MSC.35P INTERFERENCE OF RESONANCE LUMINESCENCE OF EXCITON POLARITONS IN $CuGaS_2$ CRYSTALS

N.N. Syrbu[1], I.G. Stamov[1], V.N. Bejan[1], V.E. Tezlevan[2], L.L. Nemerenco[1]

[1]*Technical University of Moldova, MD-2004 Chisinau, Moldova*
[2]*Institute of Applied Physics, Academy of Sciences of Moldova, MD-2028, Chisinau, Moldova*
lnemerenco@yahoo.com

Excitons spectra in crystals $CuGaS_2$ are investigated, in which the basic and excited states (n = 1, 2 and 3) of excitons Γ_4 and Γ_5 are found. The resonant luminescence ant its interference is found in the range excited states of excitons Γ_4 and Γ_5.

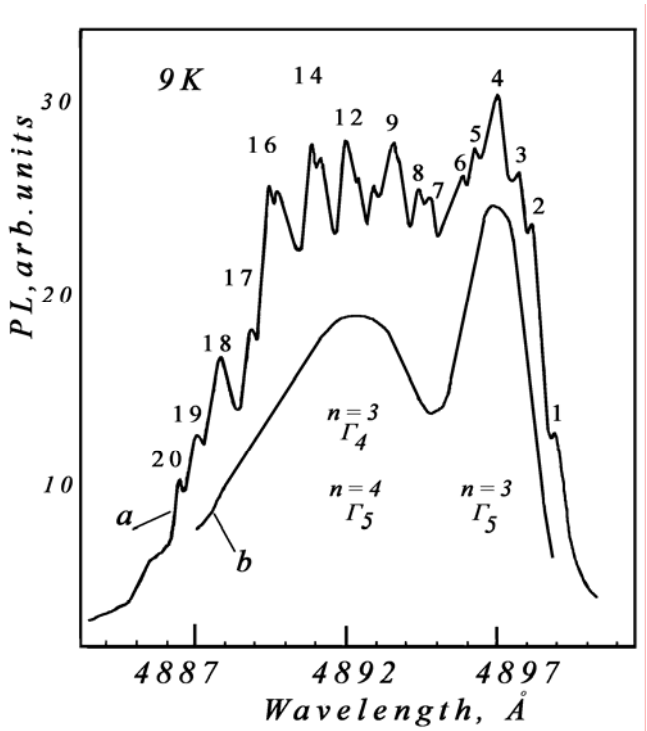

Fig.1 The interference in the luminescence spectra of thin (d ~0.6 μm) $CuGaS_2$ crystals excited by the lines 488 nm of Ar^+ laser.

Interference in the luminescence spectra is observed in the samples of the thickness 0,5-1,5 μm (Figs.1). At excitation by the line 4765 Å of the Ar^+ laser the radiation bands are not practically found, i.e. their intensity is very weak. We consider that the observed radiation possesses a resonance character, because the excitation energy of 2,5402 eV is close to the lines n = 2 of the exciton Γ_4. In these luminescence spectra another peculiarity is observed too. The intensity of the interference bands (bands 3, 2, 1) decreases as the wavelength increases relative to the central band of radiation of 2,5307 eV. From the short-wave side the intensity of the interference bands (bands 19, 20) also decreases as the wavelength decreases relative to the band 2,5332 eV. Interference takes place at three frequencies where the energies n = 4 of the exciton Γ_5 and the energies n = 2 of the exciton Γ_4 coincide. We consider that at excitation of these states there occurs an exchange between two polariton branches, i.e. the exchange between ω_t of the state n = 2 of the exciton Γ_4 and ω_t (or ω_L) n = 4 of the exciton Γ_5.

Taking into account the absorption coefficient for excitons Γ_4 and Γ_5 it may be surely considered that the Fabry-Perot interference at the thickness d~0,5-1,5 μm takes place only for the exciton Γ_5 wave. For the waves of the excitons Γ_4 these thicknesses are opaque. These waves appearing in the surface region attenuate before reaching the second face of the crystal. It should be noted that the oscillator strength of the exciton Γ_4 is much lager than that of the exciton Γ_5 in the polarization EIIc and E⊥c. Therefore, the state n = 2 Γ_4 of the exciton polariton is excited, it causes an excited polariton wave of the exciton Γ_5 (in the region n = 3 and n = 4) by the energy exchange. From calculations of interference of luminescence spectra are restored polariton branches of exciton polaritons Γ_5.

References

1. V. M. Agranovich and V. L. Ginzburg, Crystal Optics with Spatial Dispersion and Excitons (Nauka, Moscow, 1979; Springer-Verlag, New York, 1984).