Cu-510 Bright acid copper plating process

Cu-510 Bright acid copper plating process produces high leveling, High brightness, good ductility coating. The coating has low internal stress and good corrosion resistance.

This method is economical, low operating temperature, strong compatibility and simple wastewater treatment.

Solution composition

		Scope	Optimal
·Copper sulfate (High purity)	→	175-250 g/L	220 g/L
·Sulfuric acid (high purity)	→	50-70g/L	60g/L
· Cl	→	70-140ppm	100ppm
·Cu-510 Mu	→	4.0-6.0 ml/L	5.0 ml/L
·Cu-510 A	→	0.3-0.6 ml/L	0.4 ml/L
·Cu-510 B	→	0.3-0.6 ml/L	0.5 ml/L
·Cu-510D wetting agent	→	0.3-0.6 ml/L	0.5 ml/L

Operating conditions

		Scope	Optimal
· Temperature	→	20-30℃	25℃
·Cathode current density	→	1-6 A/dm^2	4 A/dm^2
·Anode current density	→	0.5-2.5 A/dm^2	2 A/dm^2
·Anode	→	phosphorous copper	
· Anode bag	→	polypropylene	

· Stir → as needed

· Filtration → continuous filtration per hour

· Current efficiency → close to 100%

MAKE UP

Pour 2/3 volume of water into the plating tank, recommend using deionized water, and heat to 60℃.

Note: If using tap water, analyze its chloride content first.If chloride levels are too high, deionized water is recommended.

· Dissolve copper sulfate in hot water, stirring continuously.

· Add 2.0 g/l of high quality activated carbon to the plating solution, stir thoroughly and settle overnight.

· Filter the treatment liquid to the plating cylinder.

· Add an appropriate amount of concentrated sulfuric acid as required, stir fully and add water to make up the water level.

· Add proper amount of pure hydrochloric acid as required and stir thoroughly.Usually when preparing 1000 liters of copper solution, 265 ml of reagent pure hydrochloric acid (35-37%) needs to be added, and its chloride concentration is 120ppm If deionized water is not used, the chloride ion content in the water must be less than 120ppm.The concentration of hydrochloric acid must be adjusted to obtain the optimal chloride content.

· Cool the solution to the operating temperature and add Cu-510MU,Cu-510A, Cu-510B and Cu-510D wetting agents as needed, and stir with air.

Device

Plating cylinder and filtration

Steel or other plastic cases lined with rubber shall be used.The plating cylinder shall be equipped with mechanical stirring equipment or air stirring pipe for continuous filtration;Air must be deoiled and a post-wash filter is recommended.Heating and cooling equipment should be provided. Continuous stirring solution is recommended.

The anode

The phosphorus content of the anode in this method should be 0.03-0.06%.Copper anodes of other materials may produce rough coatings or increase the amount of additives.The anode area is sufficient to maintain the anode current density within 2-4 amperes/decimeter .Insoluble anodes increase the consumption of additives.

Consumption

The consumption depends on the required brightness and the band out loss.Cu-510 MU will bring out the consumption.Add 50 ml Cu-510mu for every 1 kg of copper sulfate.

Consumption of other additives:

Cu-510A : 50 – 80 ml/1000 AH

Cu-510B : 20 – 30 ml/1000 AH

Solution control

The contents of chloride, copper sulfate and sulfuric acid shall be analyzed and adjusted weekly.

The content of brightener was controlled by an air - stirred Hull tank test.

Add copper sulfate to the bath through an anode bag or filter;Sulfuric acid can be added directly.Add brightener when operating amperes

When the temperature is maintained at about 25°C, the low current density area has good brightness; if the temperature is lower than 20°C, the high current density area of the workpiece will be burnt. When the temperature is around 35°C, a spot-like, matt coating is formed in the low current density area of the workpiece. The problem can be solved by increasing the amount of Cu-510A added.

Purification treatment

Generally Cu-510 bright acid copper plating does not require oxidation/or batch carbon treatment.If impurity is introduced, oxidation/or batch carbon treatment shall be carried out, the plating solution shall be drawn to the treatment tank and treated with activated carbon.

Device

The plating solution is highly corrosive. The outer layer and bottom of the plating tank must be protected by an acid-resistant coating.

Plating cylinder

Corrosion-resistant materials such as PVC, PP, PE, etc. must be used for plating tank materials. The new plating tank must be cleaned with 3-5% sulfuric acid at 50-60℃ before use.

Stir

The Cu-510 solution must be stirred by air.Polypropylene or PVC tubes are recommended.The agitation tube should be placed between the cathode rod and anode rod and fixed.The stomata shall be aligned with the bottom of the plating cylinder at an Angle of 45 degrees;The distance between the holes is 2cm,
Stomatal diameter is 3 mm.In this way, the airflow can be guaranteed and the stirring tube will drain when the bath is empty.Plating rack bottom and empty
The top of the gas mixing tube should be kept at a distance of 15 cm.Use filtered low pressure air, not compressed air.

Filter

Continuous filtration is recommended. But it is not recommended to use activated carbon, because activated carbon will filter out the light agent. The air pump and filter must be capable of turning the solution at least 2 times per hour. Due to the strong corrosiveness of the solution, the surface of the equipment touching the solution, such as filter pumps, must be acid resistant.

Anode

A phosphor copper anode containing 0.03% phosphorous is used. Other anodes will cause excessive loss of light agent and produce rough coatings.

The area of the anode must be twice the area of the cathode. Use polypropylene or polyester anode bags. It is recommended to rinse the anode bag with 5% sulfuric acid solution before use, and then rinse thoroughly with clean water before entering the plating tank. If an anode basket is used, it must be a titanium anode basket.

Cooling

It is recommended to use a titanium cooling tube or heat exchanger to cool the solution, and the operating temperature of the solution is 25-30°C. The brightness and leveling of the coating above 35°C are reduced.

Analysis and control

The contents of copper sulfate, sulfuric acid and hydrochloric acid in the plating bath shall be routinely checked and adjusted according to the following analytical steps.

Copper sulfate analysis

Instrument needed

* 50 ml straw
* 25ml graduated cylinder
* 50ml burette
* 500 ml Erlenmeyer flask

required reagents

ammonium hydroxide : reagent pure

glacial acetic acid : reagent pure

KI : reagent pure

Starch solution : 5 g/L

Sodium Thiosulfate Solution : 0.1 equivalent weight

Process

* Sample 5 ml of bath solution to 500 ml conical flask with straw.
* Add 20ml of distilled water.
* Drop ammonium hydroxide until dark blue precipitate is formed.
* Dilute with distilled water to 150-250 ml.
* Add 10 ml glacial acetic acid and 3-4 grams of potassium iodide.

Titrate with starch and 0.1 equivalent sodium thiosulfate solution.

calculation method

0.1 Titration reading of equivalent sodium thiosulfate solution (ml) x 5.0 =g/l copper sulfate

Sulfuric acid analysis

Needed Device

* 10 ml straw
* 50ml burette
* 250 ml Erlenmeyer flask

required reagents

Methyl orange indicator

0.1N caustic soda solution

Process

* Use straws to sample 10 ml of bath solution into 250 ml conical flask.
* Add 100ml distilled water and 3-4 drops of methyl orange indicator.
* Titrate with 0.1 equivalent sodium hydroxide solution until yellow precipitate is formed.

Computational Method

0.1 Equivalent sodium hydroxide solution titration reading (ml) x4.9= g/l sulfuric acid (66 degrees)

Chloride analysis

Needed device

* Electromagnetic stirrer
* 50 ml burette
* 200ml beaker
* 50ml straw

Required reagents

*50% nitric acid solution

Add 20ml concentrated nitric acid to 20ml distilled water while stirring.

*0.1 equivalent silver nitrate solution

Dissolve 17 g silver nitrate in distilled water in a volumetric flask and dilute to 1 l. Place in a brown flask.

* 0.01equivalent mercury nitrate solution

Dissolve 1.083 g of mercury oxide in 5 ml 50% nitric acid solution.Dilute with distilled water to 1 liter.

Titrate 25 ml of standard chlorine solution of 0.002 equivalent (0.1168 g/l sodium chloride) with 0.01 equivalent mercury nitrate solution according to the following formula:

Equivalent mercuric nitrate solution =0.002 equivalent x 25ml mercuric nitrate solution

Milliliters of mercury nitrate solution

Process

* Use straws to sample 50 ml of CUPRAMAX solution to 200 ml of beakers.

* Add 40ml distilled water and 10ml 50% nitric acid solution.

* Add sufficient 0.1 equivalent of silver nitrate (usually 4-5 drops) to precipitate.

Titrate 0.1equivalent mercuric nitrate solution and stir until dissolved.

calculation method

Mercuric nitrate titration reading (milliliter) x equivalent mercuric nitrate x 709= mole grams per milliliter of chloride

Troubleshooting

No.	Feature	possible cause	Measure
1	plating layer roughness	Powdered suspension carried by the anode. (poor quality phosphor copper anode, dust or damaged anode pack)	Fully filter solution, replace filter plate and polypropylene filter cloth.If the coating roughness problem is serious, filter the plating solution into another tank, and thoroughly clean
2	High current density zone charring	Bath temperature is too low	Raise the temperature
		Copper content is too low	Add copper sulfate
		Cu-510AToo much	Overconsumed Cu-510A
		Cu-510B insufficient	Join Cu-510B
3	Granular rough coating or black	Low sulfuric acid	Analyze the bath and add sufficient amount of sulfuric acid
		High current density	Reduce voltage and adjust cathode current density

	powder coating	The temperature is too low	Heat the bath to 25-28℃ before operation
		Chloride content below 70ppm	Analyze and adjust chloride content to 70-140 PPM
		Cu-510MU insufficient	Add enough Cu-510 MU
4	Poor leveling	Cu-510 MU and Cu-510A were added inadequately	Cu-510MU and Cu-510A are added regularly at 1000 ampere-hour to keep the bath in optimum condition
		High chloride content	Zinc powder or silver sulfate treatment
5	Low current density area poor leveling ; Medium and high current density area has good brightness and poor leveling	Too much to add Cu - 510B and Cu - 510A	Suspend the addition of Cu-510B and Cu-510A; Plating workpieces with simple shapes to reduce the concentration of light agents
6	The leveling boundary of the low current density area is obvious	Too much to add Cu - 510 A	Stop adding Cu-510A;Add 1.0-2.0 ml/l Cu-510mu.The amount of addition depends on plating monitoring or 1.0 amp hull tank test results.It is recommended to add a small amount of Cu-510A each time
7	Low current density zone produces spot and no gloss coating	Too much to add Cu - 510 B	Add 0.2-0.4 ml/l Cu-510A to increase the brightness of the low-current density area
		High temperature	Lower the temperature and adjust the thermostat
8	Pitting	Low Concentration of	Add 0.5-1.0 ml/l Cu-510 wetting

	coating	Cu-510 wetting agent (anti-pitting agent)	agent to overcome
		Insufficient air stirring	Place the mixing tube properly to increase air flow
9	Excessive additive consumption	Liquid temperature is too high	Cooling solution
		Cu-510A and Cu-510 B have improper proportions	Adjust the proportions of CU-510A and Cu-510B
		Anode Precipitation too much	Improper anode material or high current density
10	The difference in adhesion between copper and nickel	Improper cleaning	Wash properly and change the water
		Chloride content below 70ppm	Analyze and adjust chloride content of 70-140ppm
		Improper pickling after copper plating	Use 5-10% sulfuric acid instead of hydrochloric acid to avoid oxidation of the copper coating
11	After a few minutes of electroplating, the voltage decreases and the current increases greatly	Anodic polarization - formation of black film	Improper anode material - use phosphor copper anode
		The porosity of the anode is blocked, and the polypropylene mesh is too small or Cu-510A is excessive	Periodically clean the anode pack with hot water to remove the copper sulfate crystal from the anode pack.Use 25-30 micron polypropylene bags and wash regularly with diluted sulfuric acid
12	anode passivation	High concentration of hydrochloric acid	Clean the anode, analyze the chloride content and then add appropriate silver sulfate to adjust the chlorine content.Stir the solution thoroughly and settle.The precipitate of silver chloride was filtered and the chloride content of the solution was reanalyzed
		Poor water quality, high chloride content	Use quality water or deionized water
		Excessive sulphuric acid or copper content	Diluted electrolyte
		anode is blocked or the pores are too small	Cleaning anode bag
		The content of iron	diluted solution

		pollutants in the bath is high	
13	Anode and plating cylinder edge, solution partially crystallized	Excessive concentration of solution	solution concentration was analyzed, diluted, and thoroughly stirred
		temperature is too low	Use titanium heating tube to heat to 20-30℃