CHARACTER OF CHANGES IN THE STRUCTURAL-PHASE COMPOSITION OF SiO_2 UNDER ELECTRON IRRADIATION IN AIR AND IN AN AQUEOUS ENVIRONMENT

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When RAW is buried in a geological environment, contact with groundwater occurs. The changes in the structure and phase composition of SiO_2, which is part of the natural granites of the Ukrainian Crystalline Shield, were assessed when irradiated in two environments: in air and in a water flow. SiO2 was irradiated with electrons up to D = $10^7 \ldots 10^8$ Gy at the linear accelerator "KUT-1" NSC KIPT.

According to X-ray structural analysis and IR- spectroscopy, it was shown that with increasing irradiation dose, crystallization of semi-amorphous SiO_2 was observed, and the sample density remained virtually unchanged. Improvement of the SiO_2 crystal structure was observed already at a dose of D=10^7 Gy in an aqueous environment, which may be due to the presence of hydroxyl groups in ionic and excited states. The density of SiO_2 before and after irradiation in air and in an aqueous environment remained virtually unchanged, and the microhardness increased due to the improvement of the crystal structure.

RADIATION RESISTANCE OF ZIRCONIUM DIOXIDE BY THE EFFECT OF BREMSSTRAHLUNG GAMMA RADIATION

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Zirconium dioxide ($ZrO_{2)}$, having a unique combination of mechanical and electrophysical characteristics, is used in almost all technological links of new generation electronic equipment. In many cases, the use of zirconium dioxide, due to its high acidity, is more preferable to use than oxides of other transition metals. The difference between ZrO_2 and other oxides is its tendency to phase transitions under irradiation (crystallographic modifications: monoclinic, tetragonal and cubic phases).

To activate monoclinic ZrO_2 samples with a maximum particle size of up to 5 μm, bremsstrahlung gamma radiation from LUE (electron energy 22 MeV, current 500 μA) was used (the irradiation was carried out personally by A.N. Dovbney). The gamma radiation spectrum was recorded by a Ge(Li)-detector. Data on the phase composition and crystal structure of ZrO_2 were obtained using X-ray diffractometry and IR spectroscopy.

According to the results of X-ray diffractometry and IR-spectroscopy, no peaks related to another phase of ZrO_2 or impurities were observed in the studied spectra. When comparing the spectra before and after gamma activation, no shifts of the maxima or distortions of their shape were found. The relative intensity and width of the peaks for the gamma-activated samples were similar to their initial state. Although for gamma-activated ZrO_2, the intensity of some lines slightly increased and, in addition, their narrowing was observed, which may indicate the formation of a more perfect crystalline structure of the oxide. Crystallinity for the gamma-activated ZrO_2 samples, as expected, reached almost 100%.

These results show that materials such as ZrO_2 have high irradiation resistance in bulk form.