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GOLD PLATING BATH AND PROCESS

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This invention relates to the metal coating art and has particular reference to a process and composition for coating surfaces of a base metal with an electro plate of gold or a gold alloy.

Heretofore methods of gold plating in aqueous solutions have employed formulae using the single salt of gold cyanide (AuCN) or the double salt of either potassium or sodium gold cyanide

$$(KAu(CN)_2—NaAu(CN)_2)$$

These single or double gold cyanide salts are dissolved in solutions containing an excess of either sodium or potassium cyanides. Heat, electrolysis, absorption of gases and many other phenomena continuously bring about decomposition of the cyanide salts to complexes of carbonates and other related and deleterious products.

Heretofore it has been the practice to use a cyanide bath for gold plating. This cyanide bath has always been a source of danger, because of the poisonous character of the cyanide and requires special precautions to be taken in the plant to protect the operating personnel. Also the plate obtained from this solution when applied to a bright under surface is only bright itself when the thickness of the gold plate is in the order of three- or four-millionths of an inch. In order to obtain slightly thicker plates evenly with a bright surface, the industry has used certain brighteners which are added to the bath to allow bright plating up to a thousandth of an inch.

One of the objects of this invention is to produce a bath that is stable and will not precipitate the gold on standing and will not build up decomposition products during use.

It is also an object of this invention to provide an electrolytic bath that will plate a bright gold deposit on an unpolished article.

It is a still further object of this invention to provide an electrolytic bath that will plate a bright gold deposit up to 0.01 inch.

Briefly, this invention includes the discovery that an electrolytic bath may be prepared having incorporated therein a complex of sodium gold sulfite. This bath may be modified so that other elements may be deposited with the gold.

Various features of novelty which characterize this invention are pointed out with particularity in the claims annexed to and forming part of this specification. For a better understanding of the invention, its advantages and specific objects obtained with its use, reference should be had to the accompanying descriptive matter in which has been described a preferred embodiment of the invention.

In order to better illustrate the invention, the following specific examples are set forth, but it will be understood that these examples are for purposes of illustration only, and are not to be considered as limitations to this invention.

Example 1

Metallic gold in the form of sodium gold sulfite	grams	3 to 4
Disodium ethylenediamine tetraacetate, 40% strength	cc	40

The above quantities of material are added per liter of water solution. The bath is operated at a temperature of 100° F. to 140° F. This bath operates at a current density of 1 ampere per square foot for rack plating and 3 amperes per square foot for barrel plating.

Example 2

The same solution is used as in Example 1, except that 0.075 gram of disodium ethylenediamine tetraacetate copper complex is added for each liter of solution.

This solution will produce a brilliant gold deposit up to .005 inch thick. This plating contains traces of copper.

Example 3

Sodium gold sulfite	3 to 4 grams per liter.
Hexamethyleneamine $C_6H_{12}N_4$	40 grams per liter.
Temperature	100° F. to 140° F.
Current density	1 to 3 amperes per square foot.
Anode	Insoluble.

Example 4

Sodium gold sulfite	grams per liter	3 to 4
Hexamethyleneamine $C_6H_{12}N_4$	do	40
Ethylenediaminetetraacetic acid (disodium ethylenediamine tetraacetate), 40%	cc	40

Disodium ethylenediamine tetraacetate is used as a chelating agent. Other chelating agents may be used, such as sodium pyrophosphate, but the E.D.T.A. is the preferred compound.

In all of the aboe examples sodium gold sulfite serves as the gold supply salt as well as the conductive medium and while 3 to 4 grams per liter is the preferred concentration, and given in all of the examples, it may be varied from this concentration to contain more or less gold and this expression refers to the actual gold content, and not to the gross weight of the complex.

Wherein in the above examples, sodium gold sulfite complex has been used, potassium sulfite or other metal sulfites of the alkali metal group may also be used to form the complex; but the preferred material is the sodium or potassium sulfite.

The gold complex is prepared by taking a gold chloride solution and adding ammonium hydroxide to it to produce a precipitate. This is then filtered and washed and dissolved by adding an alkali sulfite. The sodium and potassium sulfites are the preferred materials. This then produces a solution containing all of the gold originally present as the chloride. This solution is the solution used in the above examples and referred to as the sodium gold sulfite complex. The exact composition of this salt has not been determined, but it is believed that this has the formula:

$$Na_3[Au(SO_3)_2]$$

The base article to be gold plates is cleaned by any known method and is usually polished and has the gold applied thereto in thicknesses of 1 to 3 millionths of an inch, but the present process allows, for the first time, a heavier plating of gold, up to 0.01 inch or even thicker, and the plate is bright and does not need polishing, as the plate acquires a greater brilliance as the depth of the gold increases.

The gold in the plate, as described in the present invention, is a dense, compact, fine-grained deposit and is not of the porous nature obtained by the deposition of gold in the usual cyanide bath. This novel deposit produces an article that has heretofore been unknown.

The surface of the base article, as pointed out above, must be cleaned, but it does not have to be polished in order to deposit thereon a gold plate of high brilliancy. This is also obtained by this process for the first time, as heretofore it has been necessary in order to obtain a bright plate to have the base metal of the same or greater brightness.

While in accordance with the provisions of the statute,

there has been described the best form of embodiment of this invention known, it will be apparent to those skilled in the art that changes may be made in the process without departing from the spirit of this invention as set forth in the appended claims, and that in some cases certain features may be used to advantage without a corresponding use of other features.

What is claimed is:

1. A process for coating the surface of a conductive article which comprises, immersing the article in an electrolytic bath cyanide free containing a sodium gold sulfite complex, and passing an electric current between an anode and said article as a cathode.

2. An electrolytic bath cyanide free containing a potassium gold sulfite complex and disodium ethylenediamine tetraacetate.

3. An electrolytic bath cyanide free containing a sodium gold sulfite complex and disodium ethylenediamine tetraacetate.

4. A process for coating the surface of a conductive article which comprises, immersing the article in an electrolytic bath cyanide free containing a sodium gold sulfite complex, and a soluble salt of another metal and passing an electric current between an anode and said article as a cathode.

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