Swift Xe^{26+} ion irradiation effect on structure and luminescent properties of undoped and Cd-doped ZnO films

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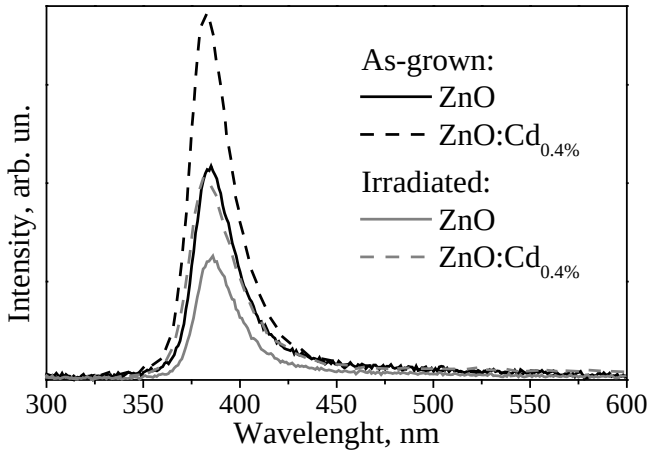
Trends in the electronic engineering lead to the conditions for technological breakthrough in the field of power electronics and optoelectronics. The basis of this breakthrough is a new class of semiconductor materials - wide-gap semiconductors (GaN, ZnO, SiC) and various heterostructures based on them. They can be used at high temperatures (400-500°C) and high voltages (3MV/cm). Another important property is their stability in extreme conditions under high radiation. According to above mentioned factors the most promising candidate for these applications is ZnO [1]. The benefits of zinc oxide are low cost and large reserves of raw deposits. ZnO is one of the most promising materials suitable for using in high background radiation, for example, in outer space [2, 3]. It is due to large degree of ionicity of the chemical bonds. The fraction of swift heavy ions (SHI) in spectrum of the galactic cosmic rays is about 1 % only, but they have the most damaging ability due to high level of specific ionization energy losses.

ZnO films were deposited on the *c*-sapphire substrates at the temperature 400 ºC using the radio frequency magnetron sputtering technique. The films were irradiated by Xe^{26+} ions with energy of 167 MeV to a fluence 3×10^{12} ions/cm^2. Irradiation was performed using IC-100 cyclotron at Flerov Laboratory of Nuclear Reactions JINR, Dubna. As-grown and irradiated samples were investigated by X-ray diffraction and cathodoluminescence (CL).



CL spectra of as-grown and swift Xe ion irradiated undoped and Cd-doped ZnO films

It was found that after irradiation Cd-doped ZnO films in comparison with undoped ones demonstrate an increasing a size of coherent scattering regions.

The CL intensity for as-grown Cd-doped ZnO is 1.6 times higher than its value for undoped ZnO. After SHI irradiation the CL intensities of both samples decrease. However, ratio of the CL intensity for irradiated Cd-doped/undoped ZnO increases and is 1.8. It means that Cd makes ZnO more resistant to radiation by Xe^{26+}.

The effect of swift Xe ion irradiation on the properties of undoped and Cd-doped ZnO films is discussed.

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