ELLIPTICAL POLARIZATION OF ACOUSTIC SHEAR WAVES IN A GdS CRYSTAL

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In working with shear waves in crystals, it is important to consider the possibility that the polarization of the wave can change in the course of its propagation.

If a shear wave with longitudinal polarization is excited in the piezo-semiconductor CdS in a direction perpendicular to the acoustic axis, there arises an elliptical polarization of the wave, since the two excitable eigenwaves have slightly different speeds. One of them, polarized along the acoustic axis, is piezoactive. By illuminating the crystal and thereby increasing the concentration of charge carriers, one can change (decrease) the speed of the piezoactive wave. Because the speed of the nonpiezoactive wave in this direction is higher in any case, illumination of the crystal leads to an increase in the difference between the speeds of the eigenwaves. Consequently, changing the conductivity of the crystal leads to a change in the elliptical polarization.

This phenomenon was observed experimentally in the frequency range 25-30 MHz with parallel and crossed transducers oriented at an angle of 45° with respect to the acoustic axis. The existence of elliptical polariztion and its variation with frequency and with the conductivity of the crystal were demonstrated. The experiment confirms the qualitative conclusion that as the difference of the phase velocities of the eigenwaves increases, oscillations of the ellipse occur more often as the frequency changes.

This phenomenon is of interest in interpreting measurements of the acousto-electronic interaction for shear waves.

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