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INFLUENCE OF ISOPROPYL ALCOHOL IN SULFURIC ACID ANODIZING ELECTROLYTE ON THE FORMATION KINETICS AND PROPERTIES OF ANODIC OXIDE FILMS

Under atmospheric conditions, the surface of metallic aluminum is covered with a thin oxide film that passivates its surface, but due to its small thickness, it is not able to provide complete protection of the metal from corrosion. After long-term operation of the metal in conditions of high humidity, a white loose coating is formed on its surface, which leads to deterioration of its appearance, mechanical strength and operational characteristics [1-3].

The purpose of this work is to study the effect of an organic additive (isopropyl alcohol) on the resulting anodic oxide films on aluminum alloys, to develop a new anodizing electrolyte, from which higher quality films will be obtained, with better properties compared to standard electrolytes.

Recently, it has been increasingly recommended to use pulsed current supply during anodizing. Since during long-term anodizing with direct current, with an increase in the thickness of the oxide film, the concentration gradient of anions on the anode surface and in the pores increases, which leads to an increase in the dissolution rate of the oxide layer and a decrease in the current efficiency. When the oxide layer thickness reaches 0.4–0.5 mm, the rate of oxide dissolution approaches the rate of its growth, the surface quality deteriorates significantly, and uneven growth of the oxide layer occurs over the surface of the plate, with the temperature increasing in areas of increased growth, sparking and burn-through of the oxide layer appearing.

Anodizing aluminum in the pulsed current supply mode allows one to almost completely eliminate these problems. Such a scheme provides special advantages in cases where the use of high-density current is required or when processing alloys with a high copper content. It is noted that the use of a rectangular pulsed electric current significantly reduces the energy costs of the process: due to the sharp rise and fall of voltage, there are no losses due to third-party processes, as in the case of using capacitor power supplies, where a smooth rise and fall of voltage is observed.

Films obtained by anodizing using pulsed current have increased corrosion resistance and abrasion resistance. In practice, such current sources allow

the use of a higher current density without the risk of destruction of the formed oxide layer.

Sulfuric acid with a concentration of 200 g/l was chosen as the electrolyte. Sulfuric acid is a universal substance for anodizing, as it is capable of dissolving the aluminum oxide formed on the surface. At the same time, the acid itself is cheap, the voltage on the bath is low, about 15-20 V, and the resulting coatings are unpainted, heat-resistant and do not peel off from the metal. The concentration was selected so that the rate of film dissolution was not greater than the rate of its deposition, and the porosity was not high.

Lead was chosen from the cathode materials, since it does not dissolve in sulfuric acid.

The anodizing process of AD31 alloy in a sulfuric acid electrolyte with the addition of organic compounds using the pulse electrolysis mode was studied. It was found that more uniform ordered anodic films are formed in the pulse mode compared to the stationary electrolysis mode. The results obtained allow us to judge the similarity of the mechanisms of formation of anodic aluminum oxide in the pulse and stationary modes. It is shown that the use of sulfuric acid electrolyte with the addition of 20 g / l of isopropyl alcohol in the pulsed anodizing mode allows to increase the electrical insulation and protective properties of the anodic coatings on the surface of aluminum alloy AD31 in comparison with the stationary electrolysis mode. At a given anodizing mode in sulfuric acid electrolyte with the addition of isopropyl alcohol, the oxide film has a more uniform morphology, has good protective (more than 30 min) and electrical insulation properties (breakdown voltage more than 260 V), and current outputs (95.98%) exceed the standard values for sulfuric acid electrolyte (70-75%).

REFERENCES

1. Grilikhes, S. Ya. Oxidation and phosphating of metals / S.Ya. Grilikhes. - 3rd ed. – Leningrad: Mashinostroenie, 1971. – 117 p.
2. Galvanotechnics: reference publication / F. F. Azhogin [et al.]; under the general editorship of A. M. Grinberg. - Moscow: Metallurgy, 1987. – 736 p
3. Method for anodizing aluminum plates and device for its implementation: patent. 1115503 USSR, IPC C 25 D 11/02, H 01 J 9/02 / E. P. Ignashev; applicant Institute of Electronics of the Academy of Sciences of the BSSR. – No. a 3508516/02; declared 06.08.82; publ. 27.03.96 // Description of the utility model to the certificate / Rospatent. – 1996. – P. 1-9.