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Nanostructured Multicomponent Coatings "KJONBOMU" for Restoration and Protection of Machine Friction Parts

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Keywords –**ion-plasma coatings, friction parts, restoration and protection**

I. Introduction

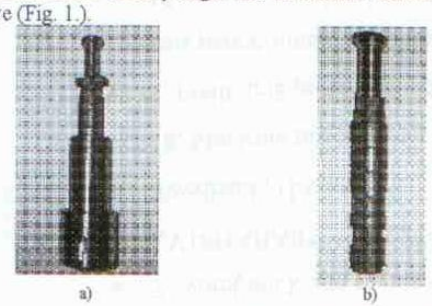
This paper deals with a development of a new ion-plasma technology for obtaining nanostructured wear-resistant composite coatings (multilayer, multicomponent) by the combined method for restoration and protection of machine part surfaces in the process of manufacturing and repair.

II. Basic Research Results

Development of new effective technologies of worn surface restoration of precision friction pair parts is a topical issue [1].

The authors offer the restoration technology of precision pair parts - valves, plungers and injectors of vehicle fuel pumps.

Experimental samples, i.e. steel plates (100x30x1.5 mm) and a precision pair (PP) of hydro fuel plunger, which is a part of high-pressure pump of a diesel engine, were used as an object of research. The precision pair consisted of an internal element called plunger and an external element called sleeve (Fig. 1.).



a) b)

Fig. 1. Precision pair (a) of hydro fuel plunger, which is a part of high-pressure pump of a diesel engine, and plunger (b)

The technology stipulates the creation of a special restoring wear-resistant coating "KJONBOMU" on the basis of Ti – Al – N deposited by ion-plasma sputtering. In the process of sputtering Ti was used as the first evaporator, Al – as the second evaporator, also Al – as a magnetron cathode material [2].

Distribution of the main elements forming the coating are presented in Fig.2.

This method has considerable advantages – absence of part distortion, some allowances for further machining and possibility of regulating coating properties over a wide range by changing sputtering modes.

Besides, the above-mentioned method ensures higher coating quality – considerably higher micro hardness and adhesion as well as lesser surface roughness.

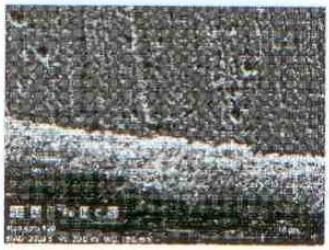


Fig. 2. Main elements of wearproof coating "KJONBOMU"

Except the restoration of trim dimensions, the composite coating possesses improved performance characteristics at the expense of increased hardness, wear-resistance, oxidation and hold resistance, corrosion resistance and decrease of friction coefficient.

The obtained coatings "KJONBOMU" are peculiar because of their enhanced wear resistance, low coefficient of friction, and good adhesion with basic material [3].

III. Conclusions

Authors developed a new high-performance ion-plasma technology for obtaining a nanostructured wear-resistant composite coating by the combined method (KJONBOMU – condensation and ion bombardment + magnetron sputtering). The combined technology makes it possible

- to create nanostructured coatings,
- ensure high microhardness and wear-resistance of a coating, its adhesion and thickness uniformity on a large area;
- to variate the composition of a coating in a wide range within a single technological cycle;
- to obtain high smoothness of coating surface (the influence of "drop phase" and the parameters of coating roughness decrease considerably) and more uniform coatings from the point of view of composition;
- as well as to ensure the ecological cleanliness of production cycle [1].

IV. References

[1] Urbaha M. "Creation of nanostructured wear resistant ion-plasma coatings for restoration and protection of machine parts", Summary of Doctoral Thesis, p.1-37, 2011.

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[3] A. Urbahs, K. Savkovs, M. Urbaha and I. Kurjanovičs. Nanostructured Intermetal-Ceramic Coatings for Blades of Gas Turbine Engines. NATO Science for Peace and Security Series B: Physics and Biophysics, 2012, Nanodevices and Nanomaterials for Ecological Security, Part 2, Pages 307-314.