

Dielectric Properties of PbGa₂S₄ Crystal in The Optic Range

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Birefringence of PbGa₂S₄ single crystals is studied in the spectral range of 0.45–0.8 μm at $T = 300$ K.

PbGa₂S₄ crystals are of yellow color; they crystallize in a rhombic lattice (Fddd - D_{2h}^{24} space group) with the lattice parameters $a = 20.70$, $b = 20.38$, and $c = 12.15$.

The measurements were carried out by the prism method. The spectral dependencies of n_a , n_b , and n_c are presented in Fig. 1.

Analysis of dispersion models of n_a , n_b , and n_c of the PbGa₂S₄ crystal is of interest in the context of the generalized oscillation model [1]. Obtained dispersion parameters are presented in Table 1.

Consequently from the correlations between E_{dtheor} with f_i and E_{dexp} obtained experimentally at different polarizations of the incident radiation the ionicity at the [010] direction is maximal.

References

1. Wempile S.H., DiDomenico M. Behaviour of the electronic dielectric constant in covalent and ionic materials. Phys. Rev. B. – 1971. – V.4, N4. – P. 1338-1351.

Fig. 1. Dispersion of refractive indices n_a (circles), n_b (triangles), and n_c (squares) for the PbGa₂S₄ crystal.

Table 1.

The dispersion parameters of a PbGa₂S₄ crystal

Crystal axes PbGa ₂ S ₄	E_d , eV	E_0 , eV	β
a	23.772	4.515	0.248
b	23.054	4.226	0.240
c	24.140	4.646	0.251
Mean values	23.655	4.462	0.246