An electroplating method for magnesium and magnesium alloys, comprising: providing a magnesium or magnesium alloy substrate, pre-treating the substrate, roughening the surface of the substrate, activating the surface of the substrate, chemically plating the substrate to form a nickel coating on the substrate's surface, electroplating the substrate repeatedly to form several coats on the chemically produced nickel coating, and the substrate is subjected to neutralization treatment.

Correspondence Address:
PCE INDUSTRY, INC.
ATT, Steven Reiss
288 SOUTH MAYO AVENUE
CITY OF INDUSTRY, CA 91789 (US)

Assignees:
SHENZHEN FUTAIHONG PRECISION INDUSTRY CO., LTD., Shenzhen City (CN); FIH (HONG KONG) LIMITED, Kowloon (HK)

Abstract:
An electroplating method for magnesium and magnesium alloys, comprising: providing a magnesium or magnesium alloy substrate and pre-treating it to be cleaned; roughening the surface of the substrate; activating the surface of the substrate; chemically plating the substrate to form a nickel coating on its surface; and electroplating the substrate to form, in order, a first nickel coating, a copper coating, a second nickel coating, and a chromium coating on the chemically produced nickel coating.
providing a magnesium or magnesium alloy substrate

pre-treating the substrate

roughening the surface of the substrate

activating the surface of the substrate

chemically plating the substrate to form a nickel coating on the substrate's surface

electroplating the substrate repeatedly to form several coats on the chemically produced nickel coating

the substrate is subjected to neutralization treatment
ELECTROPLATING METHOD FOR MAGNESIUM AND MAGNESIUM ALLOY

BACKGROUND

[0001] 1. Technical Field

[0002] The present disclosure relates to an electroplating method for magnesium and magnesium alloys.

[0003] 2. Description of Related Art

[0004] Magnesium and magnesium alloys are prone to corrosion such as galvanic corrosion and therefore, should be surface treated before being used. A typical surface treatment method now for magnesium and magnesium alloys is electroplating. After electroplating, the corrosion resistance and the metallic appearance of the magnesium and magnesium alloys may be greatly improved. However, there are some difficulties for electroplating the magnesium and magnesium alloys because they are highly chemically active. Additionally, during electroplating, magnesium and magnesium alloys tend to react with metal ions contained in electrolytes, which will affect the quality of the electroplating.

Therefore, there is room for improvement within the art.

BRIEF DESCRIPTION OF THE DRAWING

[0006] Many aspects of the electroplating method for magnesium and magnesium alloys can be better understood with reference to the following drawing. The emphasis of the drawing is placed upon clearly illustrating the principles of the electroplating method for magnesium and magnesium alloys.

[0007] The FIGURE is a flow chart of a present embodiment of an electroplating method for magnesium and magnesium alloys.

DETAILED DESCRIPTION

[0008] Referring to the FIGURE, an electroplating method for magnesium and magnesium alloys may include the steps S10 to S70.

[0009] In step S10, a magnesium or a magnesium alloy substrate is provided. The substrate may be a housing of a mobile phone, a digital camera, a personal digital assistant, or a notebook computer. The substrate may also be a housing of a container.

[0010] In step S20, the substrate is pretreated. The pretreating step may comprise degreasing and cleaning the substrate. The degreasing process may be carried out by dipping the substrate in a degreasing solution for about 5-15 minutes. The mass concentration of the degreasing solution is about 150-200 grams per liter (g/L). The temperature of the degreasing solution is about 75-90°C. After the degreasing process, the substrate is removed from the degreasing solution and bathed in water. Then, the substrate is dipped in a sodium hydroxide solution for about 4-10 minutes to be polished. The sodium hydroxide solution may further include wax-removing agent(s). The mass concentration of the sodium hydroxide is about 100-200 g/L, and the mass concentration of the wax-removing agent(s) in the solution is about 40-80 g/L. The temperature of the sodium hydroxide solution is about 75-90°C. After the cleaning process, the substrate is again bathed in water.

[0011] In step S30, the surface of the substrate is roughened by dipping the substrate in a roughening solution containing roughening agent(s) and sodium carbonate for about 10-30 minutes. The temperature of the roughening solution is about 55-65°C. The mass concentration of the sodium carbonate in the roughening solution is about 50-100 g/L. The roughening agent(s) may be pyrophosphate, the mass concentration of the pyrophosphate in the roughening solution is about 350-450 g/L. During the roughening process, the magnesium or magnesium alloy on the surface of the substrate will chemically react with the compounds in the roughening solution thereby becoming roughened. The roughened surface of the substrate enhances the adhesion of metal plating to the substrate in a subsequent process.

[0012] In step S40, the surface of the substrate is activated. The activating process is carried out by dipping the substrate in an activating solution containing hydrochloric acid for about 1-5 minutes. The temperature of the activating solution is about 30-40°C. Concentration by volume of the hydrochloric acid in the activating solution is about 150-300 mL/L. The solution may further include activating agent(s). During the activating process, a magnesium fluoride film is formed on the surface of the substrate.

[0013] In step S50, the substrate is chemically plated to form a nickel coating on its surface. The chemical plating process is carried out by immersing the substrate in a solution containing sodium hypophosphite and basic nickel carbonate for about 20-60 minutes. The mass concentration of the sodium hypophosphite in the solution is about 10-30 g/L, and the mass concentration of the basic nickel carbonate in the solution is about 20-50 g/L. The temperature of the solution is about 70-90°C. During the chemical plating, the magnesium fluoride film is dissolved, and then nickel ions in the solution are oxidized to nickel and deposited on the substrate to form the nickel coating.

[0014] In step S60, the substrate is repeatedly electroplated to form one or more metal coatings on the chemically produced nickel coating. The electroplated coating may comprise a first nickel coating, a copper coating, a second nickel coating, and a chromium coating. The electroplating process may comprise: electroplating the substrate to form a first nickel coating on the chemically produced nickel coating; electroplating the substrate to form a copper coating on the first nickel coating; electroplating the substrate to form a second nickel coating on the copper coating; and electroplating the substrate to form a chromium coating on the second nickel coating. The electroplated coating presents good appearance and enhances the corrosion resistance of the substrate.

[0015] Electroplating the substrate to form the first nickel coating may be carried out in a first electrolyte, with the metalized surface of the substrate being a cathode, and a nickel anode being provided and immersed in the first electrolyte. The first electrolyte may contain a nickel sulphate component in a mass concentration of about 240-300 g/L, a nickel chloride component in a mass concentration of about 30-50 g/L, and a boric acid component in a mass concentration of about 30-50 g/L. The temperature of the first electrolyte is about 50-55°C. The electric current density through the first electrolyte is about 1-4 A/dm². Electroplating the substrate with the first nickel coating may last for about 4-10 minutes. The first nickel coating enhances the corrosion resistance of the substrate.

[0016] Electroplating the substrate to form the copper coating may be carried out in a second electrolyte, with the metalized surface of the substrate being a cathode, and a copper anode being provided and immersed in the second electrolyte. The second electrolyte may contain a copper sulphate component in a mass concentration of about 180-220 g/L, and a sulphuric acid component in a mass concentration of about 40-80 g/L. The temperature of the electrolyte is about 20-25°C. The electric current density through the second electrolyte is about 1-3 A/dm². Electroplating the substrate with the
copper coating may last for about 5-30 minutes. Because the copper coating possesses good malleability and low porosity, the bonding of the copper coating and the first nickel coating is enhanced.

Electroplating the substrate to form the second nickel coating may be the same to the electroplating of forming the first nickel coating. The second nickel coating further enhances the corrosion resistance of the substrate. Because of the copper coating’s good malleability and low porosity, the bonding of the second nickel coating with the copper coating is enhanced.

Electroplating the substrate to form the chromium coating may be carried out in a third electrolyte, with the metallized surface of the substrate being a cathode, and a chromium anode being provided and immersed in the third electrolyte. The third electrolyte may contain a chromium sulphate component in a mass concentration of about 240-300 g/L, and a boric acid component in a mass concentration of about 70-90 g/L. The temperature of the third electrolyte is about 30-50°C. The electric current density through the third electrolyte is about 1-15 A/dm². Electroplating the substrate with the chromium coating may last for about 1-15 minutes. The chromium coating prepared by electroplating in such an electrolyte and under such an electric current density of the electrolyte has the property to bond well with the second nickel coating, as described above. The chromium coating presents high gloss appearance.

After being electroplated, the substrate is bathed in water.

In step S70, the substrate is subjected to neutralization treatment. The neutralization treatment is carried out by dipping the substrate in a neutralization solution for about 1-3 minutes to remove any residual electrolyte adhering to the substrate. The neutralization solution includes a sulfuric acid component in a concentration by volume of about 20-50 ml/L, and an oxydol component in a concentration by volume of about 50-100 ml/L. The temperature of the neutralization solution is about 20-30°C. After receiving neutralization treatment, the substrate is bathed in water to be cleaned.

The addition of chemically plating the substrate before electroplating prevents the problems that can occur from reaction between magnesium and its alloys with ions in the electrolyte used in electroplating. Thus producing better protected parts of magnesium and magnesium alloys.

It is believed that the present embodiment and its advantages will be understood from the foregoing description, and it will be apparent that various changes may be made thereto without departing from the spirit and scope of the disclosure or sacrificing all of its advantages, the examples herebefore described merely being preferred or exemplary embodiment of the disclosure.

What is claimed is:

1. An electroplating method for magnesium and magnesium alloys, comprising:
   - providing a magnesium or magnesium alloy substrate and pre-treating it to be cleaned;
   - roughening the surface of the substrate;
   - activating the surface of the substrate;
   - chemically plating the substrate to form a nickel coating on its surface; and
   - electroplating the substrate to form, in order, a first nickel coating, a copper coating, a second nickel coating, and a chromium coating on the chemically produced nickel coating.

2. The electroplating method as claimed in claim 1, wherein roughening the surface of the substrate is carried out by dipping the substrate in a roughening solution containing pyrophosphate in a mass concentration of about 350-450 g/L and sodium carbonate in a mass concentration of about 50-100 g/L, for about 10-30 minutes at about 55-65°C.

3. The electroplating method as claimed in claim 1, wherein activating the surface of the substrate is carried out by dipping the substrate in an activating solution containing hydrofluoric acid in a concentration by volume of about 150-300 ml/L for about 1-5 minutes at about 30-40°C.

4. The electroplating method as claimed in claim 1, wherein chemically plating the substrate is carried out by immersing the substrate in a solution containing sodium hypophosphite in a mass concentration of about 10-30 g/L and basic nickel carbonate in a mass concentration of about 20-50 g/L for about 20-60 minutes at about 70-90°C.

5. The electroplating method as claimed in claim 1, wherein electroplating the substrate to form the first nickel coating is carried out in a first electrolyte containing a nickel sulphate component in a mass concentration of about 240-300 g/L, a nickel chloride component in a mass concentration of about 30-50 g/L, and a boric acid component in a mass concentration of about 30-50 g/L at about 50-55°C; the electric current density through the first electrolyte is about 1-4 A/dm²; and the electroplating lasts for about 4-10 minutes.

6. The electroplating method as claimed in claim 1, wherein electroplating the substrate to form the copper coating is carried out in a second electrolyte containing a copper sulphate component in a mass concentration of about 180-220 g/L, and a sulfuric acid component in a mass concentration of about 40-80 g/L at about 20-25°C; the electric current density through the second electrolyte is about 1-3 A/dm²; and the electroplating lasts for about 5-30 minutes.

7. The electroplating method as claimed in claim 5, wherein electroplating the substrate to form the second nickel coating is carried out in substantially the same way as was the forming the first nickel coating.

8. The electroplating method as claimed in claim 1, wherein electroplating the substrate to form the chromium coating is carried out in a third electrolyte containing a chromium sulphate component in a mass concentration of about 240-300 g/L, and a boric acid component in a mass concentration of about 70-90 g/L at about 30-50°C; the electric current density through the third electrolyte is about 1-15 A/dm²; and the electroplating lasts for about 1-15 minutes.

9. The electroplating method as claimed in claim 8, wherein the substrate is subjected to neutralization treatment after the electroplating process in a neutralization solution including a sulfuric acid component in a concentration by volume of about 20-50 ml/L, and an oxydol component in a concentration by volume of about 50-100 ml/L for about 1-3 minutes at about 20-30°C.

10. The electroplating method as claimed in claim 1, wherein pre-treating the substrate includes degreasing and cleaning the substrate.