The influence of induced chiral properties on the transformation of polarization of acoustic waves in piezoelectric semiconductors

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The possibility of forming of rotating acoustic anisotropy and, consequently, chiral properties in crystals under external electric field influence was shown before. The availability of charge carriers in semiconductors allows to influence the character of interaction of acoustic waves with external fields. The charge carriers (in particular, conductivity electrons) interact with the electric field of wave in crystal. The character of interaction depends on the relative movement of wave. The character of interaction can be changed by the external constant electric field with strength $\mathbf{E}$. Owing to the external electric field influence the movement of electrons (drift) with the velocity $\mathbf{v} = -m\mathbf{E}$ is possible. Here m is the agility of electrons in crystal. In this work taking into account electron drift the interaction of ultrasound wave with rotating electric field in semiconductor in various frequency regions is considered. The following peculiarities of acousto-electron interaction are determined: independence of rotation ability of crystal with induced acoustic anisotropy from the electron drift direction; the change of sign of circular dichroism when the direction of the external longitudinal electric field changes. Such interaction when the complete transformation of an incident wave with the frequency ω to the wave with the opposite circular polarization and the frequency $\omega + 2Q$ or $\omega - 2Q$ takes place is investigated. Here Q is the frequency of rotating electric field. The thickness of crystal when complete transformation takes place depending on the parameters of drift is shown. The amplification of transformed wave when the direction of drift of electron coincides with the direction of the incident wave velocity when condition effects predominate over diffusion effects is possible.