C3-P-020705

REPETITIVELY-PULSED NITROGEN IMPLANTATION IN TITANIUM BY A HIGH-POWER DENSITY ION BEAM*

A.I. RYABCHIKOV, O.S.KORNEVA, D.O.SIVIN

National Research Tomsk Polytechnic University, Lenin Avenue 30, Tomsk, 634050, Russia

The paper presents the results of studies of the features and regularities of high-intensity nitrogen ion implantation in titanium using high-power density repetitively-pulsed beams. It has been shown that the method of low-energy high-intensity nitrogen ion implantation at current densities of 180, 140, 60, and 10 mA/cm^2 makes it possible to obtain wide ion-doped layers in titanium. The regularities of changes in both thickness and elemental composition of ion-doped layers depending on the ion current density have been established. It has been established that at ion current densities from 60 to 180 mA/cm^2, a wide diffusion layer is observed. With an increase in the ion current density, an increase in the nitrogen concentration in the diffusion layer is observed. Using X-ray diffraction analysis, it was found that the modified near-surface layer of titanium contains two phases – δ-TiNx and TiN0.3. A change in the crystal lattice period and the volume fraction of δ-phase depending on the ion current density has been noted. Transmission electron microscopy data are presented showing that the modified layers at a depth of 10 μm consist of α-Ti, in the volume of which the nanosized particles of δ-TiN crystallize. The average size these particles is 15.4 nm. The regularities of changes in the ion-doped layer microhardness depending on the ion implantation modes are discussed.

* The work was supported by the Russian Science Foundation (grant No. 22-19-00051)