

- **Physico-chemical nanomaterials science**

The electronic and structural properties of the Si-Gd-O cathode

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In the study of the formation of a multilayer structure of oxidized Gd atoms on Si (100) [1,2] was found the possibility of creating photocathodes with work function $\approx 1\text{eV}$. According to the model [2], the near-surface region of a photocathode consists of the Gd_2O_3 thin film. On the surface of the film, O-Gd dipoles are created, responsible for the low work function of the system. Our researches, however still not established the nature of the products of oxidation. It was not exactly known or oxidation products are a mixture of oxides of Si and Gd or its nanoclusters. Nothing was known about the cathode surface morphology and distribution of surface potential.

The aim of this work was to investigate of the properties of the cathode using the methods of electron spectroscopy, X-ray diffraction and reflectometry, atomic force and Kelvin probe force microscopes for obtaining the information on the electronic properties of the cathode, structure of the near-surface layer, the surface morphology and distribution of surface potential.

It was found the near-surface layer of cathode is a polycrystalline Gd_2O_3 containing textured GdO_2 and SiO_2 crystallites. The surface uniformly covered with nano-dimensional clusters (density about 310^7 cm^{-2}). Their diameters ranged by 50-70 nm and a radius of surface curvature of the 60-80 nm. Clusters demonstrate peculiarities of local surface potential, detected by Kelvin probe force microscopy. Comparison of structural and electronic properties of Si-Gd-O cathode allowed improving the model of its energetic structure.

1. *Nakhodkin M.G., Fedorchenko M.I* Interaction of oxygen and gadolinium with Si(100)-21 surface/ Formation of a system with 1-eV work function // Ukrainian Journal of Physics.-2015.-60, N 2.-P. 97-103.

2. *Nakhodkin M.G., Fedorchenko M.I* Photoelectron emission from Si-Gd-O cathode // Ukrainian Journal of Physics.-2016.-61, N 3.-P. 259-265.