Functional Materials 10, No.1 (2003)

Radiation-induced modification of optical and photoelectric properties of cadmium diphosphide crystals

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Received May 11, 2002

CdP_2 crystals of tetragonal modification have been studied grown using the static sublimation technique and from the melt. The radiation-induced defects were generated by ^{60}Co γ-quanta and electrons of 14 MeV energy. It has been established that it is just the defect accumulations and the oxygen-containing impurity-vacancy complexes that are the main optically active centers in the irradiated CdP_2.

Исследовались кристаллы CdP_2 тетрагональной модификации, выращенные методом статистической сублимации и из расплава. Радиационные дефекты вводились γ-квантами ^{60}Co и электронами с энергией $E = 14$ МэВ. Установлено, что основными оптически-активными центрами в облученном CdP_2 являются скопления дефектов и вакансионно-примесные комплексы, в состав которых входит кислород.

Cadmium diphosphide single crystals are highly optically active. Kerr cells, penetrating radiation dosimeters [1–4] as well as some other optoelectronic and nonlinear optical devices [5] can be developed basing thereon. In this work, the influence of radiation-induced defects on the formation of optically active centers has been studied in tetragonal cadmium diphosphide crystals grown from vapor phase and melt as well as temperature resistance thereof.

The CdP_2 crystals to be studied were grown using the static sublimation technique (Group A) and from the stoichiometric melt (Group B). The samples for examination were obtained by cleaving along the (100) cleavage plane (Group A) and by cutting follower by polishing (Group B). The crystals were irradiated at 300 K, the maximum doses were 10^8 rad (^{60}Co γ-quanta) and 10^{18} cm^{-2} (14 MeV electrons). The isochronic annealing duration was 15 min. The absorption spectra were measured using a SPECORD M40 spectrophotometer. The stationary photoconductivity was measured by the usual technique [6, 7] at the fixed 400 Hz modulation frequency using a MDR-3 diffraction spectrometer.

In Figs. 1 and 2, presented are absorption spectra of CdP_2 crystals grown using the static sublimation technique (A) and from the stoichiometric melt (B). The irradiation by 14 MeV electrons has been established to cause a red shift of the fundamental absorption edge (Figs. 1, 2). The shift value depends on the light beam polarization (Fig. 2, curves 2 and 3). Broad selective absorption bands with maxima at $h\nu_1 = 1.66$ eV and $h\nu_2 = 1.84$ eV are observed in irradiated crystals, too (Fig. 2). As the irradiation dose rises, the band at $h\nu_1$ increases its intensity while the peak height at $h\nu_2$ remains unchanged. The band at $h\nu_2 = 1.84$ eV is observable only for crystals grown from the stoichiometric melt. This was noted also in [8–11].

The transmission recovering under annealing of irradiated samples is observed in