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RESEARCH ON THE SERVICE PROPERTIES OF INTERMETALLIC COATINGS FOR THE BLADES OF AERO-ENGINE TURBINES ON THE BASIS OF TITANIUM-ALUMINIUM

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The modern aero-engine is an extremely stressed assembly that forms the structure of aerial vehicles. It is exposed to both physical and thermal loads. The struggle for economic and traction efficiency makes the designers of gas turbine engines (GTE) constantly look for the ways of increasing the compression ratio of compressors and the temperature of gases in front of turbines.

By use of the Laboratory of Vacuum Technologies of the Institute of Transport Vehicle Technologies of the Riga Technical University authors have accumulated extensive experience in creating coatings for different purposes (wear, heat resistant, decorative coatings etc.) by various technologies including diffusion saturation, vacuum ion-plasma sputtering, ion bombardment and other technologies.

During this research authors have created new intermetallic alloys for the blades of aero-engine turbines on titanium-aluminium basis with the density of 3.9-4.2 g/cm^3 containing 44-65% of titanium and 35-56% of aluminium as well as other alloying elements in the range from 0.1 to 10%. Also the method of sputtering an intermetallic titanium-aluminium coating was developed and pilot samples were obtained by using an experimental facility with separate sputtering of titanium by an arc source and aluminium by a magnetron source using specific experimental vacuum chamber.

The thickness of the created coating was about 10 – 15 μm, which is 2 – 3% of the total thickness of the working part of the blades of aero-engine turbines. This slight change in the geometry of the profile of the blades should not lead to a change in the aerodynamic characteristics of the engine.

The paper includes results of the research on oxidation process observed on the surface of coated samples within the high-temperature range (500 – 825°C) carried out with the use of a scanning electronic microscope (see Fig.1). The basic peculiarities of the process of coatings destruction under high-temperature oxidation conditions were determined – the created alloys have high heat resistance within the range of 700−10000°C and can be also used as a material for heat resistant coatings intended for products made of titanium alloys.

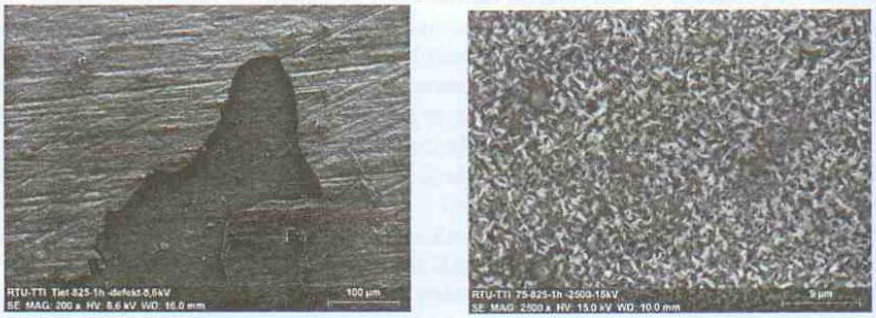

Fig. 1. General view (left) and microstructure (right) of sample surface after the test (temperature 825°C).