Nanooptics and photonics

Pockels effect in the $Hg_3S_2Cl_2$ polymorphs

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$Hg_3X_2Y_2$ crystals are of high interest for both researchers and engineers due to their physical properties and great potential for development of nonlinear and optoelectronic devices. The main structural feature of $Hg_3X_2Y_2$ mercury chalcogenide-halogenides is the tendency to formation of various polymorphic modifications due to the great conformational capacity of mercury-chalcogen component [1-4]. Nanomaterials based on $Hg_3X_2Y_2$ (X = S, Se, Te; Y = F, Cl, Br, I) gyrotropic crystals have tremendous potential in addressing the two major issues faced by our society: the searching for new energy sources and improving healthcare. Studied crystals are expected to contribute in the development of nanobiophysics and personalized medicine for health monitoring and prevention.

This paper reviews the Pockels effect in the $Hg_3S_2Cl_2$ polymorphs. To understand better the second-order polarization induced in the crystal and occurrence of the electro-optic effect the detailed theoretical analysis is conducted. The space-charge field changes the refractive index due to the Pockels effect. The electro-optic tensors for (α), (β), (γ) - $Hg_3S_2Cl_2$ crystalline phases are calculated. Symmetry considerations permit simplification of the general view for the electro-optic tensor. The nonzero coefficients of 3^{th} rank electro-optic tensor are $r_{41}= r_{52}= r_{63}$. The interest of this physical property is due to its potential application in electronic and acoustical-optical devices: light modulators, elements for dynamic holography, recording and information storage, deflectors and other devices based on the phenomena of light beams interaction.

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2. *Bokotey O.V.* Theoretical calculations of refractive properties for $Hg_3Te_2Cl_2$ crystals // Nanoscale Research Letters. - 2016. - DOI: 10.1186/s 11671-016-1476-8.

3. *Bokotey O.V., Glukhov K.E., Nebola I.I., Bokotey A.A.* First-principles calculations of phonons and Raman spectra in the $Hg_3Te_2Cl_2$ crystals // J. Alloys Compd. - 2016. - V.669. – P. 161-166.

4. *Bokotey O.V., Studenyak I.P., Nebola I.I., Minets Yu.V.* Theoretical study of structural features and optical properties of the $Hg_3S_2Cl_2$ polymorphs // J. Alloys Compd. - 2016. - V.660. – P. 193-196.