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УФТ

The Study of the Optical Properties of CdTe Thin Films Doped with Ytterbium

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Obtaining CdTe films of high optical quality is a very important task in the physics of semiconductors, since such films can be used to develop on their basis new materials for optoelectronic devices, and for elaboration of solar cells. Incorporation of rare earth elements (RE) into CdTe films leads to the gettering of residual impurities. Thus, their optical quality are improved.

CdTe films doped with ytterbium were deposited by close-spaced vacuum sublimation [1] on a glass substrate under different temperature conditions: the evaporation temperature of CdTe was equal to 700 ° C and the substrate temperatures Ts = 450, 475, 500°C for different samples, respectively.

It should be noted that characteristic feature of these films is observation of the free exciton in the reflection (ER) spectra at 4.5 K. The free excitons appear at Eex = 1.5964 eV and the distance between the minimum and the maximum of the dispersion curve is about 15 cm^{-1}.

The studies of the photoluminescence spectra (PL) at T = 4.2 K have shown thata line (λ = 777.4 nm) appears in the exciton region of the PL spectrum due to the recombination of excitons localized on the crystal field fluctuations as well as a line caused by the recombination of the donor-bound excitons (λ = 778.2 nm). In the PL spectrum, the bands (λ = 800.0 nm and 804.0 nm) are also observed due to the optical transitions of electrons from the conduction band to the acceptor level (e-A transitions) and the transitions from the donor level with the io nization energy of 14 meV to the acceptor level. An intense band is observed in the region of 840.0 nm due to the presence of complex intrinsic defects of the acceptor type consisting of a Cd vacancy (V^{2-}_{Cd}) and an ionized donor (D^{+}). Here in the long-wavelength region the phonon replicas of LO-, 2LO and -3LO are observed.

In addition, in the near infrared region, a band appears whose energy position is E = 1.3137 eV. According to [2], this band can be caused by the intracentral emission of Yb.

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[2] R.Boyn, Phys.Stat. Sol. (b)148 , 11 (1988).