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UV-VISIBLE STUDY AND DETERMINATION OF OPTICAL CONSTANT OF L-ARGININE MAELATE CRYSTAL

R.N. Shaikh[1], Mohd Anis[1], M.D. Shirsat[2], S.S. Hussaini[1*]

[1]Crystal Growth Laboratory, Department of Physics, Milliya Arts, Science and Management Science, College, Beed-431122, Maharashtra, India.
[2]Intelligent Materials Research Laboratory, Department of Physics, Dr. Babasaheb Ambedkar Marathwada University, Aurangabad-431004, Maharashtra, India.
Corresponding author: email id: shuakionline@yahoo.co.in, Mob. No. +91-9325710500

Abstract: In present investigation optical properties of L-arginine maelate crystal has been investigated. The high optical transparency of grown crystal was assessed using the Shimadzu UV-2450 spectrophotometer. The transmittance data has been used to evaluate the optical band gap of grown crystal. The optical band gap of grown crystal is found to be 3.71 eV. The imperative optical constants like refractive index and optical conductivity has also been evaluated in the visible region.

Keywords: *band gap, growth from solution, optical properties, UV-visible*

INTRODUCTION

In past decade nonlinear optical (NLO) materials has been widely grown due to the vast scope of application sin the field of second harmonic generation (SHG) and optoelectronics applications [1]. Amino acids play important role in enhancing the optical and nonlinear properties of material due to the chiral symmetry [2]. Organic NLO crystals offer fast response time, low dielectric and high structural stability [2]. In present investigation an organic crystal L-arginine maelate has been grown and the optical properties were examined to explore the different optical applications.

Synthesis

Equimolar ratio of L-arginine and malic acid were dissolved in deionized water and allowed to stir at a constant speed for five hours to achieve the complete reaction. The prepared mixture was then filtered with the No. 1 whatman filter paper and kept for evaporation in a constant temperature bath of accuracy ±0.01 ^{0}C. The transparent seed crystals were harvested within 10 days.

RESULTS AND DISCUSSION

UV-visible study

The optical transparency of grown crystal has been analyzed using the Shimadzu UV-2450 spectrophotometer in the range 200 – 900 nm. The grown crystal has high optical transparency above 85% in entire visible region which is suitable for SHG transmission devices [3]. The lower cut-off wavelength of grown crystal is found to be at 300 nm. The lower cut-off wavelength of the materials is mainly attributed due to the nitrogen and hydrogen bond present in organic compound. The lower cut-off wavelength is highly demanded for electro-optic applications [4].

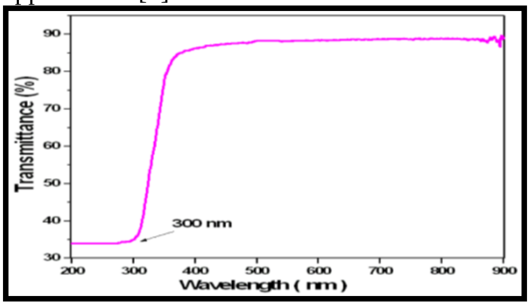

Fig.1. *Transmittance spectrum*

Determination of optical constants

The transmittance data of the grown crystal has been used to evaluate the imperative optical constants of the grown crystal. The optical band gap of the grown crystal is calculated using the relation $(\alpha h\nu)^2 = A(h\nu - E_g)$, where α is the absorption constant, $h\nu$ is the photon energy and E_g is the optical band gap. The optical band gap of the grown crystal has been determined from the Tauc extrapolation plot shown in Fig. 2. The optical band gap of grown crystal is found to be 3.71 eV which is suggests its suitability for optoelectronics applications [5]. The refractive index of the grown crystal has been evaluated using the relation given as,

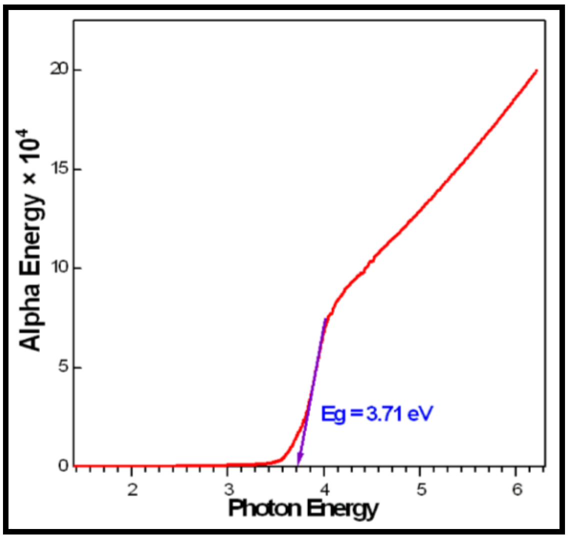

Fig.2 *Tauc plot*

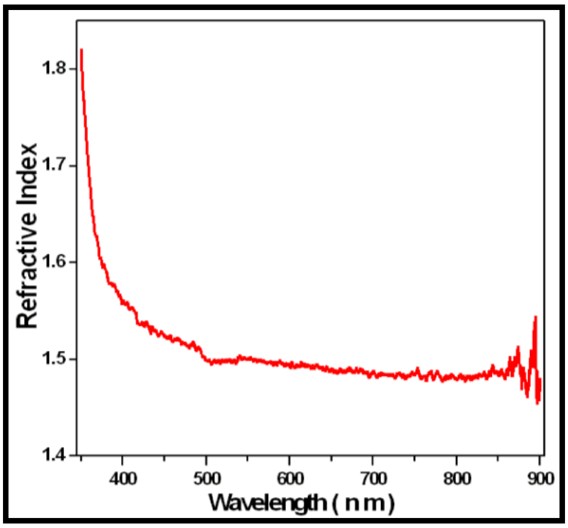

Fig.3 *Refractive index vs. wavelength*

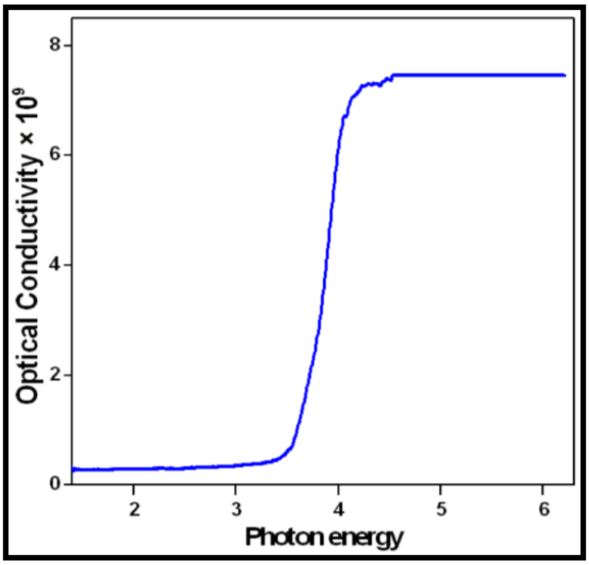

Fig.4 *Optical conductivity vs. photon energy*

$$n = (1/T_s + (1/T_s - 1)^{1/2})$$
1

The variation of refractive index is shown in Fig. 3. The lower value of refractive index indicates its prominence for determining the merit of optical reflectors, filters and resonators [6]. The optical conductivity of the grown crystal has been evaluated shown in Fig. 4. The high optical conductivity response of the grown crystal is important for optical information processing devices [5].

CONCLUSIONS

The grown crystal has high optical transparency above 85% in entire visible region. The optical band gap of grown crystal is found to be 3.71 eV. The grown crystal has lower refractive index and high optical response which are vital for distinct optical applications. The grown crystal has encouraging optical properties which makes it potential candidate for optoelectronics applications.

REFERENCES

[1] S.S.Hussaini, N.R.Dhumane, G.Rabbani,P.Karmuse, V.G.Dongre, M.D.Shirsat,*"Growth and high frequency dielectric study of pure and thiourea doped KDP crystals"* Cryst. Res.Technol. 42 (2007) 1110.

[2] S.S. Hussaini, N.R. Dhumane, V.V. Nawarkhele, G.Rabbani, M.D.Shirsat,*" Growth and High Frequency Dielectric Study of Non-linear Optical Zinc (tris)Thiourea Sulfate Crystal"* Front. Microw. Optoelectron. 19 (2008) 141.

[3] M. Rajalakshmi, R. Indirajith, P. Ramasamy, R.Gopalakrishnan,*"Synthesis, Growth and Characterization of 1H-Benzimidazolium Hydrogen Ltartrate Dihydrate Single Crystals"*Mol. Cryst. Liq. Cryst. 548 (2011) 126.
[4] J.Glorium Arul Raj, P.Selvarajan, S.Perumal, N. Murali Krishnan,"*Investigations on Growth and Characterization of Undoped and Thiourea-Doped γ-Glycine Crystals for NLO Applications"* Mat.Manufact. Process. 26 (2011) 1254.
[5] T.C Sabari Girisun, S.Dhanuskodi,*" Linear and nonlinear optical properties of tris thiourea zinc sulphate single crystals"* Cryst. Res.Technol. 44 (2009) 1297.
[6] E.F. Schubert, J.K.Kim, J.Q. Xi,*" Low-refractive-index materials: A new class of optical thin-film materials"* Phys. Stat. Sol. B 244 (2007) 3002.