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REI-20
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20th International Conference on Radiation Effects in Insulators

Book of Abstract

19 August – 23 August, 2019
L.N.Gumilyov Eurasian National University, Nur-Sultan (Astana) Kazakhstan

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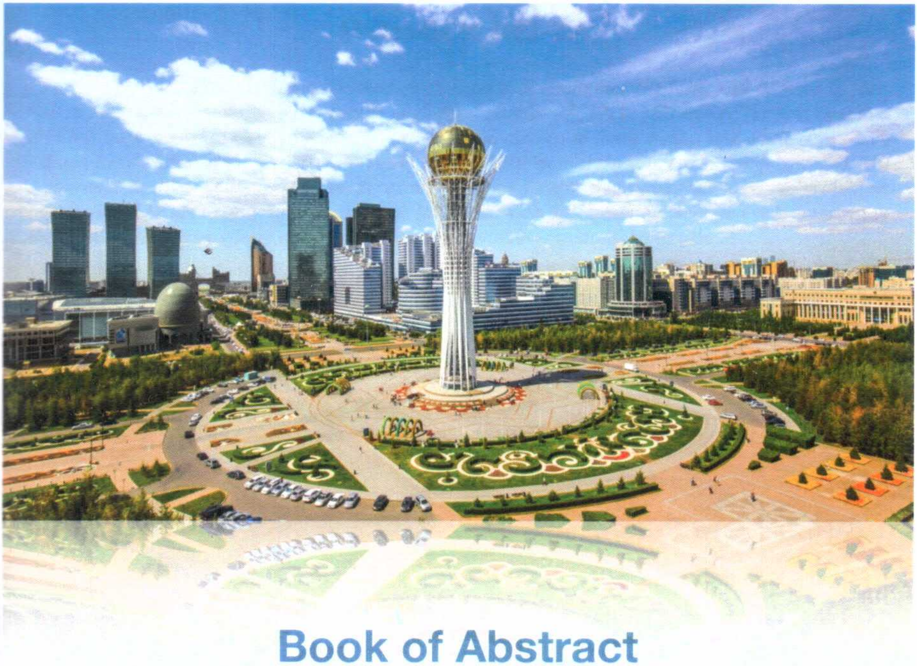

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Radiation resistance of nanocrystalline gadolinium oxide films studied by the exoelectron emission method

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Gadolinium oxide (Gd_2O_3) based nanomaterials are of interest as contrast agents for magnetic resonance imaging (MRI) guided radiation therapy [1,2]. Therefore, it is important to investigate radiation resistance of Gd_2O_3. In this research, radiation resistance of nanocrystalline Gd_2O_3 films were studied by exoelectron emission (EE) method. During the irradiation, electrons can be excited from the valence band and trapped by surface states. The trapped electrons can be released by thermal or photo stimulation and detected. The released electrons are called exoelectrons and are emitted from a surface depth with thickness less than 10 nm. Small electron escape depth makes EE an attractive method to study doses of radiation absorbed by nanomaterials [3–5].

Nanostructured Gd_2O_3 films were deposited onto a Si-SiO_2 substrate by an extraction-pyrolytic method. Chemical composition corresponding to Gd_2O_3 was confirmed by Fourier transform infrared spectroscopy (FTIR) and X-ray photoelectron spectroscopy (XPS). X-ray diffraction (XRD) revealed formation of the monophasic Gd_2O_3 with cubic crystal structure. Surface morphology of the samples was characterized by scanning electron microscopy (SEM) and atomic force microscopy (AFM). Radiation resistance of the deposited films was studied within a therapeutic range of gamma radiation (0–20 Gy) and at higher doses (1 kGy). Photo-thermo-stimulated EE spectra of Gd_2O_3 films were recorded before and after the irradiation. Photo and thermal stimulation was delivered simultaneously. Thermal stimulation was provided from room temperature to 550 °C. For photostimulation, a value of wavelength close to the photoelectric work function of Gd_2O_3 was used. The results demonstrated that the area below EE spectra decreased with increase in the dose. These results suggest that gamma radiation releases electrons that were trapped by localized states of Gd_2O_3 before the irradiation.

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