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Research Article

THE EFFECT OF Γ-IRRADIATION ON PHOTOLUMINESCENT PROPERTIES OF CDZNSE /ZNSE QUANTUM PITS

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ABSTRACT

In this paper, the effect of irradiation with γ-quanta Co60 on the optical characteristics of single and several compressed-stressed CdZnSe /ZnSe is a composition with a composition x = 0.2-0.4 grown by molecular-beam epitaxy. The breakdown of quantum pits after irradiation by γ-quanta was studied.

KEYWORDS

Radiation, energy shift, phl-intensity, deformation.

INTRODUCTION

One of the problems that restrave the creation and commercial use of lasers for a visible range based on the ZnSe / CdSe heterostructure and its solid solutions (with quantum yams, QW, as active elements [1]) is associated with degradation processes caused as laser generation, electronic or optical pumping [2]. When the laser degradation is raised, the formation, propagation and reproduction of extended defects (dislocations) in the active area and outside it, and the process of gradual degradation is dominated by recombination and accelerated defect reactions in the active zone.

EXPERIMENTAL RESULT

In fig. 1 shows typical spectra of FL (T = 4.2 K) for heterostructures with single QW (samples 1-3) before and after irradiation. The radiation intensity of the QW (IQW band) significantly exceeded the intensity of the radiation of the barrier and buffer layer ZnSe. The IQW band is due to the emission of a free exciton formed by an electron and a heavy hole (heavy exciton), and a weaker strip, located from the high-energy side, is due to the emission of free exciton formed by an electron and light hole (easy exciton). The energy position of IQW depended on the parameters of the QW and shifted from i1 = 2.602 eV (476.5 nm) (curve a) to i2 = 2.436 eV (509.0 nm) (curve c) and further ih = 2.398 eV (517 nm) (curve d) by The extent to increase the CD content in the pits of the same width of 5 nm. For a width of 9 nm with x = 0.24, a strip was observed with a maximum I2 = 2.591 eV (478.6 nm) (curve B). When the nitrogen laser is excited (λEX = 337.1 nm), the carriers were mainly generated in the cover and barrier layers of ZnSe, at a depth of 1 / α + Id≈0.6 μm [3], where the α-absorption coefficient, LD diffusion length of non-core carriers, equal to ≈0.5 μm . PL spectra of samples 1-3 in the exciton region ZnSe contained a set of lines caused by the radiation of free and related excitons. For comparison, the same figure shows a spectrum of the PL epitaxial ZnSe layer, ES, a thickness of 1.5 μm, deposited on a semi-insulating GaAs substrate according to the technology described in [4] (curve c). The SF spectrum from ZnSe epitaxial layer contained a band Ifxlh = 2.802 eV (442.6 nm) corresponding to the exciton splitting the stretching voltages into two components (IFXhh component was not clearly resolved and manifested with a larger reinforcement in the form of a shoulder from the high-energy side) and the I2Ga = 2.796 eV strip (443.5 nm), corresponding to the EXITON, associated with neutral donor. An intensive strip IV = 2.773 eV (447.1 nm) was also observed, corresponding to the extended defects [5] and Y0 band with IY0 = 2.602 eV (476.5 nm). Undoped CdZnTe/ZnTe structures had been grown by molecular-bean epitaxy. Amorphous ZnTe was deposited on a (100) semi-insulating GaAs wafers with subsequent soild-phase crystallization of this seeding coat and epitaxial growth of 1,5 m ZnTe buffer epitaxial layer on the initial nucleation bed [3].

After this operation CdXZn1-XTe quantum well and tunnel transparent ZnTe barriers had been composed. Cd content in the quantum wells was controlled using low-temperature luminescence and reflectance spectra

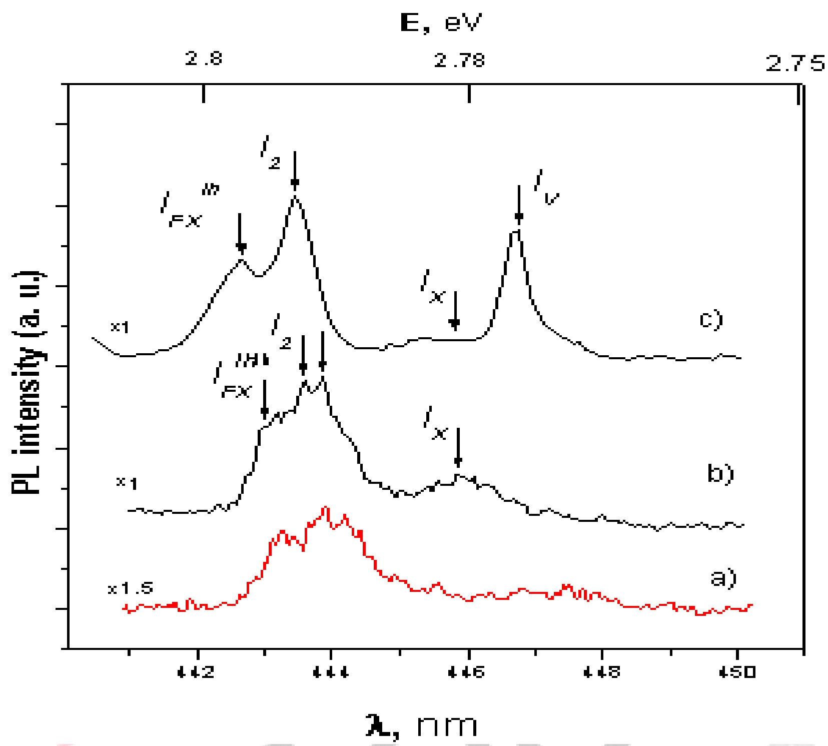

Fig-1. Low-temperature FL spectra of the ZnSe buffer layer of sample single quantum pit CdZnSe /ZnSe QW (№3) to (b) and after irradiation (a). For comparison, the spectrum of the PL of the epitaxial ZnSe layer, a thickness of 1.3 microns, is given.

With a short-wave side of the IVo strip, the IX strip was observed, probably due to extended defects. In the spectra of FL from the cover and barrier ZnSe layers on samples with the QW, the above-described series of bands in the near-oral region persisted. As the CD content increases (at the same time, the magnitude of the mismatch of the parameters ZnSt and CdZnSe /ZnSe lattices) increased the energy splitting between IFXLH strips, and ifxhh, which corresponded to the displacement of the IFXLH strip towards large energies. That. With increasing CD content, the magnitude of the elastic deformation in the ZnSe layer near Kya increased. On some samples, the I2GA band looked in the form of a double, which is associated with the presence of two types of donors in deliberately unfounded layers. In some cases, the IX = 2.789 (446 nm) band was also manifested, the position of which did not change from the sample to the sample (that is, it practically did not depend on the stresses) and did not depend on temperature. This testifies in favor of the connection of the IX band with extended defects. After exposure, there was a change in the type of PL spectra from both the pits and the ZnSe buffer layer. In the spectra of NT FL from quantum wells, after

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irradiation, the position of the IQW strip (heavy exciton) is shifted on the samples 1 and 2 towards smaller energies, and on the other in the direction of large energies (curves C,). The integral intensity of radiation, as a rule, decreased weakly (on sample 3 it practically did not change), and half-width increased somewhat. At the same time, the maximum emission of light exciton is less intense band, (1elh transition) also moved to the lower energies area, for images 1, 2; Practically did not displaced for sample 3. The ilhqw offset value, as a rule, exceeded the displacement value of the basic IQW band. The PL spectra in the exciton region of the buffer ZnSe layers near quantum wells after irradiation were also transformed.

CONCLUSIONS

The mechanism of radiation accelerated degradation CdZnSe /ZnSe QW was explained with the (I) of the significant influence of the alternate fields and their relaxation;

(ii) accelerated deformation and concentration gradients near the diffusion of a more movable element of the CD cationic cationic;

(ii) inhomogeneous in the depth of the original defective structure of the samples-cluster VZn near the GR-QWa barrier. The radiation-accelerated micromechanism diffusion of the element of the cationic junction, taking into account the vacancies of the same junction.

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