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MECHANICAL CHARACTERISTICS OF THE NANOSTRUCTURED ZIRCONIUM AND ZIRCONIUM-NIOBIUM ALLOYS

The work is aimed at formation of a nanostructural state with optimal configuration of contour boundaries in zirconium and Zi–Nb alloys by cold rolling and estimation of mechanical characteristics of the tested materials. The results of the tensile tests and microhardness measurements of the Zr, Zr–1%Nb, Zr–2.5%Nb samples before and after rolling at 293 K to the degree of ε=3.9 are given. The obtained nanostructural state provides sufficient degree of plasticity combined with high strength in every material. Thus, the work considered not only dislocation and disclination mechanisms of nanostructure formation but peculiarities of plastic flow with nanostructure evolution at tension within the range of uniform deformation.

The tests have demonstrated a possibility of creation of a nanostructural state in industrial Zr–Nb alloys with using a certain mode of rolling that does not allow crack formation and fracture of the material.

The kinetics of formation of the majority of boundaries is mostly of dislocation nature, not the result of dynamic polygonization and recrystallization. The resistance to plastic deformation is determined by amount, energy and nature of deformation boundaries. The effect of the general increase in mechanical characteristics in the course of nanograin formation reduces the level of brittle fracture more than in the case of high-strength state.

Keywords: zirconium, rolling, nanostructure, alloy, mechanical properties