Prospects of generation of terahertz radiation in borate nonlinear crystals

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Crystals of the borate family are widely used in various areas of nonlinear optics owing to their advantages such as relatively large effective nonlinear coefficient, wide spectral transparency range, high damage threshold, etc. [1]. Typical representatives of this family of crystals are barium beta-borate (β-BaB_2O_4, BBO), lithium triborate (LiB_3O_5, LBO), and bismuth triborate (BiB_3O_6, BIBO).

Recently, researchers started to show interest in using these materials in the terahertz (THz) spectral range. Terahertz optical properties (refractive index and absorption coefficient) of the crystals were measured at room and liquid nitrogen temperatures [2-4]. This work considers prospects of nonlinear conversion of fiber laser radiation (at the wavelengths of 1 μm and 1.5 μm) into terahertz radiation by the difference frequency generation (DFG). The most promising is the conversion into sub-THz (or millimeter) radiation due to the longer coherence length and low absorption of the phonon modes. This range is relevant for the new generation of telecommunication systems, including 6G. As an example, Fig. 1 shows the calculated collinear phase matching curves for the DFG process in BBO crystal and the comparison of its absorption coefficient with other borates in the THz region.

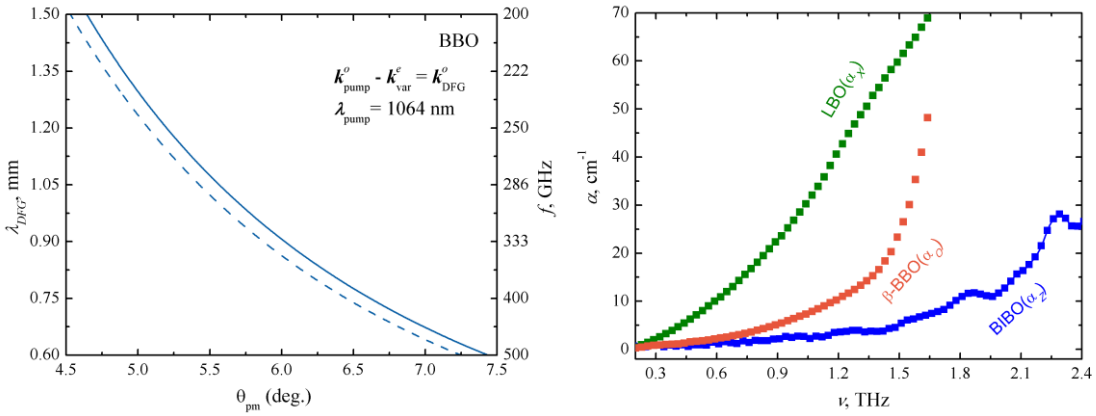

Fig. 1. DFG phase matching curves in BBO crystal pumped at the wavelength of 1.064 μm at the temperatures of 300 K (solid line) and 77 K (dashed line), left. Absorption spectra of borate crystals in the THz spectral range, right.

References

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