



COPPER GLEAM™ 125-EX Acid Copper

For PWB Metallization Applications

REGIONAL PRODUCT AVAILABILITY DESCRIPTION

- N. America

COPPER GLEAM™ 125-EX is an acid copper electroplating process designed for through-hole plating of printed circuit boards. The COPPER GLEAM 125-EX Acid Copper produces fine-grained equiaxed copper deposits that meet all the requirements of MIL-P-55110-D.

DEPOSIT PROPERTIES

Grain Structure: Fine-grain—equiaxed
 Density: 8.9 g/cc
 Conductivity: 0.59 micromho/cm
 Solderability: Excellent
 Elongation*: 20–30%
 Tensile Strength*: 280–350 N/cm² (40–50 KPSI)

*Tested in accordance with IPC-TM-650 foil thickness 2.0 mil (50 micron).

BATH MAKE-UP

Chemicals Required	100 liters	(100 gal.)
Deionized water	33 liters	33 gal.
Electronic-grade Copper Sulfate Liquid (270 g/L)	27.8 liters	27.8 gal.
C.P.-grade Concentrated Sulfuric Acid, 50% w/w	32 liters	32 gal.
C.P.-grade Concentrated HCl**	~13 mL	~49 mL
COPPER GLEAM™ 125-EX Carrier	1.0 liters	1.0 gal.
COPPER GLEAM 125-EX Additive	0.2 liters	0.2 gal.

Note: The COPPER GLEAM 125-EX Additive contains the active grain refiners. The COPPER GLEAM 125-EX Carrier contains surface active agents sometimes referred to as “wettors” or “suppressors.” COPPER GLEAM 125-EX additives should be stored in a cool, dry area out of direct sunlight. Do not subject the additives to temperatures below 2°C (35°F) or above 30°C (85°F).

**Actual add to be based on analysis.

BATH MAKE-UP PROCEDURE

1. Please refer to the appropriate procedures for the correct preparation of the tank, anodes, filters, anode bags and other related items. Do not proceed until tank has been cleaned and leached according to the instructions in the "Equipment Preparation" section.
2. Fill the tank to approximately 1/3 (33%) of the final bath volume with de-ionized water. Add the required amount of copper sulfate liquid and mix well.
3. SLOWLY, with thorough mixing, add the 50% sulfuric acid. It is recommended that dilute forms of sulfuric acid (such as 50%) be used to minimize heat build-up. CAUTION! The sulfuric acid disassociation reaction is exothermic. If concentrated acid is used, heat is generated. A dangerous condition can result if the sulfuric acid is not added very slowly with thorough mixing.

WARNING! Proper care must be taken to avoid physical contact with sulfuric acid solution as severe burns can result. The use of proper safety equipment is necessary, including chemical goggles, chemical gloves, and suitable protective clothing.

4. Turn on the circulation, filtration and solution agitation. Cool solution to 38°C (100°F) or below before proceeding to the next step.
5. Place pre-bagged anodes (see anode preparation guidelines) into tank and fill to final volume with de-ionized water.
6. Analyze the solution for copper sulfate and sulfuric acid and adjust as necessary.
7. Circulate the solution through a carbolator containing pre-rinsed, activated carbon at an approximate loading of 3–5 lbs./100 gallons of bath. Activated carbon filters may be substituted if a carbolator is not available. Circulate for 4 to 8 hours per carbon charge.
8. Continue to circulate the solution through activated carbon until a hull cell panel plated at 2A for 10 min. exhibits a matte pink deposit across the entire current density range.
9. When carbon polishing is complete, install pre-leached wound filters (previously prepared according to the procedures in this document).
10. Analyze solution for chloride and adjust to 60 ppm.

Note:

For 100 liters of bath

2.2 mL of concentrated hydrochloric acid (37%) = 10 ppm chloride

For 100 gallons of bath

8.3 mL of concentrated hydrochloric acid (37%) = 10 ppm chloride

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11. Add 125-EX Carrier
12. Electrolyze for 2 hours at 5.0 ASF anode current density
13. Electrolyze for 2 hours at 10 ASF anode current density
14. Check and adjust chloride to 60 PPM
15. Add COPPER GLEAM™ 125-EX Additive
16. Electrolyze for 3 hours at 10 to 15 ASF anode current density
17. Re-check and adjust chloride to 60 PPM

Operating Parameters—Metric		
Component	Range	Recommended
Copper Sulfate	60–90 g/L	Based on plating CD
Sulfuric Acid	200–250 g/L	225 g/L
Chloride Ion	50–80 ppm	60 ppm
125 Additive	1.0–3.0 mL/L	2.0 mL/L
125 Carrier	5.0–20.0 mL/L	10.0 mL/L
Temperature	21–29°C	24°C
Anode Current Density	0.75–2.0 A/dm ²	1.5 A/dm ²
Cathode Current Density	1.0–3.0 A/dm ²	1.5 A/dm ²
Anode to Cathode Distance	20–30 cm	25 cm
Filtration Rate	3 tank volume turnovers per hour	
Deposition Rate	25 microns in 36 min. at 3.0 A/dm ²	

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Operating Parameters—U.S.		
Component	Range	Recommended
Copper Sulfate	60–90 g/L	Based on Plating CD
Sulfuric Acid	200–250 g/L	225 g/L
Chloride Ion	50–80 ppm	60 ppm
125-EX Additive	1.0–3.0 mL/L	2.0 mL/L
125-EX Carrier	5.0–20.0 mL/L	10.0 mL/L
Temperature	70–85°F	75°F
Anode Current Density	7.5–20 A/ft ²	15 A/ft ²
Cathode Current Density	10–30 A/ft ²	15 A/ft ²
Anode to Cathode Distance	8–12 in.	10 in.
Filtration Rate	3 tank volume turnovers per hour	
Deposition Rate	1 mil (0.001 in) in 36 min. at 30 A/ft ²	

**ADDITIVE
REPLENISHMENT**

COPPER GLEAM™ 125-EX Additive should be replenished at a rate of 0.25–0.5 mL/Ahr., dependent on method of operation and air agitation. The replenishment rate with eductor solution agitation should be at a rate of 0.1–0.2 mL/A-hr. COPPER GLEAM 125-EX Carrier should only be replenished on recommendation from Dow or on the basis of CVS dilution titration analysis.

Note: Additive consumption increases with increasing temperatures of operation and increasing anode area, particularly in combination with titanium anode baskets.

**SOLUTION
MAINTENANCE AND
CONTROL
SCHEDULES**

General Maintenance

- a) Filters should be changed at 2–4 week intervals.
- b) Anode area should be checked and maintained on a regular basis. For titanium basket/anode slugs, this should include a periodic complete removal of the anodes, thorough cleaning of any sludge build-up, replenishment and reconditioning.
- c) Anodes should be bagged with polypropylene bags. Bags should be checked frequently for holes or tears. Replace defective anode bags immediately.
- d) Routine carbon treatments are recommended at 3–6 month intervals.
- e) Carbon treatment is also recommended if:
 - The physical properties of the copper electrodeposit fall below specification.
 - The Hull cell test indicates either organic contamination or excess additive conditions.

Recommended Control Schedule		
Analysis of	Method	Frequency
Copper	Volumetric Analysis Atomic Absorption Spectroscopy	1x/week
Sulfuric Acid	Volumetric Analysis	1x/week
Chloride	Specific Ion Electrode Spectrophotometric Volumetric Analysis Jackson Turbidometry	1x/week
Metallic Contamination (Fe, Ni, Sn)	Atomic Absorption Spectroscopy	1x/week
Process Performance	Hull Cell CVS Thermal Shock	1x/day 1x/day 1x/shift

Note: Technical information on preferred analytical methods, including CVS techniques, is available from Dow on request.

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**LIMITS OF
METALLIC
IMPURITIES**

Fe plus Ni 1,000 ppm
Sn 100 ppm

EQUIPMENT

Tanks:	Semi-hard PVC, polypropylene or Koroseal lined
Anodes:	Phosphorus deoxidized copper (0.04%–0.08%P); slabs with titanium hooks or nuggets in titanium baskets
Anode Bags:	Polypropylene
Anode to Distance:	20–30 cm (8–12 inches) Cathode
Anode	0.75–2.0 A/dm ² (7.5–20 A/ft ²) Current Density:
Heaters:	PTFE coated panel heaters or quartz immersion heaters
Cooling Coils:	May be required depending on climate; polypropylene, Teflon fluoropolymer or stainless steel construction
Filtration:	1–5 micron polypropylene filter cartridges; filter continuously at a rate of 5 tank volume turnovers per hour
Power Supply:	4–6 volt rectifier with a maximum of 5% ripple is required; for optimal plating distribution, split rectification is recommended
Solution:	Air must be supplied by a blower and Agitation: free of dirt and oil; a dual air sparge offset from each side of cathode center line is recommended; holes should be drilled facing down at a 45° angle from the vertical; the total area of all holes drilled in sparge should be <50% of the cross sectional area of the feed pipe in order to ensure uniform agitation across the cathode surface; do not put air agitation under the anode
Air Pressure:	0.035 kg/cm for every meter of solution depth (2 psi/ft.)
Air Flow:	0.09–0.18 m ³ /minute for every meter of sparger or (1–2 cfm/foot)
Mechanical Agitation:	Through-hole cathode agitation with a Stroke length of 1.5 to 3.0" (4 to 8 cm) at a frequency of 7 to 15 cycles per minute; total movement should be 20 to 60"/min. (50 to 150 cm/min.)

EQUIPMENT PREPARATION

Tanks and ancillary equipment should be cleaned and leached as follows:

- a) Clean tank(s) with 30 g/L (40 oz./gal.) trisodium phosphate and 25 mL/L (3.2 fl. oz./gal.) of 50% sodium hydroxide 38–50°C (100–120°F) and recirculate for 4–8 hours.

Note: Not for use with insoluble anodes.

1. Rinse tank and system thoroughly with hot water.
2. Leach tank(s) with a 10% sulfuric acid solution and recirculate through complete system. Leave leaching solution in tank for minimum of 8 hours.

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3. Rinse with hot water.
4. Rinse with deionized water.

- b) Anodes should be cleaned and deoxidized prior to use as follows:
1. Immerse anodes in a sulfuric acid/hydrogen peroxide solution or an equivalent Microetch (Dow Pattern Prep 24, for example).

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2. Rinse thoroughly.
 3. Immerse anodes in a 10% sulfuric acid solution.
 4. Rinse thoroughly with deionized water.
 5. When titanium anode baskets are used, care must be taken to ensure that they are completely filled with anode slugs.
- c) Anode bags should be cleaned and leached as follows:
1. Wash thoroughly in hot deionized water.
 2. Leach with a 10% sulfuric acid solution for 2 hours.
 3. Rinse thoroughly with deionized water.
- d) Wound polypropylene filter cartridges should be leached as follows:
1. Wash thoroughly in hot deionized water.
 2. Leach with a 10% sulfuric acid solution for 2 hours.
 3. Rinse thoroughly with deionized water.

PRODUCT DATA

COPPER GLEAM™ 125-EX Carrier

Description: Light blue to light yellow liquid
pH: ~4
Specific Gravity @ 20°C: ~1.02

COPPER GLEAM 125-EX Additive

Description: Dark blue-violet liquid
pH: <2.5
Specific Gravity @ 20°C: ~1.00

Note: These are typical properties, not to be construed as specifications.

Handling Precautions

Before using this product, associated generic chemicals or the analytical reagents required for this control, consult the supplier's Material Safety Data Sheet (MSDS)/Safety Data Sheet (SDS) for details on material hazards, recommended handling precautions and product storage.

CAUTION! Keep combustible and/or flammable products and their vapors away from heat, sparks, flames and other sources of ignition including static discharge. Processing or operating at temperatures near or above product flashpoint may pose a fire hazard. Use appropriate grounding and bonding techniques to manage static discharge hazards.

CAUTION! Failure to maintain proper volume level when using immersion heaters can expose tank and solution to excessive heat resulting in a possible combustion hazard, particularly when plastic tanks are used.

Storage

Store products in tightly closed original containers at temperatures recommended on the product label.

Disposal Considerations

Dispose in accordance with all local, state (provincial) and federal regulations. Empty containers may contain hazardous residues. This material and its container must be disposed in a safe and legal manner.

It is the user's responsibility to verify that treatment and disposal procedures comply with local, state (provincial) and federal regulations. Contact your Dow Electronic Materials Technical Representative for more information.

Product Stewardship

Dow has a fundamental concern for all who make, distribute, and use its products, and for the environment in which we live. This concern is the basis for our product stewardship philosophy by which we assess the safety, health, and environmental information on our products and then take appropriate steps to protect employee and public health and our environment. The success of our product stewardship program rests with each and every individual involved with Dow products from the initial concept and research, to manufacture, use, sale, disposal, and recycle of each product.

Customer Notice

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886-00713
2015/02