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K. Boopathi and P. Ramasamy

Citation: AIP Conference Proceedings 1591, 1220 (2014); doi: 10.1063/1.4872909
View online: http://dx.doi.org/10.1063/1.4872909
View Table of Contents: http://scitation.aip.org/content/aip/proceeding/aipcp/1591?ver=pdfcov
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K. Boopathi and P. Ramasamy*

Centre for Crystal Growth, SSN college of Engineering, Kalavakkam- 603110, India
E-mail: ramasamyp@ssn.edu.in

Abstract. A single crystal of organic nonlinear optical material 3-aminophenol perchlorate (3-AMP) was successfully grown by the slow evaporation solution method. Single-crystal X-ray diffractometer was utilized to measure unit cell parameters and to confirm lattice parameter. 3-aminophenol perchlorate belongs to monoclinic space group P2₁. The optical transparency window in the UV–vis-NIR region is found to be good for nonlinear optical applications second harmonic studies were carried out. The second harmonic output intensity was tested using the Kurtz and Perry powder method and was found to be 1.1 times that of potassium dihydrogen phosphate (KDP).

Keywords: Growth form solutions; Optical properties

PACS: 77.84.-s; 81.10.Dn;

INTRODUCTION

Significant advances have been made recently in the field of nonlinear optics (NLO) in the area of materials engineering and the associated optoelectronic device technologies. NLO is now established as an alternative field to electronics for future photonic technologies. The fast growing development in the optical fiber communication systems has stimulated the search for new NLO materials that are capable of fast and efficient processing of optical signals and integrated optics [1]. The adaptable nonlinear optical frequency conversion materials are of vital importance for many applications in the field of optoelectronics, photonics, telecommunication, optical computing, optical storage and optical information process. These molecular crystals are built up of an inorganic/organic acid and organic base. The acid part of the molecular crystal is responsible for favorable chemical and mechanical properties, due to the directional and strong hydrogen bond interactions, while the organic part due to its relatively high hyperpolarisability is mainly responsible for the nonlinear optical properties of the crystals. In building acid–base hybrid crystals, it is interesting to note that per chloric acid forms molecular crystals with different organic bases that exhibit nonlinear optical properties [2]. Many different types of hydrogen bonds, N–H/N, N–H/O, O–H/N and O–H/O, are the main key for organization of molecules in solid, especially the molecules containing complementary arrays of hydrogen bonding sites. The present work describes one type of hybrid crystals formed by perchloric acid with 3-aminophenol.

Synthesis and Crystal Growth

Perchloric acid and 3-aminophenol were used for the synthesis of the title compound 3-AMPP using ethanol and water. Aqueous solutions of perchloric acid and the respective aminophenol (in stoichiometric proportions) were prepared and left to react at 360–370K. When the solutions became homogenous, they were cooled to the ambient temperature. The solution is left for the evaporation to dryness. The dried salt was collected for further growth of 3-AMPP. The synthesized material was purified by repeated recrystallization process. The solubility test can be performed to choose the solvent for crystal growth. The solubility experiments were carried out at temperatures 30-45°C in the constant temperature bath with an interval of 5°C in water solvent. 3-AMPP is highly soluble in water. The well-defined single crystals of 3-AMPP were harvested from mother solution after a growth period of 30 days. Photograph of as grown crystal is shown in FIGURE.1

RESULTS AND DISCUSSIONS

The grown crystals were subjected to X-ray diffraction studies. The unit cell parameters of the...
The second harmonic efficiency of the grown crystal was analyzed by Kurtz and Perry powder technique [4]. The fundamental beam of 1064 nm with pulse energy of 4 mJ and pulse width of 10 ns and repetition rate of 10 Hz was used. The fundamental beam was filtered by using an IR filter. A photomultiplier tube was used as detector. KDP sample was used as the reference material and the output SHG power intensity of 3-AMPP was half of the KDP.

CONCLUSION

Good optical quality single crystals of organic 3-Aminophenol perchlorate (3-AMPP) have been grown from solution by slow solvent evaporation technique. The crystallography data of 3-AMPP was confirmed by single crystal X-ray diffraction analysis. The lower cut off wave length (290 nm) was determined from the
UV-visible spectrum and the optical band gap is found to be 4.09 eV. The powder SHG measurement shows that the grown 3-AMPP crystal has SHG efficiency 1.1 times that of KDP.

ACKNOWLEDGMENTS

The authors are thankful to Dr. P. Ramamurthi and Mr. N. Dhenadhayalan National Centre for Ultrafast Processes University of Madras Chennai - 600113 for providing the SHG measurements facilities.

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