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EFFECT OF PROTON IRRADIATION ON THE STRUCTURE AND PROPERTIES OF THE Al2O3 YSZ COMPOSITE CERAMICS SYSTEM

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In this study, the effect of proton irradiation on the structure and properties of Al2O3 –YSZ ceramics based on γ+θ-Al2O3 + n% YSZ (n = 0, 1, 5, 10, 15 wt.%) nanopowders was analyzed. The phase composition of the powders, the structure, physical and mechanical properties of the Al2O3 - YSZ ceramics were studied taking into account the YSZ concentration and the pressing pressure. We have found that various crystallization processes occur during the sintering of ceramics and two types of structure are realized: aggregate-hardened and disperse-hardened, depending on the HHP value. It is shown that the processing of compacts under HHP conditions at 600-700 MPa prevents the formation of agglomerates of YSZ grains in the intergranular space of Al2O3, and the maximum values of physical and mechanical characteristics are achieved at concentrations of 10 and 15% YSZ and HHP values of 700 MPa.
Irradiation of the synthesized ceramics of the composition γ+θ-Al2O3 + n% YSZ (n = 0, 1, 5, 10, 15 wt.%) was carried out on an EG-5 electrostatic accelerator. X-ray phase analysis showed that proton irradiation of the composite ceramics of the Al2O3 –YSZ composition did not cause changes in the phase composition of both phases (α-Al2O3 and YSZ) in the ceramic composite. It was also found that irradiation of the ceramics with a proton beam did not lead to the occurrence of macrostress fields (stresses of the 1st kind) on their surface, as indicated by the invariance of the lattice parameters in both phases before and after irradiation. The SEM method revealed the effect of crushing of ZrO2 grains under the action of proton irradiation, which leads to a decrease in the average grain size of the filler of the alumina matrix. Also, the study of the structure of ceramics after exposure to high-energy irradiation showed a strong effect of radiation-accelerated diffusion of zirconium dioxide grains in the aluminum oxide matrix.

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