OR1006

GENERAL REGULARITIES AND DIFFERENCE OF NANOSTRUCTURED COATINGS BASED ON NITRIDES OF Zr, Ti, Hf, V, Nb METALS AND THEIR COMBINATIONS

Alexander Pogrebnjak[1], V Beresnev[2], A Andreev[3], O Sobol[4], D Kolesnikov[5], F Komarov[6], S Mel'nik[7], M Kaverin[1], A Shypylenko[1]

[1]Sumy State University, Sumy, Ukraine [2]Kharkov National University, Kharkov, Ukraine [3]Kharkov Phisico-Technical Institute, Kharkov, Ukraine [4] Kharkov Polytechnical University, Kharkov Polytechnical University, Ukraine [5] Belgorod State University, Belgorod, Russian Federation [6]Belarus State University, Minsk, Belarus [7]Institute of Applied Physics, Sumy, Ukraine

vragiydron@mail.ru

Using the vacuum-arc source with the HF discharge, nano-structured hard and super-hard coatings based on Ti-Hf-N(Fe), Ti-Hf-Si-N, Ti-Zr-Si-N, and (Ti, Zr, Hf, Nb, V)N of 1.2μm to 2.5μm thickness were manufactured. The coatings were studied using the proton micro-beam μ-PIXE, RBS, SIMS, SEM with EDS, XRD, and tested for adhesion resistance, wear, and nano-hardness. It was found that a concentration of Ti, Zr, Hf, V, and Nb metals as well as a bias potential applied to a substrate and residual pressure in a chamber (N or Ar/N) affected the formation regularities of solid solutions and quasi-amorphous phases based on α-Si3N4. Hardness of the resulting coatings reached 48GPa to 52GPa, their elastic modulus was 420GPa to 535GPa. The friction coefficient was 0.12 to 0.2, and temperature resistance was as high as 1300oC.
Coating structures varied from a columnar to a nanosized one. Grain sizes of the phases of the solid solutions were from 4nm to 10nm or 12nm. Those of α-Si3N4 inter-layer were from 0.8nm to 1.2nm.
The work was performed within the framework of F41.20-2011 GFFR project of Ukraine and T11K-058 BR FFRC project of Belarus.

Keywords
super-hardness
adhesion
friction
nano-grains
thermal stability