OR0804

Investigation of nanoscale TiN/ZrN and MoN/CrN multilayered coatings, fabricated using arc evaporation

Oleksandr Bondar[1], Alexander Pogrebnjak[1], Emerson Coy[2], Tomasz Koltunowicz[3]

[1]Sumy State University, Sumy, Ukraine [2]NanoBioMedical Centre, Adam Mickiewicz University, Poznan, Poland [3]Lublin University of Technology, Lublin, Poland

oleksandr.v.bondar@gmail.com

C-PVD method (vacuum arc deposition of a cathodes) was used for deposition of multilayered coatings, based on nitrides of refractory metals, such as TiN/ZrN and MoN/CrN. Total thickness of the coatings was 11 – 19 μm, thickness of bilayers varied from 20 to 800 nm for different samples depending on deposition conditions. Such methods as X-Rays diffraction (XRD), Rutherford Backscattering (RBS), scanning electron microscopy (SEM) with microanalysis (EDS), high-resolution transmission electron microscopy (HR-TEM) and STEM with local microanalysis, as well as nanoindentation were used for investigations.Formation of the two-phase state with a NaCl type crystal lattice structure with the preferred orientation with the [111] axis, perpendicular to the plane of growth, was found in the coatings. Increasing of the bilayer thickness led to changes from preferred orientation of the crystallites with the axis [111] to nontexturized state. All layers have good planarity. RBS measurements showed, that in all layers of all coatings TiN, ZrN, MoN, CrN stoichiometric nitrides were formed with an average atomic concentrations 50 at.% (respectively to the type of coatings).
Fabricated coatings demonstrated good mechanical properties, such as wear resistance and adhesion to the substrate, as well as rather high hardness, which achieved the values of about 38 GPa for several samples, which is impossible for simple monolayered coatings, made of appropriate nitride of refractory metals. Such high values of hardness can be explained by the significant influence of the interphase boundary and triple junctions.

Keywords
multilayered coatings
nitrides of refractory metals
nanoscale
two-phase
hardness