ISSN 2229-5518

The change in the coefficient of absorption and reflection irradiated GaP.

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Summary: Studied the spectra of absorption and reflection of single crystals of GaP, non -irradiated and irradiated Φ=1016el/cm2 and by E=6MeV with fast electrons dose found that after irradiation the plasma minimum shifts to the long wavelength side by 0.3EV and the absolute reflection is reduced by 10%.

Introduction

GaP –wide gap semiconductor, which receive visible light sources. To improve the quantum yield of the diode GaP is the problem of reducing concentrations without radioactivity levels in the crystal, the solution of which is impossible without the accumulation of information about the properties of the structure.

Beams of accelerated particles convenient instrument for controlled introduction of changes in the type and concentration with help of penetrating radiation can be adjusted to unify the characteristics of the devices.

The work examines the GaP single crystals before and after irradiation with fast electrons dose $\Phi=10^{16}$el/cm^2 and by E=6MeV at 300 K. The absorption Spectra were recorded on spectrophotometer "SPECORD-75-IR" wavelength interval "0.2-25 micrometer" at 300K.

The samples were grown by the Chokhralski method and fabricated plate size 20·12 mm^2 and a thickness of 200 microns and polished on both sides and have been processed with ethyl alcohol.

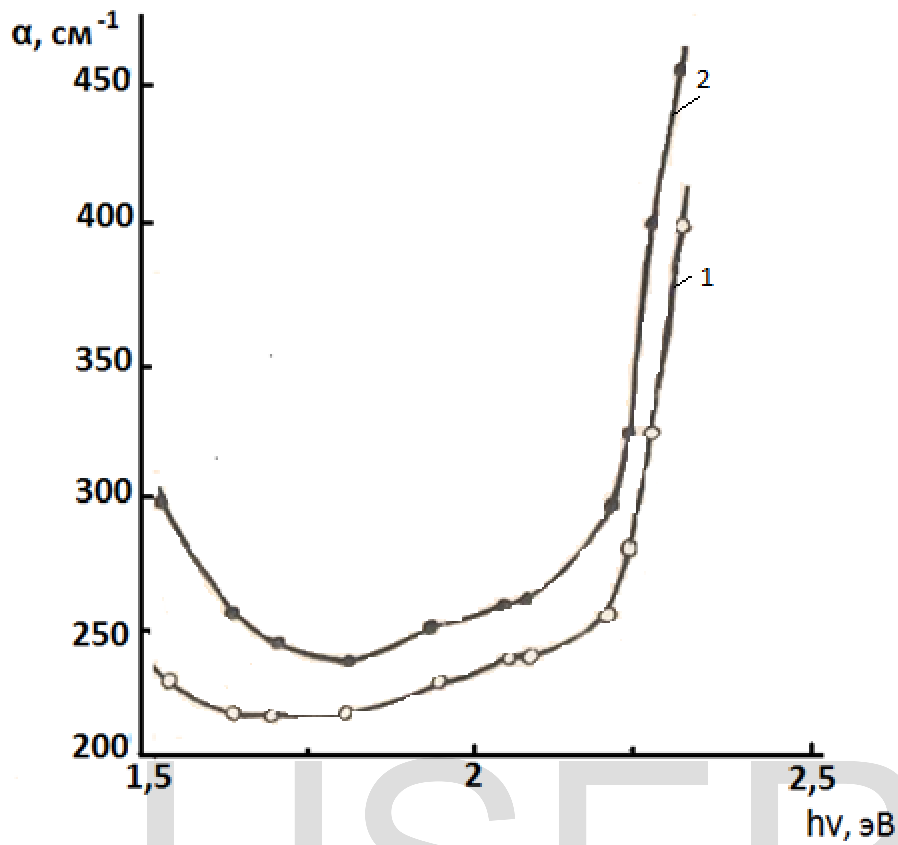

Fig.1. Absorption spectrum in the region (1,35 – 2,48) eV up to (cur. 1) and after irradiation (cur. 2) of a GaP crystal.

The figure 1 shows the absorption spectrum of GaP before and after irradiation. Clearly visible in the figure that the absorption shifts to the long wavelength region, apparently due to the radiation geek time. This shift is equal to 0.13 EV. The observed decline of E_g associated apparently with a noticeable reduction of the band gap [1,2] with the formation of radiation defects.

As can be seen following the introduction of the point defects in crystals GaP, there is a shift of the curve absorption goes to large wavelengths. And a comparison of our results with the data on the change region absorption under electron irradiation absorption changes in the area off the edge has much more. The change shown for compound A^3B^5, the value of specific

deformation appropriate to the one point radiation defects, almost an order of magnitude greater than the crystals in InP<Zn>.[3]

The following of our results of the chemical doping did not significantly affect around the regional absorption.

This leads to the conclusion that the main reason for changes around the boundary absorption during irradiation of crystals of GaP is the deformation of the crystal lattice due to the introduction of radiation defects.

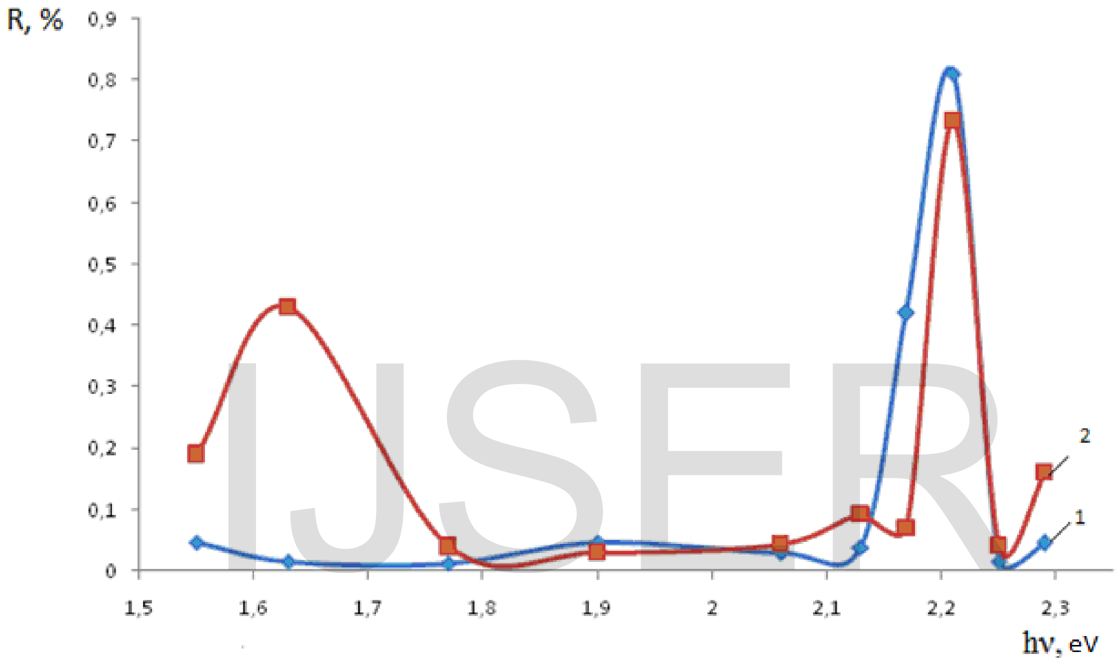

Figure 2. The reflection spectrum of the crystal GaP region (1,5 – 2,3) eV up to (cu. 1) and after (cu. 2) irradiation with fast electrons.

The figure 2. shown the spectrum reflected in the "1.5-2.3 eV" in GaP crystals non-irradiated and irradiated with fast electrons obtained by literature data [4].

As can be seen from figure 2 the region of 2.2 eV (kr2.) discovered the maximum of reflection that correspond to lines and the associated by excitons at 2.2 eV according to the literature data [5]

With exposure to the value of the maximum decreases, which is associated with the formation of radiation defects.

The observed peaks at energies of 2.12 and 1.62 in figure 2 , curves 1 and 2 after irradiation indicate the formation of radiation defects. A maximum at

energy of 2.13 eV corresponds to the results. Externally effects lead to a shift in energy of the valence bands and conduction and lowers the crystal symmetry and, as a consequence splits the degenerate heavy and light holes the point d corresponding to the center of the Brillouin zone (point G). the energy level is 1.63 eV correspond to non-defect [PGaGaP] predicted earlier by VanVechten.

As can be seen from Fig.2, there is a shift of the plasma minimum irradiation wavelength side.

Conclusion

So, it is shown that in irradiated samples GaP the plasma minimum is shifted to wavelength side by 0.3 eV; indirect transitions to exciton levels, the absolute maximum of exciton reflection is nearly 10%, resulting in an increase in absorption due to decrease concentration of free charge carriers effective mass in the region of the plasma minimum is reduced.

Literature

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