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# Microstructure and properties of nanostructured (TiZrHfVNbTa)N coatings before and after implantation of high doses of Au- and N+ ions

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Nanostructured multicomponent (TiZrHfVNbTa)N coatings were deposited on steel disks using vacuum-arc evaporation of a cathode in the nitrogen atmosphere under different deposition conditions. Thickness of the fabricated coatings was 8 μm. Size of nanograins varies from 5-8nm to 17-20nm due to different deposition conditions. For ion implantation of different samples we used Au- ions (the doze was 1×1017cm-2, kinetic energy was 60keV), and N+ ions (the dose 1×1018cm-2).
Au- ion implantation led to selective sputtering of Au atoms along the projective depth and formed the disordered polycrystalline structure without preferred orientation of the fcc-phase in the near-the surface layer. In addition, it decreased the size of nanocrystallites from 8 nm to 1÷3 nm, increased the nanohardness to 33 GPa in the implanted layer and increased the hardness of the coatings to 51GPa. Due to high-dose N+ ion implantation, multiphase structure was formed in the surface layer of the coating. This structure consisted of amorphous, nanocrystalline and initial nanostructured phases with initial sizes of nanograins. Two phases were formed in the depth of the coating: FCC and HCP (with small volume fraction). Nitrogen concentration reached 90 at.% near the surface and decreased with the depth. Nanohardness of the as-deposited coatings varied from 27 to 34 GPa depending on deposition conditions. However, hardness decreased to the value of 12 GPa on the depth of projective path after ion implantation and increased to 23 GPa for more deep layers.

**Keywords**
High-entropy alloys nitrides
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