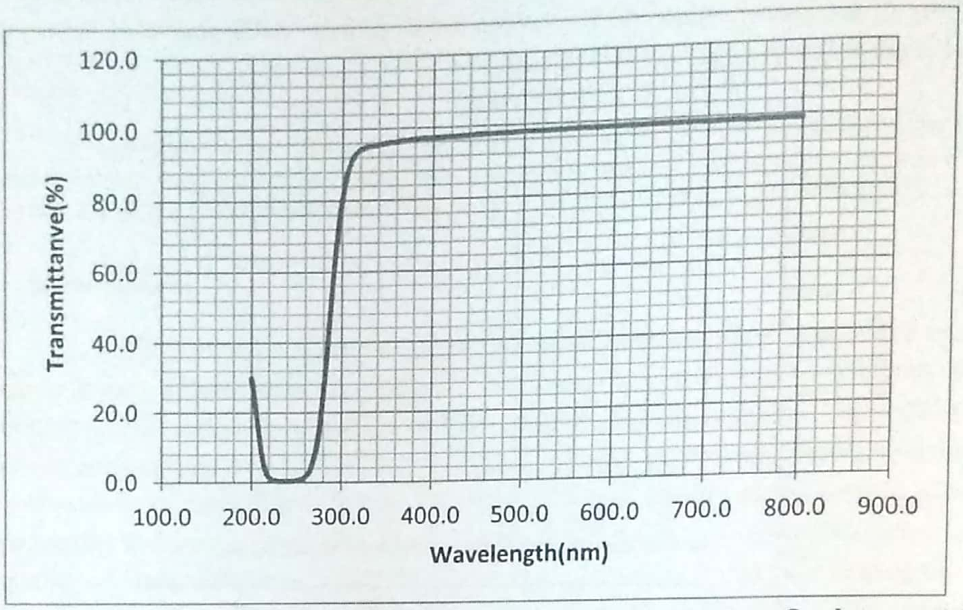

Fig: 3.The UV transmittance spectrum for L-Alanium Oxalate crystal

The L-Alanium Oxalate crystal shows maximum transmittance of 98% between the wavelength range of 500-800 nm.

3.2.1. Tauc Plot

A Tauc plot is used to determine the optical band gap, or Tauc gap, in semiconductors. The Tauc gap is often used to characterize practical optical properties of amorphous materials. The band gap calculated from Tauc plot is about 5.4 eV.

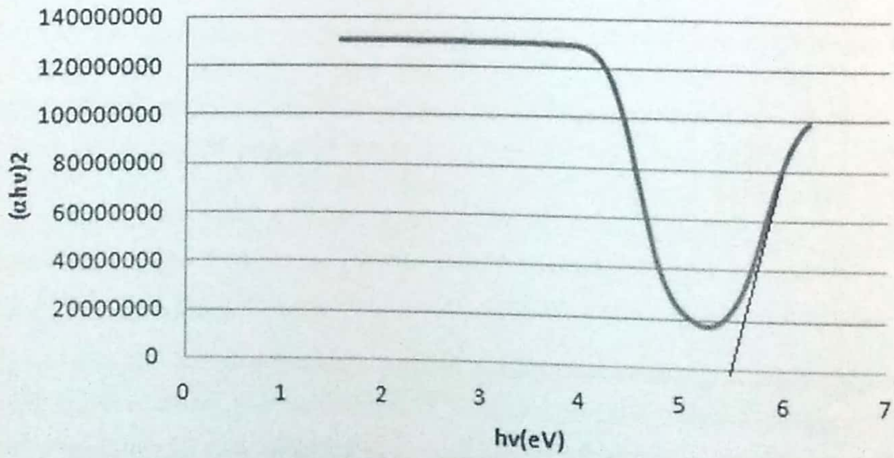

Fig: 4. Tauc plot for L-Alanium Oxalate crystal

4. Conclusion

The L-Alanium Oxalate crystal (LAOA) was grown by slow evaporation method and characterized from aqueous solution at room temperature. The XRD spectrum shows that, all the diffraction peaks in L-Alanium Oxalate crystal patterns correspond to the orthorhombic structure. The sharp peaks in XRD pattern indicate the good crystalinity of the grown crystal. The UV spectrum shows that, L-Alanium Oxalate crystals are highly transparent in nature. They have Non Linear Optical (NLO) property. L-Alanium Oxalate crystals are mainly used as optical windows and lasser applications. Because of NLO property they are used in Telecommunication, Optical computing and Optical data storage etc.

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