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PROCESS OF PRODUCING HARD CHROMIUM PLATINGS ON LIGHT METALS

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This invention relates to a process of producing hard chromium platings on light metals, such as, aluminum, aluminum base alloys, magnesium and magnesium base alloys.

Aluminium and aluminium alloys have hitherto been hard-chromium plated by first pickling the aluminium or aluminium alloy. Subsequently an interlayer was applied, in a variety of ways, which, in the case of some processes, was again dissolved away in a separate operation before entering the metal into the chromium plating bath, or in other processes served as a bonding layer for the hard-chromium layer.

For example, in the production of electro-plated metals, an electrolytic flash precipitate was applied in a preliminary bath as a bonding layer, on to which the desired metal layer was applied in the electro-plating bath proper (c. f. Germany patent specification No. 242,142). Alternately a metallic interlayer was applied by cathodic sputtering, on which interlayer the hard metal layer, of for example, chromium, nickel or the like, was produced by electrolysis (c. f. German patent specification No. 703,588).

In other processes, a layer of copper was precipitated on aluminium-magnesium alloys in a bath of copper chloride solution, which layer was then dissolved by nitric acid so as to roughen the surface of the alloy (c. f. German patent specification No. 762,716). It is also known to produce a finely divided heavy metal covering layer on aluminium alloys which covering, after treatment with an acid metallic salt solution is then removed with the aid of nitric acid, so that the surface of the alloy is exposed (c. f. German patent specification No. 760,230).

It has also been suggested to produce thick deposits of hard chromium on aluminium or aluminium alloys by first pre-treating said aluminium or aluminium alloy in an alkaline solution containing iron and zinc, then removing the resultant layer by means of nitric acid or a mixture of sulphuric acid and hydrogen peroxide, subsequently applying a copper layer of at the most 5 mu by electrolysis in an alkaline copper plating bath and finally carrying out the chromium plating in a normal chromium plating bath in accordance with known processes.

These known processes have the disadvantage that they are generally applicable only to certain groups of alloys and that hard chromium layers electrolytically applied according to these processes are insufficiently bonded to the base metal especially when subjected to simultaneous thermal and mechanical stresses. The metallic layer applied before chromium plating is either removed in a separate process before immersion of the metal into the chromium plating bath, so that the aluminium surface is not protected from oxidation up to the time of application of the hard chromium layer, or the preliminarily applied layers are intended to serve as bonding layers and are preserved as interlayers in such cases.

It was now found that the hard chromium layer can be very intensively bonded to the base metal, i. e. light metal or light metal alloy, especially aluminium or aluminium alloy, if a preliminary metallic layer is applied electrolytically in such thickness that it is at least almost completely dissolved in the chromium-plating bath itself before a hard chromium layer has been formed. This can, for example, be effected by a short reversal of the polarity before the chromium plating operation.

These preliminary metallic layers enable the prevention of oxidation before immersion in the chromium plating bath. Brass, nickel, iron and copper, for example, are suitable for such layers, especially when a complete removal, advantageously by means of a short change of polarity of the cathode, lasting from 1 to 2 seconds, is produced before the first surge of plating current of the hard chromium plating process. This complete removal of the preliminary layer is obtained with preliminary metal layers of a thickness of preferably 1 mu within 1 to 2 seconds.

The hard chromium layers obtained in accordance with the present invention, are distinguished by a particularly intense bonding to the base material and do not peel off even when strongly deformed.

The invention will be illustrated by the following non-limitative example:

Example

The surface of an aluminium or aluminium alloy workpiece is first pickled in accordance with a normal pre-treating process before the preliminary metallic layer is applied to the surface to be chromium plated. This pre-treatment can, for example be effected by using a known pickling solution containing ferrous or ferric chloride or boron-fluorine-nickel chloride. The workpiece to be plated is then immersed, for example in a brass plating bath under current, and is galvanically treated until an electrolytic layer of brass of a thickness of about 1 mu is formed. After rinsing with water for a short time, the workpiece is immersed in a chromium plating bath and treated anodically for about 2 seconds until the preliminary layer has been dissolved away, whereupon the polarity is reversed. The workpiece is then hard chromium plated under normal conditions using a current density of about 60 amps. per sq. decimetre.

What I claim is:

1. A method of applying a strongly adherent hard chromium plating upon an article having a surface of a light metal selected from the group consisting of aluminum, aluminum base alloys, magnesium and magnesium base alloys which comprises pickling the light metal surface to remove oxides, plating the thus cleaned surface with a thin metal layer of a metal selected from the group consisting of brass, nickel, iron and copper, immersing the plated metal surface into a chromium plating bath, substantially completely dissolving said metal layer from said light metal surface while immersed in said chromium plating bath and then immediately electroplating the surface with hard chromium while still in said chromium plating bath.

2. A method of applying a strongly adherent hard chromium plating upon an article having a surface of aluminum base metal which comprises pickling the aluminum base metal surface to remove oxides, plating the thus cleaned surface with a thin metal layer of a metal selected from the group consisting of brass, nickel, iron and copper, immersing the plated metal surface into a chromium plating bath, substantially completely dissolving said metal layer from said aluminum base metal surface while immersed in said chromium plating bath and then immediately electroplating the surface with hard chromium while still in said chromium plating bath.

3. A method of applying a strongly adherent hard chromium plating upon an article having a surface of a light metal selected from the group consisting of aluminum, aluminum base alloys, magnesium and magnesium base alloys which comprises pickling the light metal surface to remove oxides, plating the thus cleaned surface with a thin metal layer of a metal selected from the group consisting of brass, nickel, iron and copper about 1 mu thick, immersing the plated metal surface into a chromium plating bath, substantially completely dissolving said metal layer from said light metal

surface while immersed in said chromium plating bath and then immediately electroplating the surface with hard chromium while still in said chromium plating bath.

4. A method of applying a strongly adherent hard chromium plating upon an article having a surface of a light metal selected from the group consisting of aluminum, aluminum base alloys, magnesium and magnesium base alloys which comprises pickling the light metal surface to remove oxides, plating the thus cleaned surface with a thin layer of brass, immersing the plated metal surface into a chromium plating bath, substantially completely dissolving said metal layer from said light metal surface while immersed in said chromium plating bath and then immediately electroplating the surface with hard chromium while still in said chromium plating bath.

5. A method of applying a strongly adherent hard chromium plating upon an article having a surface of a light metal selected from the group consisting of aluminum, aluminum base alloys, magnesium and magnesium base alloys which comprises pickling the light metal surface to remove oxides, plating the thus cleaned surface with a thin metal layer of a metal selected from the group consisting of brass, nickel, iron and copper, immersing the plated metal surface into a chromium plating bath, substantially completely dissolving said metal layer from said light metal surface anodically while immersed in said chromium plating bath and then immediately electroplating the surface with hard chromium while still in said chromium plating bath.

6. A method of applying a strongly adherent hard chromium plating upon an article having a surface of a light metal selected from the group consisting of aluminum, aluminum base alloys, magnesium and magnesium base alloys which comprises pickling the light metal surface to remove oxides, plating the thus cleaned surface with a thin metal layer of a metal selected from the group consisting of brass, nickel, iron and copper about 1 mu thick, immersing the plated metal surface into a chromium plating bath, substantially completely dissolving said metal layer from said light metal surface anodically while immersed in said chromium plating bath and then immediately electroplating the surface with hard chromium while still in said chromium plating bath.

7. A method of applying a strongly adherent hard chromium plating upon an article having a surface of a light metal selected from the group consisting of aluminum, aluminum base alloys, magnesium and magnesium base alloys which comprises pickling the light metal surface to remove oxides, plating the thus cleaned surface with a thin layer of brass, immersing the plated metal surface into a chromium plating bath, substantially completely dissolving said metal layer from said light metal surface anodically while immersed in said chromium plating bath and then immediately electroplating the surface with hard chromium while still in said chromium plating bath.

8. A method of applying a strongly adherent hard chromium plating upon an article having a surface of a light metal selected from the group consisting of aluminum, aluminum base alloys, magnesium and magnesium base alloys which comprises pickling the light metal surface to remove oxides, plating the thus cleaned surface with a thin layer of brass about 1 mu thick, immersing the plated metal surface into a chromium plating bath, substantially completely dissolving said metal layer from said light metal surface anodically while immersed in said chromium plating bath and then immediately electroplating the surface with hard chromium while still in said chromium plating bath.

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