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REMOVAL OF ELECTRODEPOSITED METALS

William S. Loose, Midland, Mich., assignor to The Dow Chemical Company, Midland, Mich., a corporation of Michigan

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This invention relates to a method of removing metal coatings from the surface of articles formed of magnesium and magnesium-base alloys.

In most commercial electroplating processes a certain small percentage of the plated articles are, for one reason or another, rejected on inspection as being imperfectly plated. It is customary, in the interests of economy, to put the rejected articles through a stripping operation to remove the electroplated metal, and then to return the stripped articles to the original process for the replating. As a result, there have been developed a considerable number of stripping baths which are effective in removing electrodeposited metal coatings from articles formed of most common metals. Unfortunately, however, none of these baths is fully effective in removing electrodeposited metals from the surface of magnesium and magnesium-base alloys, and all are subject to the great disadvantage that they attack the magnesium seriously during the stripping treatment.

An object of the invention, therefore, is to provide a method of stripping metal coatings, especially electrodeposited coatings, from the surface of articles of magnesium and magnesium-base alloys which is fully effective in removing the coatings but which does not result in attack of the base metal.

In the process of the invention, the metal coating is stripped by immersing the coated article in an aqueous acidic solution of a fluoride and passing current through the article to cause it to function as anode in the solution for a time sufficient to remove the metal coating.

Although a variety of acidic fluoride solutions may be used as stripping baths, aqueous solutions of hydrofluoric acid, preferably those containing 10 to 50 per cent by weight of the acid, or of mixtures of the alkali metal and ammonium fluorides or bifluorides together with a mineral acid, are especially convenient. Preferred baths are aqueous solutions containing from about 10 to about 50 per cent by weight of hydrofluoric acid and a lesser proportion of one of the mineral acids: nitric, sulfuric, hydrochloric, hydrobromic, and hydriodic acids, especially those baths containing between about 1 and about 20 per cent by weight of nitric acid or between about 0.25 and about 10 per cent by weight of hydrochloric acid. In general, the proportion of mineral acid should be less than that of the hydrofluoric acid, since baths containing higher proportions of strong acid may at times tend to pit the magnesium surface.

In practice, the plated magnesium article to be

stripped is immersed in the stripping bath, which is conveniently but not necessarily at room temperature, and is made the anode in an electric circuit, the cathode being any suitable material, such as carbon or nickel. Current is passed through the article at a density of 10 to 100 amperes per square foot at any convenient voltage, usually at least 2 to 3 volts or higher, for a time sufficient to remove the metal coating, usually for 10 to 30 minutes in the case of coatings of ordinary thickness. As the coating dissolves in the bath, the current passing at a given voltage gradually falls off; when the metal coating is entirely removed substantially no current flows in the circuit, presumably due to the formation on the article of a very thin non-conducting film of magnesium fluoride. When this condition is reached, the article is removed from the solution, and is rinsed in water. It may then be at once replated, if desired.

Among the metal coatings which have been successfully removed from magnesium articles are those of nickel, cobalt, and iron, which may be formed as described in my Patent No. 2,313,756.

The following examples will further illustrate the invention, but are not to be construed as limiting its scope.

Example 1

A die-casting formed of Dowmetal R (a magnesium-base alloy containing 9.0 per cent aluminum, 0.2 per cent manganese, and 0.06 per cent zinc, the balance being magnesium) having on its surface a bright adherent nickel plate 0.0005 inch thick was immersed in 25 per cent aqueous hydrofluoric acid containing 1.0 per cent of hydrochloric acid. Current was passed through the article as anode at a current density falling gradually from about 100 to less than 1 ampere per square foot until the nickel plate was entirely removed. The article was then withdrawn from the bath and rinsed. The resulting surface was clean, unpitted, and free of nickel.

Example 2

A die-casting formed of Dowmetal R and having on its surface an electrodeposited coating of nickel 0.0005 inch thick, with a copper electroplated coating 0.0005 inch thereupon, was made the anode in a 20 per cent hydrofluoric acid solution at room temperature and at a starting current density of 50-60 amperes per square foot for 30 minutes. The composite metal electroplate

was entirely removed without any pitting of the base metal.

Other modes of applying the principle of the invention may be employed instead of those explained, change being made as regards the details disclosed, provided the method recited in any of the following claims, or the equivalent thereof, be employed.

I claim:

1. A method according to claim 3 wherein the mineral acid is nitric acid employed in a proportion between about 1 and about 20 per cent by weight.

2. A method according to claim 3 wherein the mineral acid is hydrochloric acid employed in a proportion between about 0.25 and about 10 per cent by weight.

3. In a method of removing electrodeposited coatings of a metal selected from the group consisting of iron, cobalt, and nickel from the surface of articles formed of magnesium and magnesium-base alloys, the steps which comprise immersing the article in a solution consisting of water and from about 10 to about 50 per cent by weight of hydrofluoric acid and a lesser proportion of a mineral acid selected from the class consisting of nitric, sulfuric, hydrochloric, hydrobromic, and hydriodic acids and passing current through the article to cause it to function as anode in said solution at a current density between about 10 and about 100 amperes per square foot for a time sufficient to remove the metal coating.

WILLIAM S. LOOSE.