- **Physico-chemical nanomaterials science**

The influence of defects on the properties of Si-Gd-O cathode

M.G. Nakhodkin, M.I. Fedorchenko

Taras Shevchenko National University of Kyiv, 64/13, Volodymyrs'ka Str., Kyiv-01601, Ukraine,. E-mail: mifedorchenko@gmail.com

The research of Gd atoms oxidation on Si (100) surface led to the creation of a surfaces with low work function $\phi \approx 1$ eV [1,2], which can be used as an effective photocathodes. The photoemission threshold was equal to ≈2.7 eV. According to our model [2], the near-surface region of a photocathode, about 1 nm in thickness, consists of Gd_2O_3 with the energy gap width of about 5.3 eV. The distance from the Fermi level (E_F) to the conduction band bottom equals about 2.7 eV in the Gd_2O_3 bulk. The model assumes that significant influence on the processes of photoemission from the photocathode have bulk localized electronic states located in the forbidden gap below the E_F and free surface states, which are located between the conduction band bottom and the vacuum level.

The aim of this work was to investigate of the impact of defects on properties of the Si-O-Gd photocathode to test the proposed model of its electronic structure. Defects were created after adsorption of additional layers of Gd and O atoms on the photocathode surface and after the bombardment of the photocathode by Ar ions. Changes of the electronic properties of the photocathode have been studied by using the methods of photoelectron (hv=2.8-10.2 eV) and Auger electron spectroscopy.

The studies have shown that after deposition of additional layers of Gd and O on the cathode surface, as well as after the bombardment of the surface by Ar ions the intensity of individual parts of photoelectron spectra, the surface work function and the intensity of Si LVV Auger line varied considerably. The results are explained by change of bulk localized states concentration in the Gd_2O_3 band gap and free surface states between the vacuum level and the conduction band bottom.

1. *Nakhodkin M.G., Fedorchenko M.I* Interaction of oxygen and gadolinium with Si(100)-21 suface/ Formation of a system with 1-eV work function // Ukranian Journal of Physics.-2015.-**60**, N 2.-P. 97-103.
2. *Nakhodkin M.G., Fedorchenko M.I* Photoelectron emission from Si–Gd–O cathode // Ukranian Journal of Physics.-2016.-**61**, N 3.-P. 259-265.