

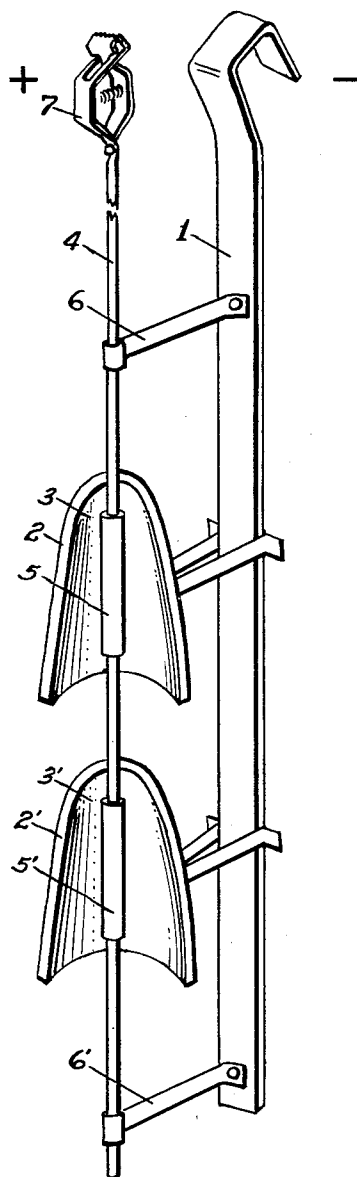
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METHOD OF ELECTRODEPOSITING CHROMIUM

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METHOD OF ELECTRODEPOSITING CHROMIUM
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This invention relates to titanium anodes having platinum coatings thereon.

Platinum coated titanium anodes are known to the art. However, in the field of electroplating, platinum coated titanium anodes have been found suitable only for nickel plating in the related fields of nickel and chrome plating processes. Whereas the platinum coated titanium anodes employed in nickel plating solutions were found to be relatively stable towards dislodgement of the platinum coating, such anodes when employed in chrome plating solutions were found to have coating particle dislodging tendencies which removed the platinum and in a short time stopped the anodic current. It further appears that none of the workers in the field of platinum coated anodes have attempted to improve the efficiency of the anode by confining the area of effective current to that area in the immediate proximity of the object being plated.

It is, therefore, an object of this invention to produce an insoluble anode which is suitable for both nickel and chrome plating processes.

It is another object of this invention to produce a titanium anode with an adherent platinum coating.

It is still another object of this invention to produce an insoluble anode having an effective current carrying surface only in the area of the object being plated.

Of the many problems which have faced the electroplating industry, the selection of an insoluble anode suitable for both nickel and chrome plating has been one of the most perplexing. Anodes of the insoluble type have been found to be subject to particle dislodging tendencies. The problem presented by particle dislodgement is increased when the insoluble anode is used in more than one type of bath, such as for instance, in both nickel and chrome plating baths.

Another problem which faces the electroplating industry is that of obtaining a coating having uniform thickness. The problem of non-uniformity in coating thickness is especially apparent when the object being coated has recessed areas. It has been found that these recessed areas receive less current and, therefore, obtain a lesser deposit of metal from the plating solution. Each plating solution is found to have its peculiarities in the degree to which irregularity of the surface of the object being coated will affect the uniformity of the coating. The peculiarity of each individual plating solution may be defined in terms of throwing power. Throwing power refers to the uniformity of plate thickness that can be expected on a shaped article over the surface of which the current density will vary. The distribution of the plating current is influenced by the relative distance of any given part of the surface from the anodes. No plating bath has a throwing power great enough to produce a uniform plate thickness on complex shaped cathodes.

Because of the low throwing power of nickel and chrome plating compositions, auxiliary anodes such as auxiliary anodes of the conforming type, have been found to be desirable when plating objects having irregular surfaces. It can, therefore, be seen that an insoluble anode which will function as an auxiliary anode free from particle dislodging tendencies in both nickel and chrome plating solutions would be a tremendous advance

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in the electroplating industry. The platinum coated titanium anode produced by the process of this invention has been found to answer these problems.

The insoluble anodes of the prior art are lead, carbon and platinum coated titanium anodes. While platinum coated titanium of the prior art is suitable for nickel plating, it has been found to be subject to the same particle dislodging tendencies in chrome plating solutions which lead and carbon anodes exhibit in both nickel and chrome plating solutions. I have now discovered a process whereby the dislodging tendencies of platinum coated titanium insoluble electrodes in a chrome plating bath is eliminated, thereby producing an auxiliary anode which will function satisfactorily in both nickel and chrome plating baths.

Titanium in itself is not a suitable anode material because the protective oxide film which forms on its surface resists the passage of an anodic electric current. Research has shown, however, that this high resistivity is very much reduced when titanium is brought into electrical contact with a second metal such as platinum. Platinum, deposited as a thin film on the titanium, either in sheet or rod form, produces a conductive surface suitable for an anode. I have found that a platinum coating which does not exhibit dislodging tendencies in a chrome plating bath may be produced when the platinum is plated on titanium wire and then heated from 400° C. to 800° C. for 15 seconds or longer. A special type of atmosphere is not required for this heating operation. A wire anode produced in this manner will function indefinitely in a chrome solution.

It appears that the platinum becomes bonded to the titanium by means of heat induced interdiffusion of platinum with the titanium base metal. The interdiffused layer serves to firmly anchor the pure platinum external coat to the pure titanium base. The interdiffused bonding also serves to prevent the sludging of the platinum coating which rendered the platinum coated electrodes of the prior art useless in chrome plating baths.

The following treating cycle for a titanium base in sheet or rod form has been found to be desirable in the process of this invention:

(1) Descale by 15 seconds to 2 minutes immersion in equal parts by volume of 48% HF, nitric acid and water.

(2) Rinse in water.

(3) Immerse in alkaline cleaning solution.

(4) Rinse.

(5) Dip in 45% HBF₄ at a temperature from 120° F. to 150° F.

(6) Rapid rinse.

(7) Plate at 2-30 amperes per square foot in a highly acid platinum plating solution. The thickness used is on the order of 0.03-0.2 mil.

(8) Heat at 400° C. to 800° C. for 15 seconds to 1 hour. An inert or reducing atmosphere is not necessary.

In some cases a portion (say 50%) of the final platinum thickness was first applied and heat treated and then the remainder of the platinum deposited. This procedure was advantageous when the initial platinum coating tended to be powdery or of poor quality. The second coating was also heat treated when the plural coating procedure was applied. If the initially deposited coating appeared good, there was no advantage in applying the plural coating procedure.

Three types of platinum plating solutions were used:

(1) A platinum chloride solution containing 6 g./l. Pt and 300 cc./l. of hydrochloric acid.

(2) A platinum chloride solution containing 6 g./l. Pt and 300 cc./l. of phosphoric acid.

(3) A proprietary solution (Platinex) containing 12 g./l. of Pt.

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The latter solution produced by far the better deposits. They were all used at 150° F. to 175° F.

As insoluble auxiliary anodes generally have the same area presented toward the workpiece, uniform current density over the entire surface of the anode is not required. An extremely effective anode has been produced by the process of this invention by coating a single area or face of the auxiliary titanium anode, thereby limiting the area coated with platinum while increasing the effective current being utilized. An insulating coating need not be placed on the areas of the titanium anode which are free of platinum as titanium will form an oxide layer which is in itself a good insulator. The anode is also greatly reduced in cost by eliminating unnecessary platinum coating.

The accompanying drawing further illustrates the various embodiments of the invention:

The single figure, which is not to scale, represents a perspective view of the novel auxiliary anode disposed in a plating assembly. The assembly consists of a rack holder 1, holding two recessed objects to be plated 2 and 2'; said recessed objects 2 and 2' having their recessed areas located at 3 and 3' respectively. The auxiliary anode 4 is coupled to the rack holder 1 by means of insulated coupling members 6 and 6'. The auxiliary anode 4 is composed of a titanium wire base having a platinum coated portions, greatly exaggerated for purposes of illustration, disposed on the areas 5 and 5' and having a suitable electrical contact clip 7 disposed at its upper extremity.

In use the rack holder 1 is hung on the cathode bar of an electroplating tank, whereby the rack holder becomes conductive and causes the objects to be plated 5 and 5' to become cathodic to the primary anodes disposed in the electroplating tank. The auxiliary anode 4 is attached to the anode rail of the electroplating tank by means of the electrical contact clip 7. The objects to be plated 5 and 5' are thereby subjected to anodic current from both the primary anode and the auxiliary anode 4. The current flowing from the auxiliary anode 4 flows from the platinum coated areas 5 and 5', thereby subjecting the recessed portions 3 and 3' of the objects 2 and 2' to an increased current density. The result of the increased current density in these recessed portions is to produce more uniform

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coating over the entire surface area of the plated objects. Without the auxiliary anode the thickness of the edge portions of the objects 2 and 2' might be at least five times as great as that in the areas 3 and 3'.

The assembly of this invention may be used for nickel plating an object and then without breaking down the assembly, the entire structure may be removed with suitable washing operations to a chrome plating bath. The novel platinum coated electrode of this invention makes possible the removal of the assembly from one tank to another, the platinum coated titanium anode of this invention being free from particle dislodging tendencies in either nickel or chrome plating baths.

Having thus described my invention, what I claim is:

1. The method of electrodepositing chromium, including the steps of suspending the object to be plated in a chromium plating bath employing a platinum coated titanium auxiliary anode, said auxiliary anode being prepared by electroplating a platinum coating on a titanium base and then heat treating the coated base at a temperature of 400° C. to 800° C.

2. The method of claim 1 wherein said platinum coating is applied by plural applications, each application being subjected to said heat treating operation.

3. The method of electrodepositing chromium, including the step of suspending the object to be plated in a chromium plating bath employing a titanium auxiliary anode having a discontinuous coating thereon; the object to be plated being disposed so as to be in the immediate proximity of the platinum plated portions of the auxiliary anode, said auxiliary anode being prepared by discontinuously plating a platinum coating on a titanium base and then heat treating it at a temperature of from 400° C. to 800° C.

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