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ELECTRODEPOSITION OF ALLOYS CONTAINING COPPER AND TIN

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7 Claims. (Cl. 204—44)

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 under-coating 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, but difficulties have hitherto been encountered in obtaining a satisfactory deposit under production conditions without undue complications. Thus the use of alloy anodes causes polarization and other difficulties and the necessary provision of separate copper and tin anodes, used either simultaneously in separate circuits or alternately, has meant added complications and cost.

The object of the present invention is to provide a process whereby an alloy containing copper and tin as the main constituents may be deposited on a cathode with no more difficulty than is encountered in the electrodeposition of nickel or pure copper with substantially the same equipment.

According to the invention, the difficulties hitherto encountered in electro-depositing an alloy containing copper and tin as the main constituents, using anodes of the alloy in question, are overcome by including in the aqueous electrolyte an organic hydroxy acid, preferably citric acid, or a suitable salt thereof. When this is done, the alloy anodes dissolve in the bath in a steady and regular manner without any tendency to polarization or other disturbances. Moreover, the presence of citric acid or its compounds leads to a marked improvement in the appearance and texture of the deposited alloy.

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, percent	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

	Preferred Concentration, g./l.	Percentage Range, percent	Concentration Range, g./l.
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

	Preferred Concentration, g./l.	Percentage Range, percent	Concentration Range, g./l.
copper sulphite	50	7–50	20–80
sodium cyanide (total)	50	7–50	20–80
sodium stannate	60	3–40	10–50
potassium hydroxide	50	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.

It will be understood that although the deposit obtained according to the invention has been suggested as an undercoating for subsequent chromium plating, it can also be used as an independent finish or as a base for a further plating operation involving the deposit of other metals.

We claim:

1. A liquid for use as the electrolyte in an electrolytic bath for the deposition of a copper-tin alloy selected from the group consisting of an alloy of copper and tin, an alloy of copper, tin and up to 2.5% aluminum, and an alloy of copper, tin and up to 3% of an aluminum and magnesium alloy from anodes of the alloy to be deposited, said liquid composed of water, having dissolved therein 5–25% copper cyanide, 10–50% sodium stannate, 10–35% sodium cyanide, 3–5% sodium hydroxide and 10–45% sodium citrate.

2. A composition adapted for use when dissolved in water as the electrolyte in an electrolytic bath for the deposition of a copper-tin alloy selected from the group

consisting of an alloy of copper and tin, an alloy of copper, tin and up to 2.5% aluminum, and an alloy of copper, tin and up to 3% of an aluminum and magnesium alloy from anodes of the alloy to be deposited, said composition consisting of 5–25% copper cyanide, 10–50% sodium stannate, 10–35% sodium cyanide, 3–5% sodium hydroxide and 10–45% sodium citrate.

3. A process for the electrodeposition of a copper-tin alloy selected from the group consisting of an alloy of copper and tin, an alloy of copper, tin and up to 2.5% aluminum, and an alloy of copper, tin and up to 3% of an aluminum and magnesium alloy on a cathode comprising passing an electric current through an aqueous electrolyte composed of water, 5–25% of a copper compound, 10–50% of an alkali-metal stannate, 10–35% of an alkali-metal cyanide and 10–50% of a compound having the citric acid radical selected from the group consisting of citric acid and an alkali-metal salt of citric acid,

and in which electrolyte the cathode and an anode of the alloy to be deposited are immersed.

4. A process as claimed in claim 3 in which the compound in the electrolyte is sodium citrate.

5. A process as claimed in claim 3 in which the compound in the electrolyte is an alkali-metal citrate.

6. A process as claimed in claim 3 in which the compound in the electrolyte is citric acid.

7. A process as claimed in claim 3 in which the composition of the anode is 80–95% copper, 5–20% tin, 0–2.5% aluminum and 0–2% magnesium.

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