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VIII ВСЕРОССИЙСКАЯ НАУЧНО-ПРАКТИЧЕСКАЯ КОНФЕРЕНЦИЯ С МЕЖДУНАРОДНЫМ УЧАСТИЕМ, ПОСВЯЩЕННАЯ 50-ЛЕТИЮ ОСНОВАНИЯ ИНСТИТУТА ХИМИИ НЕФТИ

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THE GRAIN STRUCTURE IN THE LAYER OF ZR-Y-O IN COATING ON THE BASIS OF Zr-Y-O / SI- AL-N DEPEND ON ANNEALING TIME AT 900^{O}C IN THE «IN-SITU» MODE

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Zirconium-based ceramics holds the leading place among the fire-resistant constructional materials as it retains the high mechanical properties up to 0.8–0.9 of the melting temperature of 3173 K. That is why ZrO_2 coatings are mainly used as the thermal barrier coatings in hot turbine sections and other engine units.

A special attention is paid to the reversible martensitic transformations in metal alloys (the so-called transformational conversion due to the practical use potential in many fields of science, technology, medicine and industry. These alloys belong to the group of the so-called "smart" functional materials, as they allow controlling their behavior [1]. These are transformation-hardening materials that are widely used in engineering practice as structural materials. The majority of such ceramic materials are developed based on zirconium dioxide that is partially stabilized in the tetragonal phase.

The purpose of this paper is to study the structural-phase state and the evolution of the grain structure of the multilayer coating based on Zr-Y-O/ Si-Al-N using high-temperature TEM at 900^{0}C at different annealing times.

The coatings deposition was carried out using KVANT-03MI unit equipped with a mosaic zirconium-yttrium target magnetron. The magnetron was powered from a pulse source at a frequency of 50 kHz. The samples were placed in the chamber on the rotating table. The sample temperature during the deposition was 573K. A study of the structural features of the coating was carried out on a DRON-7 instrument. The fine structure of the nanostructured coatings was studied by TEM using the JEM-2100 microscope.

It was shown by X-ray that annealing at a temperature of 900°C leads to an insignificant decrease in the monoclinic phase, a change in the predominant direction. The degree of tetragonality of the crystal lattice does not change, the size of the coherent scattering blocks decreases.

It has been established by TEM that the coatings on the basis of Zr-Y-O produced by the magnetron sputtering methods have a nanograin column structure where the columns are spread through the entire coating thickness.

At heating the layer in the TEM column in the "in-situ" mode one can observe a) martensitic transition of the tetragonal phase to the monoclinic one in temperature interval of 400-500°C, b) the grain size decreases compared with the initial grain size in the coating, c) the modification of the grain boundaries, i.e. their total length increases, the form of the grains changes, in initial column grains there are cross boundaries, which suggest the fragmentation of grains.

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