



Sensitivity to vapors of ethanol of thin films of SnO₂ alloyed by fluorine after isothermal annealing

E. Dmitrieva, S. Ibraimova, E. Grushevskaya, I. Lebedev, K.A. Mit,
D. Mukhamedshina, A. Fedosimova, A. Serikkanov

Institute of Physics and Technology, Satbayev University, Ibragimov 11, Almaty, Kazakhstan

E-mal: *grushevskaiya@bk.ru*

Films of tin oxide are intensively used as a sensitive element of sensors for the determination of various gases in atmospheric air [1]. The principle of operation of these sensors is based on the modulation of the near-surface space charge region and the change in the electrical resistivity of film crystals upon adsorption of gas molecules. In order for physicochemical processes to proceed quickly on the surface of the sensitive layer, providing a response time of several seconds, the sensor is heated to a temperature of 100-450 °C, which "activates" its surface. Sensors are used by environmental services, chemical enterprises, in oil and gas industry - wherever it is necessary to make express measurements of the concentrations of such gases as: propane, methane, hydrogen, vapors of ethyl alcohol. For a long time, thin films are in a state heated to 400°C. Determining how long the film can retain its useful properties in the operating mode is an actual scientific and practical task.

In connection with the foregoing, in this paper, the goal was to analyze the influence of isothermal annealing (400°C) of doped tin oxide films on the surface resistance and the adsorption sensitivity to ethanol vapor.

In this paper, a comparative analysis of the effect of isothermal annealing (400°C) of tin oxide films doped with fluorine ions and films obtained without the addition of a fluorinating agent on the surface resistance and the adsorption sensitivity to ethanol vapor was carried out.

The annealing of films doped with fluorine leads to an increase in the surface resistance by two orders of magnitude, which is due to the removal of fluorine from the film composition and the formation of a large number of defects. Further annealing leads to a decrease in the surface resistance, which, apparently, is associated with a decrease of defects.

It is shown that the change in the hydrogen index of the film-forming solution leads to the formation of films with a thermostable sensitivity to ethanol vapor.

Acknowledgements

The work was carried out with the financial support of the Ministry of Education and Science of the Republic of Kazakhstan in the framework of the project No.AP05134263.

[1] Zhang Dongzhi, Wang Dongyue, Zong, Xiaoqi, Dong Guokang, Zhang Yong (2018). Sensors and actuators B-chemical, V.262, p.531-541, DOI: 10.1016/j.snb.2018.02.012