



Technical Bulletin

CP 155 Copper Plating

I. Description

CP-155 is a non-dye, high-speed acid copper plating system used to electroplate printed circuit boards. It uses a single addition agent. It has been formulated to improve the throwing power of an acid copper plating bath and gives a 1:1 ratio deposit in the holes and on the surface of the panel.

CP-155 produces a bright deposit that will withstand thermal stress testing via Military Specification P55110. This makes CP-155 an excellent electroplate addition agent for through-hole plating of both double sided as well as multilayer printed circuit boards.

II. Operating Parameters

Make-Up	0.5% CP155 by volume (0.64 fl oz/gal)
Copper Sulfate Pentahydrate	60 to 80 grams per liter (8.0 – 10.7 oz/gal)
Sulfuric Acid 66° Be	10 to 15% by volume (12.8 – 19.2 fl oz/gal)
Acid to Copper Ratio	10:1
Chloride	20 to 60 ppm
Temperature	65 to 90°F (18 to 32°C)
Replenishment	0.30 - 0.40 ml per Amp hour
Current Density	2.1 to 4.2 Amps per square decimeter 20 to 40 Amps per square foot
Anodes	Baskets or Slab, 0.025% Phosphorus minimum
Anode to Cathode Ratio	2:1
Anode Bags	Polypropylene, Dynel
Filtration	Continuous while Plating
Ventilation	Advised
Agitation	Vigorous air from blower or high turbulent solution movement
Tanks	Polypropylene, Polyethylene, PVC
Heaters	Quartz or Teflon

III. Physical Properties

Appearance	Clear and colorless liquid
Specific gravity	0.99 to 1.02
PH	< 2.0
Odor	None

IV. Control Procedures

NEW BATH MAKE-UP	100 gals	100 liters
Copper Sulfate pentahydrate	58 lb	7.0 Kg
Sulfuric Acid C.P. Grade, 66° Be	10 gal	10 liters
Hydrochloric Acid, C.P. Grade	0.6 fl. oz.	4.7 mLs
CP-155 copper addition agent	0.5 gallons	0.5 liters

NEW BATH START-UP PROCEDURES

Prior to bath make-up, the tank must be clean and leached with a 5% solution of sulfuric acid and 0.1% CP-155 for a period of 12 hours. The anode bags should be washed in warm water to remove any sizing and then leached in 5% solution of sulfuric acid and rinsed. All equipment, heaters, filters, racks, etc. should also be washed prior to coming in contact with the new plating solution.

MAKE-UP

1. Fill tank half way with de ionized water.
2. Add the required amount of sulfuric acid and mix.
(CAUTION, EXOTHERMIC REACTION)
3. Add the required amount of copper sulfate and mix.
4. Add the required amount of hydrochloric acid and mix.
5. Let the solution cool to room temperature and then raise the volume of the bath to operating height.
6. Add the required amount of CP-155 addition agent and mix.
7. The plating solution is now ready to use.

SOLUTION CONVERSIONS

Plating baths can be converted to a CP-155 plating bath. A batch carbon treatment should remove the organic addition agents. This can be accomplished by treating the bath with 4 pounds of carbon per 100 gallons. An addition of 1000 mls per 100 gallons (400 Liters) of 35% hydrogen peroxide may have to be made if the level of organics prove to be a problem. If hydrogen peroxide is used, the bath should be heated to 100°F for two hours prior to carbon treatment. Carbon treatment can also be accomplished by continuously filtering the bath through activated carbon filters until a 2 amp, 5-minute hull cell shows no sign of active grain refiner. After the organics have been stripped out of solution and adjustments have been made, the addition agent can be added and plating can continue.

TIME NEEDED TO PRODUCE DEPOSIT (This is a guideline only)

Inches	.0005"	.001"	.0015"	.002"
Amps/square foot				
20 ASF	27 min	53 min	80 min	107 min
30 ASF	18 min	36 min	53 min	71 min
40 ASF	13 min	27 min	40 min	53 min
Microns	12.5	25.0	37.5	50.0
Amps/square decimeter				
1.0 ASD	56 min	112 min	168 min	225 min
2.5 ASD	23 min	45 min	67 min	90 min
5.0 ASD	11 min	23 min	34 min	45 min

V. Analysis

Determination of Copper Sulfate Pentahydrate

Reagents and Equipment Needed

PAN Indicator

0.05 M EDTA: di-sodium Salt

Ammonium Buffer (Dissolve 68 grams of ammonium chloride in 300 ml of de ionized water. Add 570 ml of 29% ammonium hydroxide and dilute to 1 Liter with de ionized water).

PROCEDURE

1. Pipette 2 ml of sample into a 600-ml flask.
2. Add 5 ml of buffer and add about 75 – 100 mL of DI water. The solution should be clear blue at this point. If not, add more buffer until it is clear blue.
3. Add 3-5 drops of PAN indicator.
4. Titrate with 0.05 M EDTA to a green endpoint.

5. Calculations:

$$\text{Copper sulfate pentahydrate (g/L)} = (\text{mL of EDTA}) \times (\text{M of EDTA}) \times 121$$

$$\text{Copper sulfate pentahydrate (oz/gal)} = (\text{mL of EDTA}) \times (\text{M of EDTA}) \times 16.2$$

Determination of Sulfuric Acid

Reagents Needed

Methyl Orange-Xylene Cyanole Indicator

1.0 Normal sodium hydroxide solution (dissolve 40 grams of sodium hydroxide in 500 ml of de-ionized water and dilute to 1 liter with de ionized water)

PROCEDURE

1. Pipette a 5 ml sample into a 500 ml Erlenmeyer Flask.
2. Add about 75 – 100 mL of DI water.
3. Add 3-5 drops of methyl orange-xylene cyanole indicator.
4. Titrate with 1.0 N sodium hydroxide until the color changes from a purple to a greenish-yellow endpoint.
5. Calculations:

$$\text{Sulfuric acid (\% by vol.)} = (\text{mls of 1N NaOH}) \times 0.56$$

$$\text{Sulfuric acid (fl oz/gal)} = (\text{mls of 1N NaOH}) \times 0.72$$

Determination of Acid to Copper Ratio

Calculations:

$$[(\text{Sulfuric acid \% vol}) / (\text{Copper sulfate pentahydrate g/L})] \times 71 = \text{Acid to Copper Ratio}$$

$$[(\text{Sulfuric acid fl oz/gal}) / (\text{Copper sulfate pentahydrate oz/gal})] \times 7.4 = \text{Acid to Copper Ratio}$$

Determination of Chloride

Reagents and Equipment Needed

1:1 Nitric Acid

0.1 N Silver Nitrate

0.01 N Mercuric Nitrate (Dissolve 1.083 grams of Mercuric oxide in 5 ml of 1:1 Nitric Acid and dilute to one liter).

THIS SOLUTION NEED NOT BE STANDARDIZED.

PROCEDURE

1. Pipette 50 ml of sample into a 250 ml beaker.
2. Add 20 ml 1:1 Nitric Acid.
3. Add 2-3 drops of 0.1 N Silver Nitrate, enough to produce turbidity.
4. Titrate with 0.01 N Mercuric Nitrate until turbidity just clears.
5. Calculation:
$$\text{Chloride (ppm)} = (\text{mls Mercuric nitrate}) \times (\text{N Mercuric nitrate}) \times 710$$

Determination of Additive (CP) by Hull Cell

PROCEDURE

1. Fill a 267 mL Hull cell to the mark with the plating solution.
2. Remove the plastic cover film, and clean the brass cathode in 10% sulfuric acid for 30 sec.
3. Place the cathode into the Hull cell and connect the negative (black wire) to it.
4. Attach the positive (red) wire to the copper anode. We recommend using the same kind of anode in the Hull cell as you have in your plating tank.
5. Start the air agitation.
6. Turn on the rectifier and plate the cathode at 2 Amps for 5 minutes.
7. Rinse the cathode in clean water and evaluate the plated copper deposit.
8. If there is dulling in the 10 – 30 ASF range, then add a small dose of additive to the Hull cell and plate another cathode. We recommend using 0.1% by volume doses of additive.
9. If there is step plating or burning in the 10 – 30 ASF range, then the additive concentration may be too high and “dummy” plating or carbon treatment may be necessary.

VI. Safety and Storage

CP-155 is a mildly acidic solution. It contains wetting agents and organic surface conditioners. Avoid breathing vapors. Use in a well-ventilated area. When handling concentrate or working solution wear protective clothing, gloves, and chemical safety goggles. In case of skin contact, remove contaminated clothing and flush affected area with plenty of cold water. In case of eye contact, flush immediately with plenty of cold water and seek medical attention immediately.

Store CP-155 in its original container. Keep away from direct sunlight and temperature extremes. Protect from freezing.

VII. Waste Treatment

CP-155 contains organic wetting agents and surfactants. Discarded solution can be treated by adjusting the pH to between 6 and 8 with dilute sodium hydroxide before sending the spent solution to the sewer. Consult with local officials for further waste disposal regulations. Please ask a Florida CirTech technical sales rep. for more information regarding waste treatment of this chemistry and our complete line of waste treatment line if additional help or information is desired.

VIII. Miscellaneous

Available in 5-gallon pails and 55 gallon drums. Consult MSDS for additional information

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