Temperature dependence of optical phonons in Guanylurea Hydrogen Phosphite Crystal in the terahertz frequency range

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Abstract— The monoclinic organic crystal of guanylurea hydrogen phosphite (GUHP) was considered. The absorption and refractive properties of an optically negative biaxial crystal were investigated. The terahertz time-domain spectroscopy under cryogenic conditions was carried out for observation of the temperature dependence of the phonon structure of GUHP crystal.

Keywords— terahertz spectroscopy; molecular crystals; Guanylurea(1+) hydrogen phosphite

I. Introduction

One of the promising nonlinear optical crystals is guanylurea hydrogen phosphite $(NH_2)_2CNHCO(NH_2)H_2PO_3$ (GUHP). It can effectively be used for nonlinear optical conversion via generation of the second and third optical harmonics of infrared laser radiation [1–4] and conversion of femtosecond radiation into the terahertz frequency range.

The purpose of this work is to investigate terahertz optical properties of GUHP crystals under different conditions. The results show the prospects of the crystals' application in terahertz photonics.

II. DISCUSSION

The absorption and refractive spectra of a GUHP crystal in the terahertz frequency range were measured on a time-domain terahertz spectrometer [5]. The crystals were cut orthogonally to one of the optical axes so that we could study uniaxial birefringence.

The absorption and refractive properties of a GUHP crystal were investigated with decreasing temperature to cryogenic. For this, the spectrometer was modified by incorporating a cryostat in the experimental scheme. The dependence of spectroscopic properties on incident terahertz power under various temperature conditions was also investigated.

The obtained results can help in studying the phonon structure of GUHP crystal, as well as in a subsequent study of the generation properties of this crystal in the terahertz frequency range.

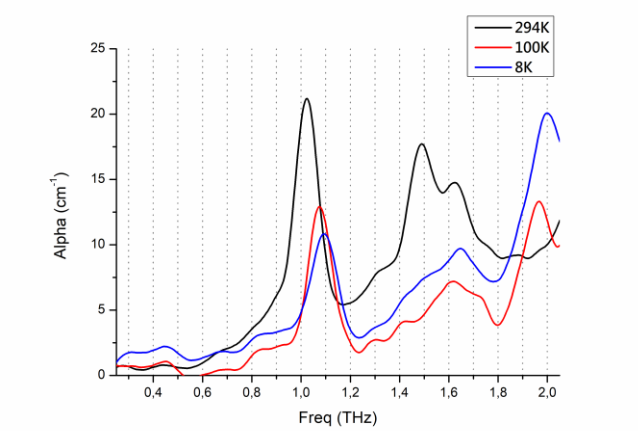

Fig. 1. Absorption spectra of GUHP crystal for different temperatures

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