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PROCESS FOR INCREASING THE RESISTANCE TO CORROSION OF LIGHT METALS AND LIGHT METAL ALLOYS

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6 Claims. (Cl. 204—56)

This invention relates to a process for increasing the resistance to corrosion of workpieces of light metals and light metal alloys.

Numerous processes are known for the production of layers containing fluorine, on light metals and light-metal alloys, for the purpose of increasing their resistance to corrosion.

Merely dipping the workpieces into aqueous solutions of fluorides furnishes layers of extreme tenuity, which are porous and provide inadequate protection against corrosive influences.

It has also been recommended to produce fluoride layers on light-metal alloys by the electrolysis of aqueous solutions containing fluorine, such as of hydrofluorid acid, and also of fused fluorine-containing salts such as acid or complex fluorides, polyfluorides and ammonium bi-fluoride+urea. Some of these electrolytic processes furnish quite useful coatings, but they are all attended with the drawback that elevated working temperatures must be employed. Since, under such working conditions, the aforesaid fluorine compounds already have an appreciable hydrogen fluoride vapour pressure, losses of substance can never be completely avoided. Moreover, at the elevated working temperatures, the material under treatment becomes attacked to a substantial extent. It has been proposed to prevent vaporisation losses, and the corrosion of the workpieces by hydrofluoric acid vapours, by forming a protective coating on the surface of the electrolyte by means of fused hydrocarbons of high molecular weight which are immiscible with the fluoride melt. This, however, is attended with considerable difficulties in practical application.

The present invention aims at providing a process for the production of protective fluoride layers, of satisfactory mechanical and anti-corrosive properties, on light metals, especially magnesium and magnesium alloys, by anodic treatment at ordinary temperatures.

To this end, according to the present invention, neutral alkali metal fluorides are employed in alcoholic solution as electrolyte at ordinary temperature. The preferred solvents used in carrying out the invention are polyhydric alcohols, such as glycerol or glycol, either singly or jointly. Mixtures of polyhydric alcohols with monohydric alcohols are also suitable for the purposes of the invention. Such mixtures may also contain a certain proportion of water when employed as solvents of neutral alkali metal fluorides. In order to improve the adhesion and compactness of the resulting anodic layer, it has been found advisable to maintain a pH value exceeding 8 but not exceeding 11 in the solutions, as has already been proposed for inhibiting the corrosive action of alcohols on light-metal alloys.

In producing fluoride layers in purely alcoholic solutions, a voltage of at least 50 is necessary, and this can be increased up to 150 volts, whilst, in the case of mixtures of alcohols and water, a working voltage below 50 may be employed. The current density is about 1 amp. per sq. decimetre at the outset, but falls very quickly as the operation proceeds, and finally becomes a mere fraction (about 1/100) of the initial value. The length of the treatment when using an alcohol or a mixture of alcohols as solvent, does not exceed 10 minutes; but in the case of mixtures of alcohol and water, up to 30 minutes are generally required.

In carrying out the treatment direct current is preferably employed, but use can also be made of two- or poly-phase alternating current or of superimposed direct and alternating current, or of pulsating direct current.

Example I

The workpiece to be treated, such as a magnesium alloy containing 1% of zinc, 6% of aluminium and 0.5% of manganese, is suspended as anode in an electrolyte consisting of a solution of 100 grms. of potassium fluoride in 1 litre of ethylene glycol, and a high percentage magnesium alloy is employed as cathode. A direct current of 100 volts is passed through the bath at room temperature (20 to 25° C.) the initial current density amounting to 1 amp. per sq. decimetre of surface. At the end of five minutes a coherent, firmly adherent layer of fluoride has become deposited on the surface of the anode. If desired, this layer can be consolidated by suitable known methods.

Example II

A light metal alloy (containing for example 2% of manganese and 0.3% of silicon, the remainder being magnesium), is anodically treated in a mixture of glycol and water (2:1) saturated with potassium fluoride, the treatment being carried out under the same conditions as in Example I, but with a current of 60 volts, and an initial density of 1 amp. per sq. decimetre. By the end of 20 minutes at room temperature, a firmly adherent coating of fluoride, capable of withstanding corrosive influences, has become deposited on the alloy.

We claim:

1. Process for increasing the resistance to corrosion of workpieces of magnesium and magnesium base alloys by formation of a protective layer on such workpieces which comprises employing the workpiece as the anode in an electrolytic treatment at room temperature with an electrolyte consisting of a solution of a neutral alkali fluoride in a solvent comprising predominantly an alcohol.

2. Process for increasing the resistance to corrosion of workpieces of magnesium and magnesium base alloys by formation of a protective layer on such workpieces which comprises employing the workpiece as the anode in an electrolytic treatment at room temperature with an electrolyte consisting of a solution of a neutral alkali fluoride in a solvent comprising predominantly a polyhydric alcohol.

3. Process for increasing the resistance to corrosion of workpieces of magnesium and magnesium base alloys by formation of a protective layer on such workpieces which comprises employing the workpiece as the anode in an electrolytic treatment at room temperature with an electrolyte consisting of a solution of a neutral alkali fluoride in a solvent comprising predominantly glycol.

4. Process for increasing the resistance to corrosion of workpieces of magnesium and magnesium base alloys by formation of a protective layer on such workpieces which comprises employing the workpiece as the anode in an electrolytic treatment at room temperature with an electrolyte consisting of a solution of a neutral alkali fluoride in a solvent comprising predominantly an alcohol and also water.

5. Process for increasing the resistance to corrosion of workpieces of magnesium and magnesium base alloys by formation of a protective layer on such workpieces which comprises employing the workpiece as the anode in an electrolytic treatment at room temperature with an electrolyte consisting of a solution of a neutral alkali fluoride in a solvent comprising prodominantly an alcohol, the pH value of the electrolyte being at least 7.

6. Process for increasing the resistance to corrosion of workpieces of magnesium and magnesium base alloys by formation of a protective layer on such workpiece which comprises employing the workpiece as the anode in an electrolytic treatment at room temperature with an electrolyte consisting of a solution of a neutral alkali fluoride in a solvent comprising predominantly an alcohol, the pH value of the electrolyte being between about 8 and about 11.

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