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J-PLATE CU 400

J-PLATE CU 400 is a high throw, high speed, bright acid copper plating process especially designed for direct plating. It produces highly levelled, bright smooth copper deposits on properly prepared and conductive PCB at both high and low current density levels.
When correctly operated **J-PLATE CU 400** bath will produce hole wall to surface distribution of 1:1.

J-PLATE CU 400 is particularly suited to pattern-plating and to high aspect ratio fine line PWB.

OPERATING SOLUTION

	Range	**Optimum**
Copper	20-25 g/l	22,5 g/l
Copper sulphate pentahydrate	80-100 g/l	90 g/l
Sulphuric acid	180-210 g/l	200 g/l
Chlorides (as Cl^-)	50-80 mg/l	70 mg/l
J-PLATE CU 400	4-8 ml	6 ml

OPERATING CONDITION FOR J-PLATE CU 400

Temperature	20-30°C	27°C
Current density	0,1-8 A/dm^2	2-3 A/dm^2
Agitation	Air or mechanical agitation	
Plating rate	0,8 µ/min at 3 A/dm^2 with air agitation	
Replenishment	1 litre of brightener **J-PLATE CU 400** for every 8000 A/h	

EQUIPMENT REQUIRED

Anodes	Phosphorised copper
Anodes bags	Polypropylene
Heaters	Teflon or titanium
Filtration	Continuous filtration on polypropylene filters is recommended.

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SOLUTION MAINTENANCE

CHLORIDES

To promote smooth deposit and increase the **J-PLATE CU 400** bath's tolerance to impurities the chloride concentration must be maintained above 60 mg/l. An out of balance chloride level causes burning and irregular deposit in the current density areas

AGITATION

The **J-PLATE CU 400** solution should be air or mechanical agitated. Polypropylene or PVC is recommended for the air tubes. One air tube for each vertical plane of work in the tanks is recommended. The air tubes should be directly under the work and supported at least one inch off the bottom of the tank. Low ressure air, not compressed air, should be equipped with dry air filter to ensure that only clean air enters the solution.

TEMPERATURE

It is recommended that **J-PLATE CU 400** solution should be operated at between 20-30^{o}C. Loss of brightness and levelling occurs at temperatures above 30^{o}C. Teflon or titanium cooling coils or exchangers are recommended to cool the solution if necessary.

FILTERING

Continuous filtration is strongly recommended; however, continuous filtration through activated carbon is not recommended as this will remove the **J-PLATE CU 400** brightness. The pump and filters should have sufficient capacity to turn over the solution at least once every hour. Plastic magnetic driven pumps and polypropylene filter are recommended.

RACKS

Plating racks must be coated with materials that will not contaminate the plating solution. Usually coating for acid copper solutions is OK.

ANODES

Phosphorised anodes or phosphorised roller copper anodes with a minimum of 0,02% phosphorus should be used in the **J-PLATE CU 400** solution. Other anodes may cause excessive brightener consumption, poor levelling, and roughness. The anode areas should be twice the cathode area and napped polypropylene anode bags should be used.

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ANALYSIS

Cu^{2+}:

1. Pipette 2,0 ml sample into a 250 ml E-beaker.
2. Add 80 ml DI water.
3. Add 1-2 ml buffer solution with pH 10.
4. Add a pinch of murexindicator.
5. Titrate with 0,1 M EDTA from greenish to purple endpoint.

Calculation
g/l Cu^{2+} = 3,177 x ml 0,1 M EDTA

H_2SO_4:
1. Pipette 5,0 ml bath into a E-beaker.
2. Add 100 ml DI water.
3. Add 5-6 drops of methyl orange.
4. Titrate with 1,0 M NaOH to greenish endpoint.

Calculation
g/l H_2SO_4 = 9,81 x ml NaOH
Chlorides:
The potentiometric method is recommended.

Potentiometric method:
1. Pipette exactly 50 ml bath into a 100 ml cup.
2. Place one silver-(Ag) and one mercury sulphate-($HgSO_4$) electrode in a cup and connect them to a potentiometer.
3. Titrate with 0,02 M silver nitrate solution. ($AgNO_3$)
4. Add silver nitrate in small doses, for instance 0,2 ml each time.

Note potential after every addition. The total addition of silver nitrate that gives the greatest potential decrease is used in the calculation.

Calculation
14,18 x ml 0,02 M $AgNO_3$ at maximum.

Visual method
1. Pipette 10 ml bath into an 100 ml E-beaker.
2. Add exactly 5 ml reagent solution*. If the solution becomes clear does it mean that the bath contains less than 15 mg Cl^-/l. If the solution stays turbid, add another 5 ml reagent solution. Every addition of 5 ml corresponds to 15 mg Cl^-/l bath.

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* The reagent solution: 0,170 g mercury nitrate ($Hg(NO_3)_2$) dissolved in 200 ml nitric acid diluted by 1:1 with DI water. Add 0,10 g $AgNO_3$ and dilute the solution to 1000 ml.

Reagent solution	conc. Cl^-/litre bath
5 ml	**<10 mg /l**
10 ml	**15-30 mg/l**
15 ml	**30-45 mg/l**
20 ml	**45-60 mg/l**
25 ml	**60-75 mg/l**

TROUBLESHOOTING

Problem	Problem cause	Corrective measures
Burning and roughness	**Copper concentration too low**	Adjust copper sulphate Roughness level.
	Acid content to high	Dilute bath with water.
	Temperature to high	Cool solution.
Problem	**Problem cause**	**Corrective measures**
	Anode bags contaminated	Clean or replace anode bags.
	Poor agitation	Increase air flow. Agitate cathode bars if possible.
	Too high current density	Decrease current. Optimum current density depends on degree of agitation and board configuration.
	Brightener out of balance	Perform test cell analysis. The use of mechanical or air agitation is required; electrolyse each panel at 3 amperes for 5 minutes for a 1 litre plating cell.
	Chloride content too low	Analyse for chloride and replenish as required.
Voids in holes	**Insufficient electroless copper**	Balance electroless solution consistence. Lengthen immersion time. Lower current upon electrolytic bath entry.

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	Particles in solution	Filter bath. Spray rinse boards prior to electroplating. Check all solution for suspended matters.
	Dissolution of electroless copper	Check for organic contamination. Check concentration of pre-treatment line solutions
Lack of response to brightener	Anode polarisation high voltage/low amps	Increase anode area. Balance copper metal to sulphuric acid to maintain the right ratio. Check for metallic contamination, i.e. iron, nickel, zinc. Check anode banks for blocked pores, or too tight bags. Check chloride content. Low chloride content will cause anode polarisation. Check phosphorus content of anodes. Too high phosphorus content may result in anode polarisation.
Problem	**Problem cause**	**Corrective measures**
	Chloride out of balance	May be indicated by narrow bright range. Maintain the right level in the working solution.
	Temperature too high	Cool solution.
	Solution needs carbon treatment	Carbon treat solution.
Poor metal distribution	**Air agitation to low or too high**	Adjust air flow.
	Mechanical agitation too fast	Reduce agitation rate.
	Temperature too high	Cool solution.

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	Phosphorus content of anodes incorrect	Replace anodes.
	Anodic current density too high	Reduce current density.
	Anode to cathode ratio too small	See requirements
	Poor throwing power	Copper content too high; analyse and dilute as necessary. Acid content too low; analyse and add as required. Temperature too high; cool bath. Metallic contamination (i.e. nickel, tin, iron etc.)
	Heavier deposit on one side of panel	Balance anode area to cathode area.
	Poor levelling	Increase current density. Analyse bath for chlorides. Increase cathode area. Filter bath. Check cleaning solution prior to plating tank.
Problem	**Problem cause**	**Corrective measures**
Matt deposit	**Current density below 2 ASD**	Increase current density.
	Temperature too high	Cool solution.
	Concentration of brightener too low	Perform test cell analysis and replenish as necessary.
	Air agitation too low	Increase air.
	Anode to cathode ratio too small	See requirements.
	Loose anode contacts	Check for proper contact.

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SAFETY INSTRUCTIONS
Irritating to eyes, skin and respiratory system.
Avoid contact with skin and eyes. Wear suitable protective clothing. Wear protective gloves. Use protective glasses or face mask.

WASTE TREATMENT
Raise pH to 10-12 with sodium or potassium hydroxide diluted in water. Add flock medium to settle all copper. Decant the clear water and neutralise. Pump out the clear water.

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