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METHOD OF ELECTROPLATING ON TITANIUM

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1 Claim. (Cl. 204—32)

This invention relates to electroplating and more particularly to electroplating adherent electrodeposits of metals on titanium such as on very thin vacuum coated deposits of titanium.

Heretofore to obtain adherent deposits on titanium, strong pickling solutions and reagents have been employed. These solutions not only remove the oxide layer from the titanium but etch it as well. We have found in the case of very thin layers of vacuum coated titanium that these previous methods of effecting adherence of metals to titanium are entirely unsuited because the vacuum coated titanium layers are destructively attacked.

An object of the present invention is, therefore, to provide an improved electroplating process for plating metals onto articles which have been coated with a relatively thin titanium layer by vacuum coating methods.

Another object of this invention is to provide an improved electroplating plating process whereby metals such as copper and nickel may be plated onto thin titanium coatings without attacking or etching the titanium.

Other objects will appear hereinafter.

In accordance with the invention these and other objects are attained by cathodically cleaning the titanium surface to be plated, activating the surface in a stannous chloride activating solution, coating the titanium surface by immersion in a copper reducing solution or gold chloride dip, electroplating copper thereon from a special copper solution and copper striking the surface in a copper cyanide solution. The work is preferably rinsed between each of the above steps.

The invention is presented in more detail in the following examples:

Example 1

A surface having a vacuum coated layer of titanium thereon is cleaned by being made the cathode in an aqueous alkaline cleaner solution containing 8 ounces per gallon of sodium orthosilicate and 2% by dry weight of orthosilicate of a non-ionic surfactant. The temperature of the solution was maintained at 160° F. Three volts were applied for 5 minutes. The cleaned titanium surface was then rinsed and given a two minute dip in an aqueous stannous chloride activating solution. The activating solution contained 1% stannous chloride and 1% hydrochloric acid. After rinsing, a reduced copper mirror was placed on the titanium surface by dipping it into a copper reducing solution containing:

Copper sulfate	grams	5
Sodium hydroxide	do	7
Rochelle salts	do	18
Potassium sulfate	do	10
Formalin (40%)	milliliters	15
Water	liter	1

After rinsing, the surface was electroplated in a special copper solution containing:

Copper sulfate	grams	25
Rochelle salts	do	10
Triethanolamine	milliliters	25
Water	liter	1

A current of 28 amperes per square foot was employed for 15 minutes. The solution was held at about 20° C. The plated surface was rinsed and copper plated in a copper cyanide solution comprising:

$(Cu(CN)_2)$	oz./gal.	2.5
NaCN free	oz./gal.	0.8
Rochelle salts	percent by volume	8
pH		10.0

A current of 15 amperes per square foot was employed with a bath temperature of 140° F.

Example 2

A surface having a vacuum coated layer of titanium thereon is cleaned by being made the cathode in the cleaner solution described in Example 1, the temperature of which was maintained at a temperature of 160° F. The cleaned titanium surface was then rinsed and given a two minute dip in an aqueous stannous chloride activating solution containing 1% stannous chloride and 1% hydrochloric acid. After rinsing the titanium surface was coated with a layer of gold by chemical displacement in a 1% gold chloride solution at room temperature. A good film forms in approximately 1–2 minutes. The gold layer promotes the formation of a better and thicker copper mirror. The surface was rinsed and a reduced copper mirror was placed thereon by dipping it into the copper reducing solution shown in Example 1. The plated surface was then rinsed and further plated in the copper cyanide solution shown in Example 1 while employing a current of 15 amperes per square foot with an electrolyte temperature of 140° F.

Further examples of this technique would involve the formation of silver or gold mirrors by chemical reduction over the sensitized titanium surface and their subsequent plating with copper.

The mirrors may alternatively be plated with nickel in lieu of copper provided the nickel deposit has little internal stress.

On massive objects of titanium the process may be further modified by coating the copper mirror or gold immersion coating directly with nickel phosphorous alloy as deposited from the catalytic chemical reduction processes as disclosed in Brenner et al. Patent No. 2,532,283 of December 5, 1950.

Palladous chloride may be substituted for the gold chloride to form a palladium layer followed by nickel-phosphorous alloy coating by catalytic chemical reduction.

Our process for plating metals onto thin layers of titanium more particularly titanium coated by vacuum methods gives excellent adhesion without removing a measurable amount of vacuum coated titanium.

We claim:

A method of electroplating a firmly adhering metal coating onto a thin titanium layer which comprises cathodically cleaning the titanium surface in an alkaline solution containing sodium orthosilicate, activating the cleaned surface in an aqueous stannous chloride solution, adding a relatively thin copper coating thereover by dipping into an aqueous copper reducing solution containing copper sulfate, sodium hydroxide, Rochelle salts, potassium sulfate and formalin, electroplating a copper layer thereover from an electrolyte comprising copper sulfate, Rochelle salts, triethanolamine and water while employing a current of 28 amperes per square foot and further electroplating the surface in a copper cyanide electrolyte comprising copper cyanide and free sodium cyanide while holding the pH of the solution at approximately 10.

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