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METHOD OF PROTECTING MAGNESIUM AND ITS ALLOYS FROM CORROSION

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The invention relates to methods of providing corrosion resistant coatings for magnesium and its alloys. One of the objects of the invention is to provide a method of developing a corrosion resistant film-like coating upon magnesium and its alloys. Another object is to provide a method of the aforesaid character whereby articles of magnesium and its alloys may more readily retain paint, varnish, and the like.

Heretofore it has been proposed to subject articles of magnesium and its alloys to the chemical action of an aqueous solution of hydrofluoric acid or the water-soluble fluoride salts by immersing the article in such solution either with or without the application of electrolysis. The protective coatings thereby produced, I have found, are subject to considerable deterioration in time when exposed to either the atmosphere or aqueous salt solutions, particularly those of the nature of sea water. I have now found that, if instead of the simple acid fluoride or soluble fluoride salts there may be employed a complex acid fluoride, as for example, hydrofluosilicic acid, a very superior corrosion resisting coating is developed upon magnesium and its alloys. The invention, then, consists of the method hereinafter fully described and particularly pointed out in the claims.

In carrying the invention into effect the article of magnesium or an alloy thereof is immersed in an aqueous solution containing fluosilicic acid. The concentration of the solution I prefer to use is from about 20 to 35 per cent, although other concentrations may be used, such as 10 per cent or less. The duration of the treatment in the solution will vary with its concentration and may be from about 5 to 15 minutes, although satisfactory results may be obtained with a longer or a shorter duration of treatment. I normally prefer to immerse the article for about 10 minutes in a 28 per cent solution of the acid at room temperature. Higher temperatures may be employed, although it is best to operate below about 40° C. to avoid excessive loss of silicon tetrafluoride which is evolved at higher temperatures.

In comparison with the conventional method of treating solutions containing hydrofluoric acid, I have found that the resistance to corrosion of articles treated according to my improved method is as much as twice as great as determined by the

usual alternate immersion test in a 3 per cent salt solution at 95° F. As an illustration of the method an extruded test bar of a magnesium alloy consisting of 4 per cent aluminum, 0.3 per cent zinc, 0.2 per cent manganese, the balance being magnesium, was immersed for 10 minutes in a 28 per cent solution of hydrofluoric acid, then rinsed and dried. Upon subjecting the so treated article to the alternate immersion test in 3 per cent salt solution at 95° F., more than 20 per cent of the area of the specimen showed corrosive attack in 4 days. A similar specimen immersed for 10 minutes in a 28 per cent solution of fluosilicic acid showed less than 12 per cent of corroded surface area upon subjection to the same alternate immersion test for 4 days. Similar results were obtained upon similarly treating articles of other magnesium base alloys.

If desired, the article may be anodically electrolyzed while being subjected to the action of the solution as by applying a potential of 20 to 50 volts or more to the article using a cathode of magnesium.

Other modes of applying the principle of the invention may be employed instead of those explained, change being made as regards the method herein disclosed, provided the step or steps stated by any of the following claims or the equivalent of such stated step or steps be employed.

I therefore particularly point out and distinctly claim as my invention:

1. In a method of forming a corrosion-resistant coating on the surface of articles of magnesium and its alloys, the step which comprises immersing the article in a water solution of from about 10 to about 35 per cent of fluosilicic acid at a temperature below about 40° C. for a time sufficient to form a coating thereon.

2. In a method of forming a corrosion-resistant coating on the surface of articles of magnesium and its alloys, the step which comprises immersing the article in a water solution of from about 10 to about 35 per cent of fluosilicic acid at a temperature below about 40° C. for a time sufficient to form a coating thereon, and subjecting the article while so immersed to an anodic electrolysis.

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