Corrosion Tolerance Study of Metal Coated Plastics

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ABSTRACT

Metallized plastics with a decorative coating can withstand steel balls on the surface, and the impact area is not as deep even when the balls are thrown from above. And in light alloy products with the same coating, it is deeper.

The corrosion resistance of metal-coated plastics is stronger than that of similarly coated metal parts. The reason for this is that plastic does not participate in the formation of galvanic microevaporation, and the hole formed by corrosion does not deepen, but only expands. When metal-coated plastics are used in atmospheric conditions, the appearance of the product is preserved for 2-3.5 years.

Keywords: polystyrene, polyethylene, glass plastics with phenolformaldehyde and epoxy, polyester plastics, polyamides, polyethylene terephthalate, fluoroplast, corrosion

Currently, most metal-coated plastics are coated with decorative coatings. Production of decorative metallized plastic products on an industrial scale began only in 1962-1964. But this production developed very quickly. The annual turnover of decorative metallized plastics in the world market is estimated at several tens of millions of dollars. There are more than a hundred companies dealing with metallized plastics in the world.

Metal-coated plastic products usually replace non-ferrous metals and light alloys. This saves a lot of money. Plastic parts are about twice as cheap as metals and several times lighter. The value of plastic is only about 20-30% of the value of metal-coated products. Another important achievement of plastic metallization is the absence of expensive and labor-intensive processes such as mechanical processing, grinding and polishing of metal products.

A variety of widely used details from decorative metallized plastics: household appliances, housings and accessories for cameras and telephones, kitchen utensils and catering equipment, door handles, numbers and inscriptions, suitcase and refrigerator frames, decorative bars and bases, covers , buttons, simple jewelry, toys, decorative panels, bas-reliefs (an embossed design on a flat surface), flower pots, ashtrays, cigarette cases, clock parts.

Plastic products coated with special coatings are widely used. Stamping patterns, wave transmitters, engraving dies, gears, and printing machine parts are made by coating ABS plastic with metal.

Polycarbonates coated with metal will have the property of high hardness. They are used in making lens antennas.

Polystyrene coated with silver or other metals, polyurethane and mostly polyurethane foam are used as light wave transmitters and antennas.

Nickel coatings with high corrosion resistance are used to protect the plastic parts of the aircraft from rain erosion. In the chemical metallization method, powdery and porous materials, for example, activated carbon, ionites, diamonds, are applied to metal coatings. To

increase electrical conductivity, metal layers and fibrous materials are applied by chemical metallization.

Metal-coated plastics are unique composite materials. In this, their properties depend on the composition of the initial plastic, the method and order of their production, the methods of preparation and metallization of the surfaces, and the properties of the metal coatings (thickness, composition and structure).

In the metallization of plastics, the characteristics of integral, solid bonding of metal layers with plastic (electrical conductivity, optical, magnetic properties, etc., distribution of metal in nature and coating structure) are very important. Chemical metallization can be used on all types of plastics and other non-conductive materials. But when using these opportunities, it is important to use consumer requirements and technologies:

1. Strong connection of the plastic base with the metal coating.

2. Plastic and coating must have the specified mechanical and physical properties.

3. The properties of plastic must fully meet the specific requirements of the fields of application.

4. Plastics should have unique chemical properties, should be chemically stable and easy to dissolve in various solutions.

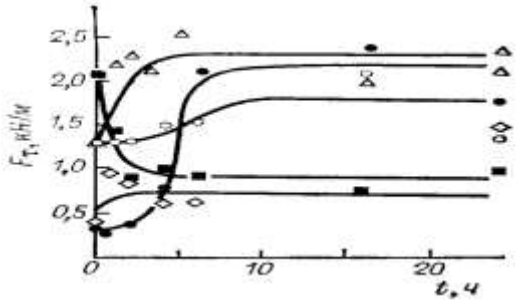
Currently, 90% of metallized plastics are ABS plastics. They are easy to work with, densely covered, the surface can be easily polished, dense metal coatings are formed with the base.

Plastics such as impact-resistant polystyrene, nylon, polyacetal, polyphenylene oxide, polysulfone, polycarbonate, polypropylene are metallized in industry on a large scale. Polyvinyl chloride, nylon and kapron, polymethyl methacrylate and polyacetal, epoxy resins are metallized in laboratory conditions. Several plastics, such as polyethylene, phenolformaldehyde and epoxy glass plastics, polyester plastics, polyamides, polyethylene terephthalate, fluoroplast, carbon fiber, are metallized by special methods.

As a result of surface metallization of plastic brands such as SNP, SNK, STAN, eplon, ABS-2020 and copolymers from styrene and polypropylene, decorative metal coatings are created.

Coatings obtained by metallization of the surface of plastics should have the following properties: heat-resistant, high coefficient of heat resistance, resistant to cyclic temperature stress, ease of processing (change in shape under pressure (liquefaction, fluidity), surface smoothing, internal tension, shrinkage), dense and tough, chemically stable and abrasion resistant.

Chemical metallization is used to form a thin (0.2 – 0.5 μm) electrically conductive coating. Such coatings are made of Ni-P, Ni-B, Ni-Co-P, Cu, Ag. The picture below shows the gluing of such coatings with the base.



A graph of the density of the plastic-metal coating after chemical metallization as a function of drying time (F_t).

Some chemically deposited metal coatings, such as thin-film chemically deposited copper and deposited Ni-P coatings for printed circuit boards, are self-maintaining.

The composition of the electrically conductive galvanic half-layer can be different. Examples of such thin layers are dull or shiny copper, dull and semi-gloss nickel coatings. In decorative metallization, with a high coefficient of heat resistance with a temperature change, the first thin layer serves to densify the metal and plastic and quench the stress-correcting element. For this, the coating should have high plasticity and make up ¾ of the total thickness. In order to improve the working method of metallization, it is necessary to form hard nickel coatings by chemical-galvanic coating method with compression of plastics. Decorative metallization of plastics is used to obtain high-quality coatings obtained from shiny, shiny movusiminate or black chrome, nickel, thin layer of gold.

The corrosion resistance of metal-coated plastics is stronger than that of similarly coated metal parts. The reason for this is that plastic does not participate in the formation of galvanic microevaporation, and the hole formed by corrosion does not deepen, but only expands. When metal-coated plastics are used in atmospheric conditions, the appearance of the product is preserved for 2-3.5 years.

Usually, metallized plastics are corroded by the mechanism for anode protection: the copper layer melts, as a result of which green or dark brown spots with corrosion products appear on the surface. When the corrosion process lasts longer, the metal layer, especially the nickel, is chemically treated. In this case, adhesion is reduced and point bumps are formed. This type of corrosion process affects the properties of metal-coated plastics (polypropylene parts are more resistant than ABS-plastics) and the types of surface activation before chemical metallization. When the corrosion process continues for too long, the coating breaks down and migrates.

In order to increase corrosion resistance, a nickel layer is applied to plastics in a larger amount (25-30 mkm), duplex and triplex nickel coatings, microporous and microcracked chrome coatings are also used.

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