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COPPER AND BRASS PLATING BRIGHTENER

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This invention relates to new and useful improvements in plating solution brighteners for copper and brass plating solutions or baths.

More particularly, the invention proposes providing a plating solution brightener which will produce bright ductile deposits of brass or copper from alkali-cyanide brass or copper electroplating baths.

Bright and ductile deposits of brass and copper are most desirable, useful and of great interest in the plating art since bright plated deposits are usually hard and not ductile. One of the principal objects of my invention is to provide a brightener additive for brass or copper alkali-cyanide electroplating baths whereby brightness of metal deposits is obtained without the usual loss of ductility.

Other objects, features and advantages of the invention will be apparent from the following description and appended claims.

The basic formulation for one gallon of the brightener composition in accordance with the invention is:

Sodium arsenite, two ounces,
Sodium nitrate, ten ounces,
Sodium zincate, ten ounces,
Sodium hydroxide, twenty ounces,
Methyl alcohol, sixteen ounces,
Formaldehyde (40%), sixteen ounces,
Wetting agent, thirty-two ounces,
Tetraethylrhodamine, one gram,
Water to make one gallon.

While this formula with the proportions set forth is the basic one for the brightener, the brightener can be made more concentrated or more dilute as long as all the constitutents are similarly reduced or concentrated and ranges of ten to twenty ounces of sodium nitrate and one to five grams of tetraethylrhodamine (rhodamine B) may be used.

In the brightener, sodium zincate and sodium arsenite (in the ratio of zinc to arsenic of 10:2) are the basic brightening agents. However, were these added alone to a copper plating bath, the optimum brightening effect would not be obtained. Furthermore, a tendency for the copper deposit to become yellow would be apparent due to the zinc and arsenic. The formaldehyde, tetraethylrhodamine and methyl alcohol rectify such reaction. These organic agents reduce the zinc and arsenic to a colloidal form and when in such form they do not affect copper in an objectionable manner. The formaldehyde, tetraethylrhodamine and methyl alcohol also reduce the copper ions in a copper plating bath which in turn produces a finer crystal structure of deposited metal and results in a brighter deposit.

Sodium nitrate is provided in the brightener to reduce hydrogen gas formation in the plating bath. When hydrogen gas is present on the surface of a metal being plated, it is deposited along with the metal plating deposit. This results in a dull or burnt deposit because the metal being deposited must go around or over the hydrogen gas on the surface of the metal being plated and in doing so

produces an irregular metal structure of plating metal. The sodium nitrate reduces the hydrogen gas which in turn allows the plating metal being deposited to form a continuous fine grained structure on the work.

A typical copper electroplating bath initial composition and maintenance in which the new brightener of the present invention may be used with optimum results is as follows:

Copper Bath Make-Up	Copper Bath Maintenance
Sodium cyanide, 8.0 ounces	Free sodium cyanide, 1.0–1.5 ounces.
Sodium hydroxide, 8.0 ounces	Sodium hydroxide, 5.0–8.0 ounces.
Copper cyanide, 6.0 ounces	Copper cyanide, 5.0–6.0 ounces.
Rochelle salts, 4.0 ounces	Rochelle salts, 2.0–4.0 ounces.

In such a bath operated at a temperature of 110–140 degrees Fahrenheit the new brightener of this invention has been added in the proportion of three-fourths of an ounce to each gallon of plating solution and Hull cell tests taken, such as are described in the third edition of "Principles of Electroplating and Electroforming" by Blum and Hogaboon published by McGraw-Hill Company and well known in the art of electroplating. In these tests panels plated at two amperes for five minutes at a temperature of 130 degrees Fahrenheit appear perfect in respect to brightness, ductility and color. The tests show that current densities from 0 to 100 amperes can be used per square foot to produce bright and ductile deposits of copper.

Similarly, a typical brass electroplating bath initial composition and maintenance in which the brightener of this invention may be used is as follows:

Brass Bath Make-Up	Brass Bath Maintenance
Sodium cyanide, 18.0 ounces	Free sodium cyanide, 5.0–6.0 ounces.
Sodium hydroxide, 12.0 ounces	Sodium hydroxide, 8.0–12.0 ounces.
Copper cyanide, 12.0 ounces	Copper cyanide, 10.0–12.0 ounces.
Rochelle salts, 2.0 ounces	Rochelle salts, 1.0–2.0 ounces.
Zinc cyanide, 1.0 ounces	Zinc cyanide, .6–1.0 ounces.

In such a bath operated at a temperature of 145–170 degrees Fahrenheit the brightener in accordance with this invention was added in the proportions of one and one-half ounces of brightener to each gallon of plating solution. Similar results were obtained by Hull cell tests as those obtained with the copper bath described above.

In the new organic metallic complex brightener of this invention, different chemical compounds may be used than those shown in the formula set forth above if on their mixture they form the original chemical compounds. For example, zinc cyanide, zinc oxide and arsenic trioxide plus sodium hydroxide may be used. When zinc cyanide is dissolved in sodium hydroxide a new compound is formed which is sodium zincate. The same reaction takes place when zinc oxide is dissolved in sodium hydroxide. Arsenic trioxide can also be dissolved in sodium hydroxide to form sodium arsenite. In the proportions of the original formula the sodium hydroxide may be increased to 32 ounces and the zinc cyanide, zinc oxide and arsenic trioxide used respectively as follows: 12 ounces; ten ounces; and 3 ounces.

Having fully described my invention, I claim:

1. A plating solution brightener for producing bright ductile deposits of a metal selected from the group consisting of copper and brass from alkaline-cyanide electroplating solutions comprising the following in substantially the following proportions, two ounces of sodium arsenite, ten to twenty ounces sodium nitrate, ten ounces sodium zincate, twenty ounces sodium hydroxide, sixteen ounces methyl alcohol, sixteen ounces formaldehyde, thirty-two

ounces wetting agent, one to five grams tetraethylrhodamine and water sufficient to make one gallon of brightener.

2. A plating solution brightener for producing bright ductile deposits of a metal selected from the group consisting of copper and brass from alkaline-cyanide electroplating solutions comprising the following in the following proportions, two ounces of sodium arsenite, ten ounces sodium nitrate, ten ounces sodium zincate, twenty ounces sodium hydroxide, sixteen ounces methyl alcohol, sixteen ounces formaldehyde (40%), thirty-two ounces wetting agent, one gram tetraethylrhodamine and water sufficient to make one gallon of brightener.

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