ISSN: 0976-3376

Available Online at http://www.journalajst.com

ASIAN JOURNAL OF SCIENCE AND TECHNOLOGY

Asian Journal of Science and Technology
Vol. 07, Issue, 08, pp.3461-3463, August, 2016

RESEARCH ARTICLE

EFFECT OF L-ARGININE ON THE GOWTH AND PROPERTIES OF POTASSIUM HYDROGEN PHHALATE SINGLE CRYSTALS

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ARTICLE INFO

Article History:
Received 18th May, 2016
Received in revised form
26th June, 2016
Accepted 18th July, 2016
Published online 30th August, 2016

Key words:

KHP,
Crystal Growth,
Optical and NLO Properties.

ABSTRACT

KHP crystal presents long term stability and is used in devices due to its electro optical properties. Single crystals of pure and L-arginine doped Potassium Hydrogen Phthalate (KHP) were grown by slow evaporation method. Effect of L-arginine was studied for 1 mole% concentration. The grown crystal was subjected to various studies. Lattice parameters were determined by powder X-ray diffraction datas. The UV Vis- NIR spectral studies were performed to analyze the optical property. The NLO property of grown crystals also analysed.

INTRODUCTION

The search for new conversion materials for various device applications has led to discovery of many organic, inorganic and semi organic materials, which have potential applications in various fields (Meera *et al*., 2004; Ambujam *et al*., 2007; Justin Raj *et al*., 2008). The Potassium Hydrogen Phthalate (KHP) one of NLO material having superior non linear optical properties has been exploited for variety of applications (Ramesh Babu *et al*., 2006; Vijayan *et al*., 2003; Lakshamana Perumal *et al*., 2002; Masilamani *et al*., 2014). In the present investigation the single crystal of pure pure and L-arginine doped Potassium Hydrogen Phthalate were grown by slow evaporation method and the harvested crystals were characterized by X-ray diffraction studies, NLO test and UV-Vis-NIR studies

Crystal growth

Analytical reagent (AR) grade sample of pure KHP and L-arginine along with triple distilled water were used for the growth of single crystal.

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The solution of KHP salt was prepared in a slightly under saturation condition at 30 ˚C with one mole percent of L-arginine as dopant and then stirred well for 4 h. Then the solution was filtered using a filter paper. The solutions were kept undisturbed by covering with a thick porous sheet of paper and placed in a dust free atmosphere for controlled slow evaporation. Optically transparent crystals were harvested in 15-20 days. The photograph of L-arginine doped KHP crystal is shown in Fig 1. The grown crystals were subjected to different characterizations such as Powder XRD, UV–visible spectral studies and SHG efficiency.

Characterizations

Powder X-ray diffraction pattern was recorded using a X pert PRO X-ray diffract meter. The UV-Vis-NR absorption spectra were recorded by using Double beam spectrophotometer- 2202 and NLO test done by the Kurtz and Perry powder technique.

RESULTS AND DISCUSSION

Powder XRD Analysis

The powder X-Ray diffraction pattern (Fig. 2) of L-arginine doped KHP crystal was recorded using *Philips X'pert Pro apparatu*s.

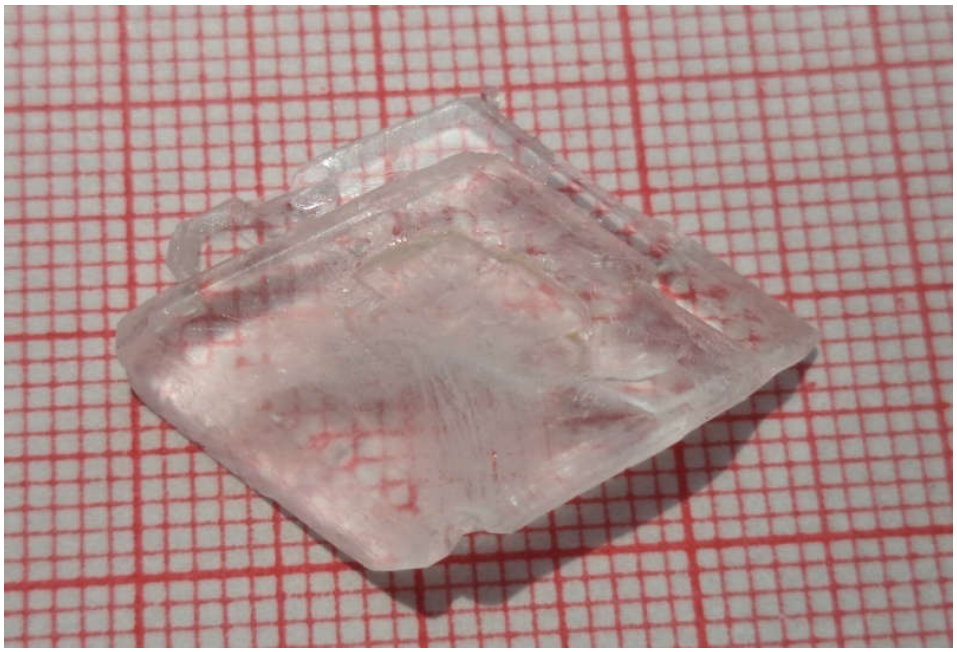

Fig. 1. Photograph of L-arginine doped KHP crystal

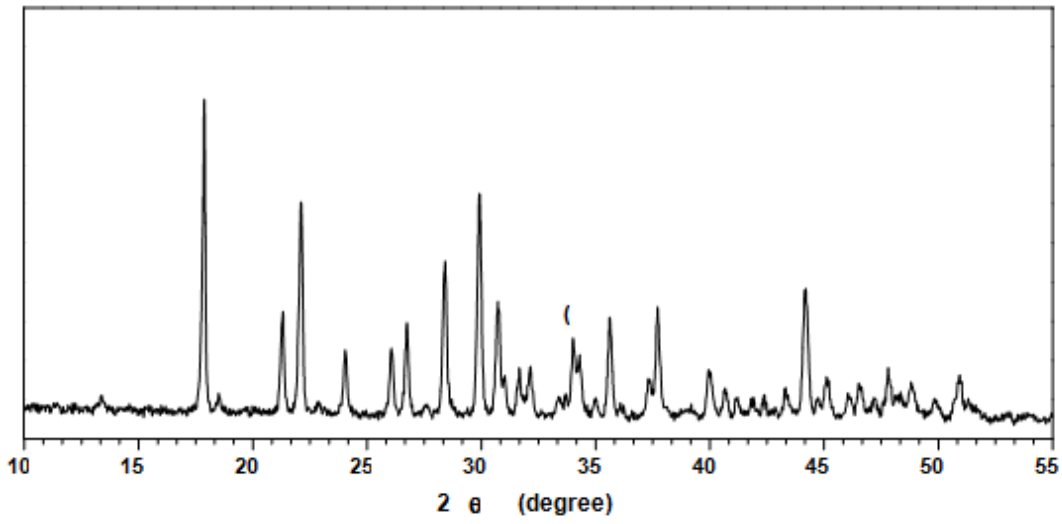

Fig. 2. The powder XRD pattern of 1 mole % L-arginine doped KHP crystals

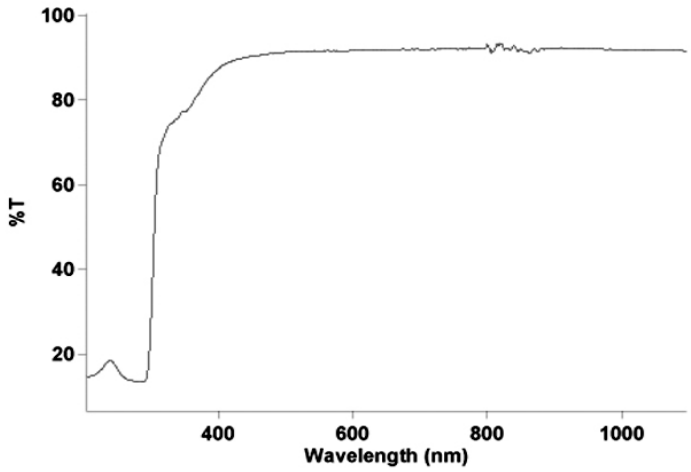

Fig. 4. UV- Visible spectrum of KHP crystals doped with 1 mole% L-arginine

This study reveals that the grown crystal belong to orthorhombic system and its cell parameters are a=9.813 Å, b=13.490 Å, c=6.101 Å and cell volume V=807.634 Å3. The cell parameters were good agreement with the reported values (JCPDS). The increasing cell volume and slight changes in the unit cell parameters shows that the doped material is incorporated into the crystal lattice of KHP.

UV Visible Spectral Studies

The UV –VIS spectrum of crystal was recorded in the region 100 to 1500 nm using *Perkin Elmer mode Lambda 35 spectrometer* and the recorded spectra are shown in Fig. 4. The transmission spectrum of 1mole % L-arginine doped KHP crystal shows that the high transparency and better lower cut off wavelength. The forbidden enery gap of the grown crystal is 4.119eV.This confirms that the L-arginine doped KHP crystal is a good candidate for electro optic applications (Chithambaram, 2010).

Second Harmonic Generation (SHG) efficiency

To confirm the nonlinear property of the sample, the powder form of L-arginine doped KHP crystals were subjected to NLO test obeying the Kurtz and Perry powder technique (30). The Second Harmonic Generation (SHG) was confirmed by the emission of green light (= *532*). The powder SHG efficiency of the pure and doped KHP crystals are compared with KDP and it was found that the SHG efficiency of L-arginine doped KHP was 0.51 times that of KDP and it was very much greater than (1.6 times) that of pure KHP. Due to the presence of L-arginine in the crystal lattice, there is an increase in polarizability of the molecule, which tends to increase the SHG efficiency. In addition to this, the increase in SHG in the case of all doped KHP crystals may also be attributed to the central ion in metal organic complex which offers a certain anisotropic field to keep NLO active chromopores and vary the hyper polarizibility value (Kurtz, 1968; Krishnakumar, 2007).

Conclusion

The single crystal of L-arginine doped KHP crystal were grown by low temperature solution growth method. The powder XRD confirms its crystal structure. The UV- visible spectra shows that there is strong transmission for L-arginine doped KHP crystal. This shows that in L-arginine doped KHP crystals there is more transmission; hence this crystal is more applicable for optoelectronics application than pure KHP. The SHG test shows that the optically active carbon in L-arginine reacts with hydrogen of KHP and enhanced the non Centro symmetric structure of host and hence its nonlinearity increases and thus considered as a potential candidate for optoelectronic device fabrication.

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