Abstract Submitted
for the MAR10 Meeting of
The American Physical Society

Studies on the crystal distortion – birefringence relationship in $ZnGeP_2$ RAMAZAN ATALAY, MUSTAFA ALEVLI, MAX BUEGLER, GOKSEL DURKAYA, NIKOLAUS DIETZ, Prof. Dr, DIETZ RESEARCH GROUP TEAM — $ZnGeP_2$ as a member of the ternary II-IV-V_2 compound chalcopyrite family has been extensively studied over the last decades as promising birefringent material for nonlinear optical applications in the near- and mid infrared (IR) wavelength region. The high birefringence in the $ZnGeP_2$ material system enables applications such as second-harmonic generation (SHG), optical parametric amplifier (OPO), and sum/difference frequency mixing. The birefringent effect in the $ZnGeP_2$ crystal structure is related to the compressive distortion of the chalcopyrite lattice in c-direction. Utilizing unpolarized/polarized Raman spectroscopy (RS) and infrared reflectivity (IR) measurement, we studied the vibrational phonon modes in $ZnGeP_2$ crystals and analyzed phonon contributions related to the anisotropic lattice distortions. The effect of birefringence is analyzed from the shift of the Γ_4^{L0} Raman mode. Furthermore, the symmetry forbidden Raman (SFR) scattering modes, observed in the $ZnGeP_2$ Raman spectra, have been analyzed to understand contributions related to the lattice distortion and contributions related to crystal defects. Our studies show that the non-linear mixing of radiation only occurs along the [001] crystalline plane, where conservation of momentum or so-called phase matching is present.

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Date submitted: 25 Nov 2009 Electronic form version 1.4