Abstract

Galvanic plating in engineering. Development of technological process of protective cadmium-tin coating on steel details.

Kopernyk N.O. –Kyiv: Igor Sikorsky KPI, ChTD, group XE-31.

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Interest in the study of the kinetics of the common metal recovery and the development of the technology of electrolytic precipitation of alloys due to the expansion of areas of application of coatings electrolytic alloys, which in some cases, their physical, chemical and physical properties exceed the coating of metallurgical alloys and pure metals. In addition, the use of alloys provides significant economic benefits to the use of coatings with pure metals.

Joint deposition of tin with other metals can eliminate these deficiencies and expand the scope of coverage by improving their physical and chemical properties.

In the area of galvanic coatings, cadmium-tin alloy, despite the toxicity of cadmium ions, is widely used to protect tools, radio components, components and components of aviation engines from corrosion.

Galvanic coatings of cadmium-tin alloy have a higher anti-corrosion resistance than cadmium, zinc and tin-zinc alloys and zinc-cadmium in aggressive environments. The coatings of this type are plastic, resistant to high temperatures and well soldered. In

addition, the coatings of this type are highly corrosion-resistant, their corrosion resistance in the conditions of the marine climate is 40-80% higher than the resistance of cadmium coatings.

At present, more than 20 electrolytic coatings are known for alloys of tin with other metals that have wide application in the industry. Tin coatings have a number of valuable properties, the main ones being high chemical resistance, ductility, good ability to solder tin, but there are significant disadvantages that prevent wide application as a galvanic coating. Under the influence of low temperature, it is possible to convert a compact metal into a powdered state, spontaneous growth of filamentous crystals starts on tin coatings with prolonged storage, in addition, in the conditions of storage of tinned parts, the surface's ability to solder sharply deteriorates.

The corrosive influence of the environment, which is determined by the conditions of product operation, is one of the most important factors that determine the choice of type and thickness of the coating. In engineering, an important requirement for coating is the density, high adhesion of the metal-coated coating and high mechanical resistance.

The cadmium-tin alloy coating is applied to parts of copper and steel parts for better soldering and screwing because these coatings have good anti-friction properties. The alloy coating provides better corrosion resistance in harsh environments as well as marine tropical climate compared to cadmium.

Tin-soft silver-white metal, resistant to chemical reagents. Its density is 7,310 g / cm^3, melting point is 231,93 ° C, boiling point 2602 ° C, specific electrical resistance 11,5 · 10-8 Ω · m (20 ° C).

Potentials of tin:

E0 Sn2 + / Sn = -0.1336 V, and E ° Sn4 + / Sn2 + = 0.151 V

The peculiarity of tin is its relatively high stability in most minerals and organic acids and organic compounds. The coefficient of dry friction of tin in steel is 0.08-0.14. Also, the characteristic feature of tin is the good ability to bind.

Cadmium - silvery-white soft metal with a bluish tint, flexible, agile, fusible, toxic transition metal. The metal density is 8.65 g / cm³, the melting point is 321.1 ° C, boiling point is 766.5 ° C. Reacts with acids. Soluble compounds are poisonous.

Cadmium Potential:

E ° Cd2 + / Cd = -0.403 V

The bulk of industrial consumption of cadmium accounts for cadmium protective coatings applied to protect steel parts from corrosion. These coatings have a significant advantage over nickel, zinc or tin, because they are not detached from the details when deformed.

Cadmium coatings in some cases exceed all others: 1) in the protection against corrosion in seawater, 2) for parts working in enclosed areas with high humidity, 3) for the protection of electrical contacts. However, unlike tin, cadmium is plastic.

Cadmium-tin alloy is applied to obtain a coating with high corrosion resistance in aggressive environments, as well as to increase the antifriction and mechanical properties.

Tin-cadmium alloy coating improves soldering and screwing of parts.

The choice of technological scheme for applying the necessary coating on the part is determined by many factors: the type of coating; The nature of the metal parts; Shape

and size of the parts; The quality of the external processing of the part entering the coating, and the quality of the appearance of the part after the coating; Economic expediency of one or another operation.

Objective and accurate estimation of surface roughness plays an important role in engineering. The roughness of the coated surface affects the flood of the metal due to the dependence of the diffusion of atomic hydrogen on the size of the comb on the surface of the part. There is a relationship between the protective properties of the sediment and the roughness of the covered surface: the higher the surface cleanliness class, the higher the corrosion resistance of the products. It is used to increase the corrosion resistance of parts, especially in cases where the increase in the thickness of protective coatings is impossible.

For electrolytic coating of cadmium-tin alloys cyanide, chloride-fluoride, fluoride-containing hydrofluoric and sulfate electrolytes are used.

The above electrolytes are quite simple in the preparation and operation, have high stability, electrical conductivity, dissipation power. However, the operation of the above-mentioned electrolytes is acutely the problem of sewage treatment from heavy metal cations and inorganic and organic anions of acids. Partially this problem is solved either by using electrolytes diluted by ions to provide good quality coatings with high current output, or by replacing toxic anions in electrolytes with more secure anions of organic acids (wine, lemon and acetic). For electrolytic coatings of coatings Cadmium-tin alloys use cyanide, chloride-fluoride, fluoride-containing hydrofluoric and sulfate electrolytes.

The thickness control of the coating is determined by means of ultrasonic thickness gauges - devices designed to measure the thickness of the coating without their destruction.

The principle of operation of mechanical thickness gauges is based on the direct measurement of the thickness of the coating.

On the monitored surface, no swelling or flaking of the coating should be observed.

The following features are not accepted as defective:

- darkening or weakening of the color intensity of the coating on the parts after the heat treatment;

- a darker or lighter shade of coating in the openings and grooves on the inner surfaces and concave parts of the components of complex configuration, the places of fastening of inseparable folding units, sharp corners, places of contact with devices, between the coils of springs with a small step;

- matt strips around the holes;

- single mechanical damages of coverage not more than 2% of the total area;

- traces of water stains.

Lack of coverage:

- in pores, places of inclusions, those that are allowed on casting;

- on welded and soldered seams and near them at a distance not more than 2 mm on both sides of the seam and in the inner corners of mutually perpendicular planes under the condition of further additional protection of these places;

- in the places of contact of parts with accessories, except for special cases specified in the design documentation.

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