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ELECTRODEPOSITION OF ALLOYS CONTAINING COPPER AND TIN

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6 Claims. (Cl. 204—44)

This application is a continuation-in-part of our application, Serial No. 334,088, filed January 29, 1953, now abandoned,

The present invention relates to improvements in electroplating and is more particularly concerned with the electrodeposition of alloys containing copper and tin as the main constituents.

As is well known, in bright chromium plating techniques, the usual practice is to deposit a thin film of chromium on an electrolytically-deposited undercoating of another metal, conveniently nickel. As an alternative which affords many technical advantages, the use of an alloy containing copper and tin as the main constituents in place of nickel has much to recommend it, and various methods have been proposed in order to obtain a satisfactory depositing under production conditions which involves certain difficulties. One method which largely overcomes these difficulties is disclosed in our copending application Serial No. 320,617 filed November 14, 1952, now Patent No. 2,722,508.

All methods hitherto proposed for electrodepositing copper-tin alloy suitable as undercoating for bright chromium plate have, however, given a dull deposit which requires polishing or other brightening treatment if the subsequent chromium plating is to come out bright.

The major object of the present invention is to provide a method whereby copper-tin alloys may be deposited in a bright condition so that a subsequent bright chromium plating operation is possible without any intermediate treatment of the articles.

This improvement is of very considerable commercial importance as it makes it possible to transfer the articles being plated direct from the alloy plating bath to the bright chromium bath without the necessity of removing them from the plating jigs or suspenders in order to carry out a polishing or brightening treatment. Such intermediate treatment would usually involve unwiring the articles and hence an appreciable amount of labor, and the possibility of dispensing with it owing to the depositing of a bright alloy undercoating, represents therefore an important economic advantage.

According to the invention, the alloy coating may be obtained in the bright state by adopting a suitable chemical measure.

The chemical measures employed comprise the addition to the electrolyte of certain compounds of lead. The effect may be increased by the use of a secondary brightener which may consist of organic compounds such as acetates, cyanates, thiocyanates, tartrates, and/or citrates which may be supplied in the form of their alkali-metal salts or as salts of lead previously referred to.

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An example of a suitable composition for the electrolyte is as follows:

EXAMPLE 1

	Gm./l.
Copper cyanide	40
Sodium stannate	20
Sodium cyanide (total)	65
Sodium hydroxide	7½
Sodium citrate	50

This gives a rather weak electrolyte and in circumstances in which the use of a more concentrated electrolyte is preferable, the following composition might be used:

EXAMPLE 2

	Gm./l.
Copper cyanide	20
Sodium stannate	100
Sodium cyanide (total)	35
Sodium hydroxide	10
Sodium citrate	100

The quantities of the various components may vary within the ranges defined by the upper and lower limits set forth in the two preceding examples.

For instance, the proportions by weight of the solids may vary as follows:

	Percent
Copper cyanide	5–25
Sodium stannate	10–50
Sodium cyanide	10–35
Sodium hydroxide	3– 5
Sodium citrate	10–45

Other suitable examples of electrolyte compositions are as follows:

EXAMPLE 3

	Preferred Concentration, g./l.	Percentage Range	Concentration Range, g./l.
copper carbonate	55	7–60	20–80
potassium stannate	30	3–75	10–50
sodium cyanide (total)	65	7–60	20–80
sodium hydroxide	5	0. 25–20	1–20
potassium citrate	75	3–70	25–125

EXAMPLE 4

copper oxide	15	3–50	10–50
sodium stannate	100	3–50	10–50
potassium cyanide (total)	45	8–70	20–100
ammonium citrate	100	10–80	25–125

EXAMPLE 5

copper sulphite	50	7–50	20–80
sodium cyanide (total)	50	7–50	20–80
sodium stannate	50	3–40	10–50
potassium hydroxide	60	10–40	20–100
citric acid	50	10–40	20–100

The various components may be added to the aqueous bath separately or they may be mixed in suitable proportions beforehand and subsequently dissolved in the appropriate amount of water.

The composition of the anodes, which primarily controls the nature of the deposit, may be 80–95% copper and 5–20% tin and very good results have been obtained with 90% copper and 10% tin. It has also been

found advantageous to include a small proportion of aluminum or aluminum alloy, for instance, up to 2.5% of aluminum or up to 3% of an alloy of aluminum and magnesium.

The citrate or citric acid given in each of the above examples of electrolytes are not essential to the present invention.

According to the present invention, there is added to an electrolyte as set forth in the above examples (with or without the citrate or citric acid present) a primary brightener compound of lead. Such compounds may include oxides, carbonates, cyanides, tartrates or acetates.

It has been found that lead is the most effective metal, the compounds of which will serve as a primary brightener. Titanium, which is also a metal of the fourth group of the Periodic Table, does not satisfy the requirements of the present invention which are so well served by lead.

The quantity of the primary brightener added to an electrolyte solution containing the composition of any one of Examples 1–5 will vary from .01 to 1 gram per liter or about .003–.3% of a soluble lead compound selected from the group consisting of oxides and salts. It is preferred to add the brightener compound to the electrolyte solution after formation of the solution rather than incorporating it with the compositions of Examples 1–5 and adding the entire composition to the water. In other words, it is deemed advisable to add the brightener compound to the electrolyte solution separately. Alternatively, the brightener may be included in the form of a small proportion of the appropriate metal alloyed with the anode.

The invention accordingly represents an important step forward in the plating art whereby improved results may be obtained with less labor.

We claim:

1. A process for the electrodeposition in bright form of alloys consisting mainly of copper and tin on a cathode comprising passing an electric current through an electrolyte containing major portions of copper and tin, a primary brightener comprising about .003 to .3% of soluble compounds of lead selected from the group consisting of oxides and salts, and in which the cathode and an anode of the alloy to be deposited are immersed.

2. A process as claimed in claim 1 in which the effect of the primary brightener is increased by the addition

to the electrolyte of a secondary brightener consisting of a metallic salt of an organic acid selected from the group consisting of acetic, cyanic, thiocyanic, tartaric and citric acids.

3. A process as claimed in claim 2 in which an organic salt of lead serves as both a primary and a secondary brightener.

4. A composition adapted for use when dissolved in water as the electrolyte in an electrolytic bath for the electrodeposition in bright form of an alloy consisting mainly of copper and tin, said composition comprising 5–25% copper cyanide, 10–50% sodium stannate, 10–35% sodium cyanide, 3–5% sodium hydroxide and .003–.3% of a soluble lead compound selected from the group consisting of oxides and salts.

5. A liquid for use as the electrolyte in an electrolytic bath for the electrodeposition in bright form of an alloy consisting mainly of copper and tin, said liquid comprising an aqueous solution containing dissolved solids in the proportion by weight of 5–25% copper cyanide, 10–50% sodium stannate, 10–35% sodium cyanide, 3–5% sodium hydroxide and .003–.3% of a soluble lead compound selected from the group consisting of oxides and salts.

6. A process for the electrodeposition in bright form of alloys consisting mainly of copper and tin on a cathode comprising passing an electric current through an electrolyte comprising an aqueous solution containing dissolved solids in the proportion by weight of 5–25% copper cyanide, 10–50% sodium stannate, 10–35% sodium cyanide, 3–5% sodium hydroxide, and .003–.3% of a soluble lead compound selected from the group consisting of oxides and salts and in which the cathode and an anode of the alloy to be deposited are immersed.

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