

STUDY OF RADIATION-THERMAL DECOMPOSITION OF WATER ON NANO ZrO_2 BY IR SPECTROSCOPY METHOD

A.A. Garibov, T.N. Agayev, G.T. Imanova

Institute of Radiation Problems, ANAS, Baku, Azerbaijan

gunel_ismayilova@rambler.ru

There have been studied radiation-thermal decomposition of water in nano- ZrO_2 in the temperature range 300-673K by Fourier IR spectroscopy method. By X-ray phase method there were revealed that the used sample possess centre symmetrical monoclinic crystal structure. It is shown that the adsorption of water in nanodioxide of zirconium occurs by the molecular and dissociative mechanisms. There were registered intermediate products of radiation-heterogeneous decomposition of water: ion radicals of molecular oxygen, hydrogen peroxide, zirconium hydride and hydroxyl groups. There were carried out a comparative analysis of changes of absorption bands of molecular water and surface hydroxyl groups from the temperature and detected the simulative role of radiation in the radiation-thermal decomposition process of water.

This paper presents the results of IR spectroscopic studies of radiation-thermal decomposition of water in a heterogeneous system of nano $\text{ZrO}_2 + \text{H}_2\text{O}$ at $T = 300-673 \text{ K}$ and impact of γ -quantum with the aim to establish the role of intermediate particles and identify regularities of adsorption-active hydroxyl groups in these processes.

In unirradiated heterosystem in the area of valency vibrations of hydroxyl (OH) groups after adsorption of water on the surface of dioxide of zirconium there is appear absorption bands, which indicates the flow of molecular and dissociative adsorption: molecular form of adsorption (intense broad band with maximum at 3280 cm^{-1} in the region $3500-3000 \text{ cm}^{-1}$) and dissociative chemisorption (relatively narrow bands with maxima at 3580 and 3450 cm^{-1}) (Fig. 1, curve 2). Occurrence of two types of adsorption also confirmed by the formation of PP in the area of deformation vibrations of OH with maxima at 1630 and 1600 cm^{-1} .

Changes in the intensities of absorption bands of molecular water, H-connected and isolated hydroxyl groups at a fixed dose of irradiation depending on the temperature of the radiation-thermal decomposition process of the water shows that there is an anti basic dependence between them.

Thus, an increase in temperature from 300 to 673 K is accompanied by full and partial destruction of molecular water and H-connected OH groups, respectively formation of isolated OH-groups.