
SYNTHESIS, GROWTH AND CHARACTERIZATION OF BENZALDEHYDE 4-NITRO PHENYLHYDRAZONE CRYSTALS

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Abstract: An organic nonlinear optical (NLO) Single crystal of Benzaldehyde 4- nitro Phenyl hydrazone (BPH) was grown by slow evaporation solution growth technique. The grown crystal was characterized by various spectroscopic methods such as powder X-ray diffraction carried to find the structural properties of crystal, the vibrational studies are carried out by FTIR, FT-Raman and factor group analysis. The transparency of crystal was characterized by UV-VIS spectroscopy. Second harmonic generation (SHG) was investigated to inquire into its NLO properties.

Keywords: nonlinear optical, single crystal, transparency, SHG.

Introduction: Nonlinear optics (NLO) is a frontier of science and technology playing a major role in the emerging field of photonics, which involves the applications of photons for information and image processing [1,2]. The development of photonic and optoelectronic technologies rely heavily on the growth of NLO materials with high nonlinear optical responses and the development of new and more efficient materials. Organic NLO materials are generally more versatile than their inorganic counterparts owing to their more favourable nonlinear response, since these are often formed by weak Vander Waals and hydrogen bonds. Moreover organic materials offer flexibility of molecular design, virtually an unlimited number of crystalline structures and moderate damage resistance to optical radiation. Hence, these materials might make it desirable to replace electronic switching circuits in computing and telecommunication systems with purely optical devices [3]. Due to their potential applications in photonic devices, the study of nonlinear optical properties of molecules, and their hyperpolarizabilities is considered as important for extensive research, and lot of efforts taken on the experimental [4,5] and theoretical aspects [6,7] on the bulk NLO properties as well as their dependence on the first order hyperpolarizabilities of molecules. In this present investigation we report the growth and characterization of Benzaldehyde 4- nitro Phenyl hydrazone (BPH) crystals.

Synthesis, Solubility and Crystal Growth of BPH: A mixture of 0.5 g of p-nitrophenylhydrazine, 0.5g of

the aldehyde, 10-15 ml of ethanol and 2 drops of glacial acetic acid was refluxed for 10 minutes. The clear solution was cooled and p-nitrophenylhydrazone was filtered off. The reaction scheme is shown in Fig.1. The synthesized BPH was purified by repeated crystallization process before growth. The recrystallization was carried out in order to improve the optical quality as well as the size of the growing crystals.

The solubility of BPH in acetone was estimated as a function of temperature in the range 30-55°C. A thermostatically controlled vessel (100 mL) was filled with the solution of BPH with some undissolved BPH and stirred for 24 hour. On the next day, a small amount of the solution was pipetted out, and the concentration of the solute was determined gravimetrically. Fig. 2 shows the solubility curve for BPH. The title compound exhibits good solubility and a positive solubility temperature gradient (direct solubility) in the acetone.

The solution of recrystallized BPH was prepared at 35°C using acetone as the solvent. The beaker containing the solution was covered at the top to prevent the evaporation of the solvent. The solution was housed in a constant temperature bath (+ 0.10C) and continuously stirred using Teflon coated magnetic stirrer. When the solution was subjected to slow cooling (0.5°C/day), the temperature was achieved (320C) to initiate nucleation and the temperature has been thereafter reduced at a rate of 0.150C/day. The crystals were harvested after 10 days (Fig.3).