

Optical constants of lithium triborate crystals in the 55-71 eV region

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Lithium-triborate (LBO) is a popular nonlinear optical crystal. However, due to its strong absorption, it only produces wavelengths less than or equal to 275 nm by second harmonic generation (SHG) and less than or equal to 188 nm by wave mixing. It has been proposed that in the case of strong absorption a reflection configuration can be used for second harmonic generation, and the phase-matching requirement is relaxed. Calculations show that for a double resonance condition a nonlinear crystal such as LBO can have a SHG efficiency as high as $\sim 12\%$ in the VUV and x-ray regions.

To design a workable system for VUV and x-ray regions, a knowledge of a crystal's optical constants in those spectral regions is required. In this paper we report a determination of the optical constants of LBO in the region 51-71 eV. Reflection spectra were measured for three crystal orientations. The optical constants were derived for the principal axes. Five absorption transitions were observed and we have calculated their oscillator strengths and matrix elements. The data show that LBO crystal is strongly anisotropic. A comparison of the absorption curve of LiCl and the absorption coefficient of LBO indicates that the energy levels of the LBO crystal in this region are mainly determined by the Li ion.

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