Comparison study of non-centrosymmetric materials from aminopyridines

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Abstact.

Performed study on the co-crystallization of heterocyclic molecules of aminopyridine series with a nonlinear optical chromophore (4-Nitrophenol) and receiving molecular crystals with non-centrosymmetric crystal lattice based on them. Experiments on the growth of single crystals of these substances by slow evaporation technique in a closed volume. The dependence of the crystal symmetry on the growing conditions. A comparative study of nonlinear optical properties of crystals based on aminopyridines and measured their nonlinear optical coefficients.

Keywords—molecular crystal; nonlinear optics; crystal growth; crystal engineering.

Summary.

Nonlinear optical (NLO) materials play a major role in fast developing fields of science and technology such as photonics and optoelectronics. For this application, organic materials have been of particular interest because of its high nonlinear and optical susceptibilities and good optical threshold for laser power.

To generate non-centrosymmetric lattice, heterocyclic molecules of aminopyridines was used with NLO chromophore 4-Nitrophenol, because that's must be exhibits second harmonic generation [1].

Crystals was grown by slow evaporation technique in a closed volume. Toluene and isopropyl was used as the solvents. A hot toluene solution of aminopyridines was added to a hot toluene solution of 4-Nitrophenol. Because the molecular crystals may take various forms, which is not uncommon for organic compounds [2], and to obtain monocrystals, prepared compounds after co-crystallization was re-crystallized from isopropyl to obtain form of monocrystals [3,4]. The UV-vis-NIR spectrum of these crystals was recorded with Shimadzu UV-1800 spectrophotometer in the range 190 – 1100 nm and the one of recorded spectrums is shown in Fig. 1. The cutoff wavelength of obtained crystals is near 400 nm. The recorded spectrum shows that crystals have wide transmission of above 40 – 50% up to 1100 nm from cutoff wavelength. Transmission spectrum of new NLO materials show that this organic material will be suitable for Nd:YAG laser second harmonic generation (SHG) (532 nm).

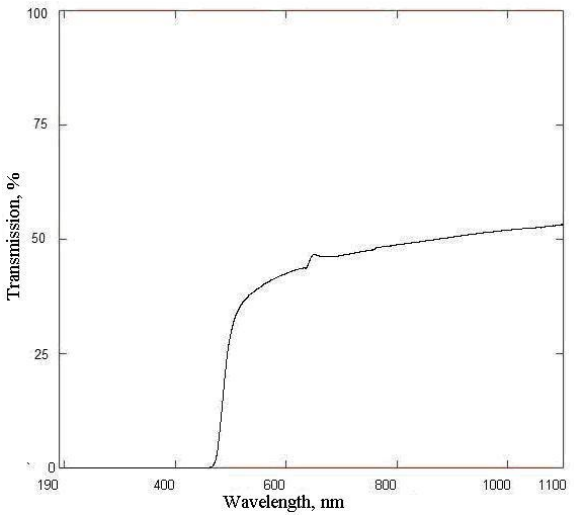

Fig.1. Transmission of one of the crystals based on aminopyridine

SHG conversion efficiency of the grown crystals was measured by comparison technique. The configuration used for study of SHG consists of a pulse Nd:YAG laser (LF-117) as a light source. A laser beam of fundamental wavelength 1064 nm, 15 ns pulse width, with 10 Hz pulse rate was made to fall normally on the sample. After sample the fundamental beam is removed by a short wavelength passing filter and second harmonic signal is detected by a photodetector with sensitivity zone 420-675 nm. Potassium titanium oxide phosphate (KTP) crystal was used as reference material in the SHG measurement. To quantify NLO response was made the comparison of the samples of aminopyridines crystals with KTP crystals. Nonlinear coefficient of 10–30 pm/V was obtained on these crystals.

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