TITANIUM NANOSTRUCTURED COATINGS OBTAINED BY MULTI-CHAMBER GAS-DYNAMIC ACCELERATOR

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Abstract

In view of high physical-mechanical properties of titanium and its compounds, it is of interest to deposit a coating of titanium on surface of aluminium alloy. In this study, multi-chamber gas-dynamic accelerator (MCDS) was applied for deposition of Ti powder coatings on aluminium 6063 (Fe-0.35Cr-0.06Cu-0.10Mg-0.05Ti-0.15, all in wt pct). Titanium powder Raymor Industries Inc. Gr 1 0-45 micron (100 wt. % Ti) was used to form a dense ceramic layer on the aluminium surface. The coatings microstructures and phase compositions were characterized using SEM, TEM, OM and XRD techniques. Measurement of the microhardness of samples was done with an automatic micro-hardness tester DM – 8B (Affri) using a Vickers’s indenter with load on of 0.05 N. It was established that MCDS has provided the conditions for formation of a dense layer at lamellas and deformed titanium particles with hardness of 1300 ± 100 HV0.05, porosity of less than 1-2 % and the wear was less than the wear of the aluminium alloy. Lamellae in the coatings consisted of dislocation-free titanium nanocrystalline grains 30 nm in size, separated by interlayers of the amorphous phase and titanium oxide crystalline grains with a cubic lattice. The “coating-substrate” interface has no defects. The coating-substrate transition layer up to 15 micron thick contains TiAl- type nanocrystalline intermetallic compounds such as TiAl3 и Ti3Al.

Keywords: gas-dynamic accelerator, nanostructured titanium coatings, microstructure, hardness, porosity