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PLATINUM PLATING COMPOSITION AND PROCESS

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4 Claims. (Cl. 204—47)

This invention relates to a platinum electrolyte from which it is possible to plate thick layers of bright platinum and to the process for making the same

Up to the present time the only commercially useful platinum plating baths have depended on chloroplatinic acid ($H_2PtCl_6 \cdot 6H_2O$) or platinum diamino dinitrite $Pt(NH_3)_2(NO_2)_2$ for the platinum ions. The chloroplatinic acid baths though suitable for flash plating are unwieldy for heavier deposits, the deposits becoming spongy as the thickness increases. The useful life of this bath is very short because of the rapid accumulation of chloride ions as the platinum is replenished. Platinum diamino dinitrite (also known as P-salt) which is disclosed in U.S. Patent No. 1,779,436 is dissolved in an electrolyte containing ammonium hydroxide. This bath should be maintained at a temperature of 200° F. which causes a rapid loss of ammonia and a subsequent loss of electrodeposition efficiency. In order to obtain heavier than flash deposits with these baths it is necessary to remove the article from the bath from time to time, scratch brush it and only then continue the plating. These baths operate erratically, apparently due to inconsistent cathode efficiency and occasionally cease operating altogether.

Among the objects of this invention is to provide a platinum containing electrolyte suitable for plating bright platinum of relatively great thicknesses.

Among other objects of the invention is to provide a method for making the electrolyte of the invention.

One phase of this invention is based on the discovery that a solution obtained by heating said P-salt in a mixture of sulfuric and phosphoric acid and mixed with water, when concentrated acids are employed, to provide an electrolyte containing at least 6 g./l. of platinum metal, can be electrolyzed to deposit bright platinum coatings on a cathode.

The objects of the invention are attained by heating 10–40 g. of the platinum diamino dinitrite in about 200 cc. of an aqueous mixture comprising about 10–100 cc. of concentrated H_2SO_4 and about 10–100 cc. of concentrated H_3PO_4 until dissolved, diluting the resultant composition to provide a solution containing at least about 6 g. per liter of platinum (which corresponds to about 10 g. per liter of the P-salt) and electrolyzing this solution.

The following are very satisfactory operation conditions for such a bath.

Platinum metal content	6–20 g./liter.
Sulfuric acid (conc., 66° Bé.)	10–100 cc./liter.
Phosphoric acid (conc., 85%)	10–100 cc./liter.
Bath container	"Pyrex" glass.
Anodes	Platinum.
Anode to cathode ratio	1 to 1 or higher.
Operating temperature	75° to 100° C.
Current density	5 to 30 amperes per sq. foot.
Agitation rate	Moderate to rapid.
Electrodeposition rate	5–25 mg./ampere minute.

Dilute sulfuric and/or phosphoric acid may replace the concentrated acid as long as the same amount of the acid components are added. The dilute acids should have a total concentration of at least 20% of the two acids, however.

The following example illustrates how the invention is put into practice.

Example

50 cc. of concentrated H_2SO_4 (98.+%) and 50 cc. of concentrated H_3PO_4 (85%) are mixed with 100 cc. of water and heated to about 95° C. whereupon 20 g. of platinum diamino dinitrite are added with stirring. A certain amount of bubbles and foam form but in a short time a clear solution is obtained. It has not been possible to determine the composition of the resulting salt in the solution at the present time but it may be a fairly complex compound. The resultant solution is diluted with water to make 1 liter of solution and is then ready for electroplating.

The platinum is plated at a voltage of about 1 to 3 and at a current density of about 5–30 amps. per square foot.

As indicated above the proportion of

$$H_2SO_4(98\%):H_3PO_4(85\%)$$

can vary from about 10:100 to about 100:10 and up to about 40 g. of the P-salt can be dissolved in 20 cc. of the mixture of concentrated acids or 100 cc. of the 20% aqueous solution of the acids. The electroplating bath should have a concentration of at least about 6 g. of Pt per liter for otherwise spongy and/or dull deposits results. There is actually no limiting upper limit of Pt concentration, efficiency increases somewhat as the Pt content increases but so does the drag-out.

Basis metal products having a polished surface have been plated with the above solutions to thicknesses of up to 0.0002" and greater and such products retain the brightness and polish of the original surface.

The features and principles underlying the invention described above in connection with specific exemplifications will suggest to those skilled in the art many other modifications thereof. It is accordingly desired that the appended claims shall not be limited to any specific feature or details thereof.

We claim:

1. As an electrolyte for plating of platinum, a solution comprising water and the solution obtained by heating 10–40 g. of platinum diamino dinitrite in about 200 cc. of an aqueous mixture containing about 10–100 cc. of concentrated sulfuric acid and 10–100 cc. of concentrated phosphoric acid.

2. The electrolyte as claimed in claim 1 wherein said electrolyte comprises at least about 6 g. per liter of platinum metal.

3. A process for electroplating relatively thick layers of bright platinum comprising dissolving platinum diamino dinitrite in the proportion of 10–40 g. in 200 cc. of an aqueous mixture comprising about 10–100 cc. of concentrated sulfuric acid and about 10–100 cc. of concentrated phosphoric acid, adding water to said solution to provide an aqueous solution containing at least 6 g./liter of platinum metal and electrolyzing the solution to plate out platinum therefrom.

4. The process as claimed in claim 3 comprising dissolving the platinum salt in the mixture of acids with the aid of heat.

References Cited in the file of this patent

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