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# THE PROCESS OF MAO COATING FORMATION AT THE COATING-SURFACE INTERFACE*

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Aluminum is one of the most promising and widely used materials in many industries. Aluminum alloy parts have low weight and high thermal conductivity relative to steel and cast iron. The disadvantages of aluminum products are low wear resistance, high coefficient of linear thermal expansion, irregularity and high porosity of the oxide film. The surface modification of aluminum parts allows improving their properties [1, 2, 3].

The method of micro-arc oxidation (MAO) allows modifying the surface and producing protective coatings on aluminum, titanium, magnesium, zirconium, tantalum, neobium and their alloys. The coatings have an increased adhesion ability, high hardness, corrosion resistance, resistance to aggressive media, and insulating properties. This method (MAO) consists in modification of product surface by microplasma discharges and formation of protective ceramic coating at the metal-electrolyte interface, consisting of oxide forms of substrate metal and electrolyte elements. It is possible to obtain coatings up to 400 μm thickness, using the MAO method [4, 5].

The study of the metal-MAO coating interface obtained at different technological parameters will help to study the coating formation processes in more detail, as well as to consider the influence of electrical parameters on the properties of MAO coatings.

MAO coatings were formed in the anodic mode by the MANEL technology on aluminum samples (D16 and AMg3 alloys), ø50 mm and h = 2 mm, in the electrolyte "Manel-B" (pH = 6) using a pulse power supply ARCCOR III (EleSy Company) at voltage 600 V, pulse duration from 20 to 200 μs and frequency from 70 to 300 Hz. There were implemented 6 technological modes and were obtained 2 samples for each mode. At the beginning of MAO process, a transition layer of metal-coating with a thickness of 5-20 μm was formed. Then the external thickness of the coating was increased up to 30-40 μm, the average formation speed depended on the parameters of the power source and ranged from 0.125 to 32 μm/min.

The samples were dried in a drying box at 100°C after MAO treatment. The surface roughness of MAO-coating was measured using TR220 roughness meter, elasticity was evaluated using an Eriksen method, and impact resistance was determined using a Constanta U2-M device.

Cross-sections were made from the samples obtained using a Buehler polishing system to study the metal-coating interface. The surface morphology and the cross-sectional microstructure of the coatings were characterized by scanning electron microscopy (SEM, Quanta 200 3D), microhardness was evaluated by Shimadzu DUH-211S dynamic ultra micro hardness tester; the film thickness was measured by Positector 6000 vortex thickness meter.

The paper presents the quantitative distribution of elements at the metal-MAO-coating interface. It was obseved that the microhardness values near the metal-MAO coating interface depend on a coating composition. On the other hand, technological parameters such as pulse duration and pulse frequency influence on distribution elements in the coating.

It is shown the MAO coating has the lowest values of the formation rate and surface roughness at low values of the pulse duration and pulse frequency. Increasing these parameters leads to MAO coating growth rate and surface roughness growth.

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