Contribution ID: **173** Type: **Poster presentation**

The effect of laser radiation on CdZnTe radiation hardness.

Monday, 4 July 2011 12:46 (1 minute)

It was noted that radiation damage occurs in semiconductor radiation detectors during their operation, while measuring ionizing radiation, which impairs the ability of the device [1]. The main expressions of radiation damage are: the increase of leakage current in a semiconductor detector, the need to increase the bias voltage, reduction of the efficiency of collecting the charge created by ionization.
The aim of this work is to study the possibility to increase the radiation hardness of Cd0.9Zn0.1Te crystal using laser radiation. Pulsed Nd:YAG laser for this aim was used. Estimation of the crystalline lattice defects before and after irradiation by γ-ray using photoluminescence method in the experiments was applied.
Irradiation of Cd1-xZnxTe crystal by γ-ray with of 60Co (E=1.2MeV) a dose rate of 5×105 Rad = 5.0 KGy leads to strongly increase of A0X band intensity in PL spectra of Cd1-xZnxTe crystal by 10 times. In the same time D0X band in PL spectrum of Cd1-xZnxTe crystal disappears fully. We explain it by Cd vacancies generation and localization in the excited luminescence thin layer after γ-irradiation of Cd1-xZnxTe crystal.
The main effect observed in the study is suppression of VCd generation and /or localization by γ-radiation at the irradiated surface of Cd1-xZnxTe crystal if the crystal preliminary irradiate by the laser. The phenomenon increases with intensity of the laser in region of the laser intensity up to 0.50 - 2.0 MW/cm2. The intensity of A0X band in PL spectrum of Cd1-xZnxTe crystal increases only 1.7 times (for comparison, non-irradiated by the laser 9.3 times) after γ-radiation if the crystal preliminary was irradiated by the laser at intensity 1.2WM/cm2.
The mechanism of this effect is explained in the following way: γ- radiation leads to generation of additional VCd near the surface layer, which causes an increase of A0X band in PL spectrum. Laser radiation has an opposite effect on Cd0.9Zn0.1Te crystal: interstitial Cdi atoms are concentrated near the irradiated surface layer, but vacancies in the bulk of semiconductor according to TGE. This leads to increase of D0X band intensity in PL spectrum. Increase of Cd atoms concentration nearby the surface layer leads to increase of materials radiation hardness because Cd atomic weight is larger comparing to other atoms in Cd0.9Zn0.1Te crystal - Zn and Te [2].

REFERENCES
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Session Classification: Poster MiniTalks I

Track Classification: Sensor Materials, Device Processing & Technologies