ABM 22P INTERFERENCE OF BIREFRACTIVE WAVES IN $ZnAl_2Se_4:Co^{2+}$ CRYSTAL

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The anisotropy of reflection, transmission and wavelength modulated reflection and transmission optical spectra of $ZnAl_2Se_4$ crystals doped by cobalt were investigated at 10 and 300 K. Intersections of refractive indices spectral dependences of ordinary and extraordinary waves (isotropic wavelengths λ_0, λ_{01}, λ_{02} and λ_{03}) were revealed in the region of electron transitions from Co^{2+} ions and in the depth of absorption band (λ_{04}, λ_{05}, λ_{06} and λ_{07}).It was found, that the spectral dependence $\Delta n=n(E\perp c)-n(E\|c)$intersects the zero axis in all values of isotropic wavelengths as in transmission region and in the depth of absorption band. The bands observed in reflection spectra of crystals in parallel and crossed polarizers at isotopic wavelengths have half-widths around 7 - 15 Å. Refractive indices in isotropic wavelengths change in 10^1 - 10^3 times. Narrow-band filters of different wavelengths could be created on the base of $ZnAl_2Se_4$ crystals doped by cobalt.

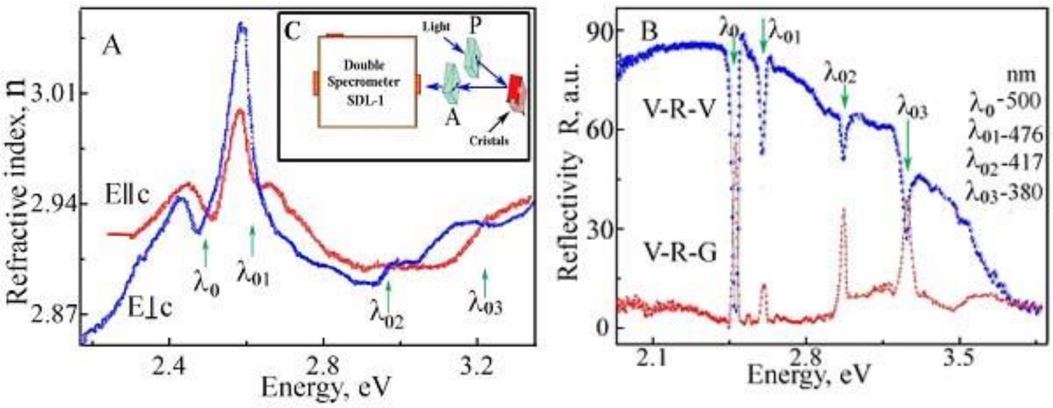

Fig. 1 A - Spectral dependence of refractive indices for E||c and E⊥c polarizations. B - Reflection spectra in parallel (V-R-V) and crossed (V-R-G) polarizers. C - Scheme for measurements where A is analyzer and P is polarizer.

The intersections of spectral dependences of refractive indices for ordinary and extraordinary waves in the region of cobalt ion levels (isotropic wavelengths λ_0, λ_{01}, λ_{02} and λ_{03}) and in absorption depth (λ_{04}, λ_{05}, λ_{06} and λ_{07}) were found out. It was established that the spectral dependence of $\Delta n=n(E\perp c)-n(E\|c)$ intersects the zero axis in all isotropic wavelengths as in extrinsic and in intrinsic regions of absorption. The calculated phase difference possesses zero values in isotropic wavelength. Figure 1, A shows the spectral dependences of refractive indices in E||c and E⊥c polarizations. One can see on figure 1 that refractive indices spectra for different polarizations cross in four isotropic points. Figure 1, B shows reflection spectra measured for parallel polarizers. Figure 1, C shows a measurement scheme where our sample was put between polarizer (P) and analyzer (A).

Sharp lines observed at energies of isotropic wavelengths in reflection spectra of crystals deposed between parallel and crossed polarizers havehalf-width∽7-15 Å. The magnitude of absorption coefficient in isotropic points changes in 10^3 times. Such structures can be used as narrow-band filter for respective wavelength.

Revealed isotropic wavelengths connected with absorption and reflection processes on impurity levels of Co^{2+} allow to develop multi-wavelengths narrow-band filters (or band pass filters). Presence of isotropic points in short-wavelengths of visible spectrum videlicet in region of fundamental absorption of birefractive crystals permits to create narrow-band filters for nanoelectronic devices.