Development of nanostructured antifriction coating for the protection of machines details

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Unacceptable wear is the main problem of machines and mechanisms failure in most cases. One of the numerous solutions – specially designed protective antifriction coating is described in this paper. Protective coatings are the most prospective solution for problems of wear and friction. In comparison with various lubricants, protective coatings are more reliable and durable due to their better adhesiveness.

There is sufficiently great variety of methods for the application of the protective antifriction coatings. More often surface of the element is treated by the particles (ions, atoms, cluster) and the high energy quantum flow. The ion sputtering is one of the fast developing methods of the coating application and is considered as appropriate method to solve wear and friction problem. [1, 2, 3]. When a solid surface is bombarded by the positive ions and the particles are deposited on the element. Ion-plasma treatment in vacuum makes it possible to combine different layers in one technological cycle.

The protective antifriction coating was made in the vacuum equipment *NNV-6,6-I1* by the method of ion-plasma sputtering an application of. The multilayer coating of the titanium (*Ti*) and copper (*Cu*) composition in argon (*Ar*) and argon and nitrogen (*Ar+Ni*) media was deposited on steel surface of the sliding valve. During the sputtering cycle the developed multilayer nanostructured coating out of *Ti*, *TiN*, *TiCN*, *TiC* resulted in titanium nitride (*TiN*), and intermetallide of titanium copper (*TiCu*) formation. Wear resistant titanium nitride (*TiN*) coating was formed on the surface of the experimental element wear-resistant coating with the microhardness HV=1100. Titanium copper (*TiCu)* has a good running-in and adhesion properties with microhardness HV=301 after the run-in. Research on mechanical properties had shown that average microhardness and roughness of the experimentally tested part had increased 2-3 times.

References

1. Urbahs A., Savkovs K., Urbaha M. High temperature oxide resistant components of perspective high strength intermetalceramic composite coatings // AES Technical Reviews International Journal, Part D: International Journal of Reliability and Safety of Engineering Systems and Structures, IJRSESS, 1(1) 2011, pp. 53 – 57.
2. Urbahs A., Urbaha M., Savkovs K., Bogdanova S. Wear resistant nanostructured multi-component coatings // NATO SCIENCE FOR PEACE AND SECURITY SERIES, Series B: Physics and Biophysics, 2012, Nanodevices and Nanomaterials for Ecological Security, Part 1. pp 161-170.
3. Urbahs A., Savkovs K., Urbaha M., Kurjanovich I. Nanostructured Intermetal-Ceramic Coatings for Blades of Gas Turbine Engines // NATO SCIENCE FOR PEACE AND SECURITY SERIES, Series B: Physics and Biophysics, 2012, Nanodevices and Nanomaterials for Ecological Security, Part 2, Chapter 28, pp 307-314.