

Investigation of Acoustic-optical Properties of Nontransparent Crystals

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In the present work, the acoustic-optical properties of Silicon crystal (Si) were investigated at the light wavelength 632.8 nm, in which it is nontransparent. To observe the scattered light beam the Dy_2S_3 crystal was used as the buffer sample because it is transparent in the visible range of spectra. For this reason the geometry of experiment was changed so that we could observe the scattered light beam using a photomultiplier. A single crystal of pure Dy_2S_3 was formed with a pair of opposite faces polished for entrance and exit of the light wave. Also, at least one of the faces of this pair was perpendicular to the propagation direction of the acoustic wave, which is excited in the silicon sample at a fixed frequency by a piezoelectric transducer of quartz. Another face of the buffer crystal (under an angle of 90.degree) provides the physical contact with the investigated Silicon crystal. In the experiment we observed the scattering of light on transversal acoustic waves in the Silicon crystal. It was detected that the scattered light intensity is much more powerful in comparison with that for Dy_2S_3 crystal. The acoustic-optical efficiency M_2 (it is defined the acoustic-optical quality of material) has been calculated from the values of optic coefficients and elastic constants for appropriate directions of sound and light. The results of the investigations have shown the possibility of determination of the photoelastic properties of nontransparent crystals by the Bragg scattering method. At that rate, the very high intensity of scattered light can be obtained in comparison with that in transparent crystals.