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METHOD OF ELECTRODEPOSITING A LUSTERLESS, ELECTRICALLY CONDUCTIVE COATING

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ABSTRACT OF THE DISCLOSURE

A nickel electroplating solution is used for electrodepositing a lusterless, abrasion, resistant, and electrically conductive coating on a metal body. The nickel electroplating solution contains activated carbon and the nickel coating may be deposited on an initial electroplated nickel layer not containing carbon.

This invention relates in general to the art of electrodeposition, and in particular to a method of electrodepositing a lusterless, abrasion resistant, electrically conductive coating on a metal body from a nickel electroplating solution.

BACKGROUND OF THE INVENTION

The substrate for the electronic components which need a camouflage or lusterless coating is usually steel or aluminum alloy, but stainless steel or magnesium is adopted for some hardware. Aluminum alloys are customarily cleaned and prepared for copper plating by a procedure that includes treatment in a zincate solution to apply an adherent displacement coating and a subsequent copper electroplate. Nickel deposited on the copper provides the major share of corrosion protection in tropical, marine, and industrial environments. This system is limited in durability because galvanic corrosion couples are set up between adjacent layers of aluminum (or magnesium), zinc, copper, and nickel when the electroplated coating system is perforated by mechanical damage or corrosion pitting. Once the aluminum or zinc is exposed, galvanic corrosion occurs laterally, parallel to the surface of the light metal, which induces catastrophic corrosion failure.

SUMMARY OF THE INVENTION

The general object of this invention is to provide an electrically conductive, lusterless abrasion resistant nickel coating for metals.

A further object of the invention is to provide a nickel electroplating solution from which the coating can be electrodeposited. A still further object of the invention is to deposit nickel directly on aluminum in such a manner that the nickel coated metal will have improved life in corrosive environments.

According to the invention, a nickel electroplating solution is provided which can be electrodeposited onto a light metal to provide an electrically conductive, lusterless, abrasion resistant coating. The coating consists of two layers of nickel. The first layer is 0.8 mil of nickel deposited in a nickel plating bath containing 330 grams per liter of solution of nickel sulfate $NiSO_4 \cdot 6H_2O$, 45 grams per liter of solution of nickel chloride, $NiCl_2 \cdot 6H_2O$, 40 grams per liter of solution of boric acid, H_3BO_3 and with a pH of 4.0 to 4.5. The second layer is 1.0 mil of porous nickel deposited in a nickel plating bath as above but also containing 15 grams per liter of solution of activated carbon, and with a pH of 1.8 to 2.2.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

In one embodiment, the metal to be coated is a 7 x 1.25 x 0.35-inch low-carbon steel strip bent on a 90 degree angle, 1 inch from the end. Panels are mounted vertically with the bent end in a horizontal position. A single nickel anode is positioned under the panel. The two nickel plating baths as above described are used to deposit a first layer of 0.8 mil of nickel, and a second layer of 1.0 mil of porous nickel. A uniform appearing lusterless coating is deposited all over.

In another embodiment, shaped parts such as tubular sections of stainless steel telescoping antennas are plated in a nickel bath with two sets of anodes on opposite sides of the electronic hardware parts. Parts are racked to provide electrical contact using practices well known in the plating industry. Adhesion of nickel is achieved by plating first in an all nickel chloride bath known as Wood's strike followed by plating in the porous nickel plating bath.

The nickel electroplating solutions are prepared using practices well known in the plating industry. That is, metals such as iron and copper which may be present in the salts are removed by appropriate high pH and/or low current dummying treatments. In making up the porous nickel plating bath, the activated carbon is added and the pH adjusted after the initial purification. Removal of traces of organic materials (oils, greases, etc.) is not needed to prevent pitting because the activated carbon absorbs them. The plating bath compositions are maintained within 10 percent of the makeup concentrations.

In the step for plating the porous nickel, a temperature range of 140 to 150 degrees F. is maintained at a current density of 100 to 200 amps per square foot. Vigorous air agitation is also employed and the pH maintained between 1.8 and 2.2.

Porous nickel can be plated on simple-shaped parts in 10 minutes at 100 amps per square foot. However, for complex-shaped parts, higher current densities are required to insure uniform deposition in low-current-density areas.

The steel strips plated by the method described exhibit no rust spots after exposure to 100 hours of a corrosive salt spray. The plated strips are light gray in color and characterized by a gloss index measured at 60 degrees after abrasion for 100 cycles using CS–10 wheels on a Taber Abraser of less than 5. The adhesion and flexibility of the plated strips are excellent.

In plating adherent nickel on aluminum alloy, an anodic treatment for 15 minutes at about 40 to 50 volts in 60 grams per liter sodium carbonate solution maintained at 125 to 135° F. is required prior to nickel plating.

While there has been described what is at present considered to be the preferred embodiment of this invention, it will be obvious to those skilled in the art that various changes and modifications may be made therein without departing from the invention.

What is claimed is:

1. Method of electrodepositing a lusterless, abrasion resistant, and electrically conductive coating on a metal body, said method including the steps of

(A) preparing an aqueous nickel electroplating solution including about 330 grams per liter of solution of nickel sulfate, $NiSO_4 \cdot 6H_2O$, about 45 grams per liter of solution of nickel chloride, $NiCl_2 \cdot 6H_2O$, about 40 grams per liter of solution of boric acid, H_3BO_3 and with a pH of 4.0 to 4.5,

(B) placing the metal to be coated in the solution as the cathode, and a nickel electrode in the solution as the anode,

(C) plating a first layer of about 0.8 mil of nickel onto the metal to be coated,

(D) adding about 15 grams per liter of solution of activated carbon to an aqueous nickel plating bath as in step A above, and with a pH of 1.8 to 2.2, and

(E) plating a second layer of about 1 mil of porous nickel onto the metal to be coated at a temperature of 140 to 150 degrees F., a current density of 100 to 200 amperes per square foot, under vigorous air agitation.

2. Method according to claim 1 wherein the metal to be coated is aluminum.

3. Method according to claim 1 wherein the metal to be coated is aluminum alloy.

4. Method according to claim 1 wherein the metal to be coated is an alloy of aluminum that has been preconditioned by an anodic treatment in sodium carbonate solution.

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29—183.5, 194, 196.6; 204—40, 49