Effect of a DC electric polarization induced by intense THz radiation in ferroelectric single crystals

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The rapid development of terahertz optoelectronics stimulates interest in the search for new effects that can lead to a further increase in the conversion efficiency in the terahertz range. However, these studies are noticeably limited by the fact that the available laboratory facilities in most cases provide a relatively low power of THz radiation, which noticeably limits the observation and study of effects depending on its intensity. The emergence of unique THz sources using free electron lasers as pumping expands the THz power range of action on materials and makes it possible to observe effects that were not manifested in standard laboratory stands.

In this report, we present the results of observation and study of a DC electric polarization induced by intense THz radiation in well-known ferroelectric single crystals of barium titanate (BT), triglycine sulfate, and lead germanate. The observed effect is compared with optical rectification initiated by femtosecond optical pulse. Attention is paid on differentiation of THz-induced rectification from pyroeffect.

In all the crystals studied, an anisotropic dependence of the voltage taken from the electrodes of the crystal capacitor on the polarization of the incident THz radiation was observed. In this case, an anomalous behavior was observed in the BT crystal, which manifests itself in a change in the sign of the THz-induced voltage at certain orientations of the radiation polarization. This effect was not observed in other investigated materials.

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