SEAE P33 MODIFICATION OF THE SURFACE OF TITANIUM DURING COMPLEX TREATMENT WITH NITRIDING, OXIDATION AND ELECTROEROSIVE ALLOYING

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Titanium and its alloys, having high specific strength and corrosion resistance, can often not be used in critical components operating under friction, due to low wear resistance. In these cases, they resort to the application of wear-resistant coatings on the working surfaces of these assemblies.[1]
Among methods of coating deposition using highly concentrated energy sources, electroerosive alloying (EEA) is distinguished, [2] which differs in that the applied coatings have a high adhesively to the substrate. Ultra-high heating and cooling rates make it possible to obtain a unique structure and properties of the formed coatings with high performance characteristics.
Given these advantages of the EEA method. In this paper, the goal is to develop a complex process of modifying (hardening) the surface of technical grade VT1-0 by treatment according to the scheme: nitrating + EEA and oxidation + EEA, and also in the reverse order: EEA + nitriding, EEA + oxidation. With these treatment schemes, it was assumed that under the influence of electric pulses a high-density dislocations field arises, in the relaxation of which channels are formed along which the elements diffuse into the substrate, and also form various compounds: alloys, pseudoalloys, solid solutions, and the like.
In the presented table, the results of the phase analysis of titanium samples BT1-0, searched by the EEA method prior to oxidation or nitriding (a) and after oxidation and nitriding (b) are shown, which shows that even with an insignificant electric pulse energy of 0.3 J, phase transformations are observed with the formation of intermetallides if pure metals (Al, Ni), as well as carbides, were used as the processing electrode when an electrode from graphite served as the anode.

Table. Phase composition of coatings obtained by complex treatment of titanium VT1-0 by electroerosive doping, oxidation and nitriding

a

EEA + nitriding, EEA + oxidation
BT1-0+[C]+N_2 →Ti+C+TiC; BT1-0+[C]+O_2 →Ti+TiC+TiO_2; BT1-0+[Ni]+N_2 →Ti+Ni+NiTi+TiN;

b

Nitriding + EEA and oxidation + EEA
BT1-0+O_2+[Al+Cr] →Ti+Al+Cr+TiO_2+Al_2O_3; BT1-0+O_2+[Al] →Ti+Al+$TiAl_3$+TiO_2+Al_2O_3; BT1-0+N_2+[Al] →Ti+Al+$TiAl_3$+TiN+Al_2O_3; BT1-0+N_2+[C] →Ti+C+TiC+TiN;

Thus, the complex treatment of titanium by the action of electrical impulses before oxidation and nitriding, or after them allows to significantly modify the surface of titanium in terms of improving its physical and mechanical properties: hardness, wear resistance, etc.

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