



ELECTROPOSIT™ 1100 Acid Copper

For PWB Metallization Applications

Regional Product Availability

- North America
- Asia-Pacific

Description

The Dow Electronic Materials ELECTROPOSIT™ 1100 Acid Copper plating additive is designed for reliable through-hole plating of conventional printed circuit boards. Use of the additive can significantly increase productivity while providing excellent leveling, surface distribution, and throwing power when plating through-hole aspect ratios up to 10:1. Dow Electronic Materials can also provide processes for plating through-holes with aspect ratios up to 20:1. Contact your Dow Electronic Materials Technical Representative for details.

The Dow Electronic Materials ELECTROPOSIT 1100 Acid Copper plating additive, in conjunction with the Dow Electronic Materials ELECTROPOSIT Bath Analyzer, is a make-up and replenishment additive system that provides a number of important circuit board fabrication advantages.

Advantages

- Excellent throwing power, surface distribution, and leveling at plating rates of 40 A/ft² and above
- Utilizes conventional equipment
- Superior thermal shock resistance meets or exceeds MIL-P-55110D
- Ease of Control
- Straightforward Hull Cell interpretation
- Dow Electronic Materials ELECTROPOSIT Bath Analyzer for additive component analysis
- Reduced bath maintenance

Bath Make-Up

Component	Range	Recommended
Electrolytic Grade Copper Sulfate (CuSO ₄ •5H ₂ O) Reagent Grade	60–90 g/l (8.0–12.0 oz./gal.)	80 ⁽¹⁾ g/l (10.7 oz./gal.)
Concentrated Sulfuric Acid (specific gravity of 1.84)	100–250 g/l 5.4–13.6% b.v. (13.4–33.3 oz./gal.)	225 g/l 12.2% b.v. (30.0 oz./gal.)
Chloride (as HCl)	40–60 ppm	50 ppm
ELECTROPOSIT 1100 C Additive	5.0% b.v	5.0% b.v.

Bring to final working volume with D.I. water.

(1) NOTE: For boards with higher difficulty factors, the Copper Sulfate Penta-hydrate concentration can be reduced and the current density lowered to achieve improved throwing power performance.

An acidified copper sulfate solution, ELECTROPOSIT 1100 Starter Solution, is available from Dow Electronic Materials. Please inquire for details.

Bath Operation Panel/Pattern Plating

Cathode Current Density:	0.5–4 A/dm ² (5–40 A/ft ²)
Agitation:	Moderate air and paddle agitation
Temperature:	22–29°C (72–85°F)
Anode to Cathode Ratio:	1:1–2:1 Anode Current Density*: 2 A/dm ² (20 A/ft ²) max.
Anode to Cathode Distance:	15–30 cm (6–12 in.)
Anodes:	Phosphorized copper (0.03–0.08% P)
Anode Bags:	Napped polypropylene
Filtration:	Continuous through 3 micron filter NOTE: 1 micron absolute filtration with appropriately sized chambers and pumps would be best

*Correct current density and ratio are necessary to maintain adherent anode film.

Replenishment Schedule Based On Amp Hours

Component	Addition Rate
ELECTROPOSIT™ 1100 B-3 Additive	0.05–0.3 ml/Amp-hr
ELECTROPOSIT 1100 R Additive	0.05–0.3 ml/Amp-hr

Replenishment schedule of ELECTROPOSIT 1100 B-3 Additive and ELECTROPOSIT 1100 R Additive will vary with temperature, anode type and anode to cathode spacing. Reduced anode to cathode spacing or increased temperature, above 29°C (89°F), may affect replenishment schedule or result in less than optimum performance.

ELECTROPOSIT 1100 C Additive	0.0–0.50 ml/Amp-hr
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Replenishment additions of ELECTROPOSIT 1100 C Additive are to be added at least twice weekly or after every 20 Amp-hours/liter (75 Amp-hours/gal.) whichever comes first.

Large Carrier additions to the tank must be avoided. It is generally best practice to limit single additions to less than 5% (or 0.05x) of a full make-up and it is recommended that any single addition be ≤ 0.1% (or 0.001x) of a full make-up if possible.

When analysis is infrequent as it is when using an outside lab, this can be achieved by determining an approximate amount to be added per analysis interval, then dividing this amount into smaller amounts, each being less than 0.1% of the volume and scheduling additions at regular intervals.

It is best practice to make carrier additions after work is completed and no parts are in the tank, i.e just prior to anode maintenance or before end of operation.

New Bath Installation

I. Tank Preparation

New tanks or product conversions

When using any new equipment or when converting from another plating bath, tanks and all piping included in circulation system must be cleaned and leached prior to installation of the ELECTROPOSIT 1100 Chemistry. Proper tank leaching involves several steps and solutions. Ensure that during each step all the cleaning, leaching and rinse solutions come in contact with any parts of the tank and peripheral equipment that will eventually contact the plating solution.

This requires purging each solution through all air spargers, pumps and filter chambers that may be in use at any time during the lifetime of the bath.

II. Leaching Procedure

- Completely remove old plating solution from the tank.
- Remove the anode baskets from the tank.

- c) Clean any debris from the tank, then rinse the tank and all equipment with clean water and drain. Recirculation of rinsing solutions throughout all piping is required.
- d) Fill tank with water and circulate the solution through the complete system for 30 minutes and drain.
- e) Fill the tank with 4 oz./gal. Sodium hydroxide (or 5% bv of 50% sodium hydroxide liquid or 5 oz./gal. tri-sodium phosphate), heat to 100–110°F (40–45°C) and circulate through the entire system for a minimum of 4 hours.
- f) Drain the tank completely, and then rinse the tank and all equipment with clean water and drain.
- g) Fill the tank with clean water and circulate through the entire system for 1 hour.
- h) Drain the tank completely, and then rinse the tank and all equipment with clean water and drain.
- i) Fill the tank with 100 ml/l (10%v/v) sulfuric acid solution. Circulate through the entire system for a minimum of 8 hours.
- j) Drain the tank completely, and then rinse the tank and all equipment with clean water and drain.
- k) Fill the tank with clean water and circulate through the entire system for 1 hour.
- l) Drain the tank completely, and then rinse the tank and all equipment with D.I. water and drain.

III. Anode Preparation

a) Anode Bag Preparation

- 1) Do not reuse anode bags—only use new anode bags.
- 2) Separate anode bags and wash thoroughly using hot water until no foam/sizing is observed.
- 3) Soak the anodes for a minimum of 1 hour in a 10% solution of sulfuric acid.
- 4) Rinse the bags thoroughly in D.I. water.

b) New Anodes Procedure

- 1) Micro-etch copper anodes using a sodium persulfate or peroxide sulfuric micro-etch until they are no longer shiny and have a uniform matte pink appearance.

- 2) Rinse the anodes well.

- 3) Fill the titanium anode baskets with the anodes. Ensure that the anode baskets are completely filled with the anode balls or nuggets.

NOTE: When in the tank, the anode baskets should extend a minimum of 1–2 inches above the solution level with the air agitation on.

- 4) Place anode baskets into previously leached anode bags.

- 5) Immerse anodes/baskets/bags in a 10% (v/v) sulfuric acid solution for 3 minutes.

- 6) Place the anodes in the appropriate positions within the acid copper tank.

c) Used Anodes Procedure

- 1) Remove and thoroughly rinse existing anodes.
- 2) Remove and discard the anode bags from the existing anode baskets.

- 3) Sort nuggets and discard small nuggets.
- 4) Micro-etch remaining copper anodes using a sodium persulfate or peroxide sulfuric micro-etch until they are fully cleaned and have a uniform matte pink appearance. No black anode film should remain.
- 5) Rinse the anodes thoroughly with deionized water.
- 6) Fill the bottom third of the anode baskets with previously etched new anode material (not the used material from above).
- 7) Top off using the larger used material from above.
- 8) Place anode baskets/anodes into previously leached anode bags.
- 9) Immerse the anodes in a 10% (v/v) sulfuric acid solution for 3 minutes.
- 10) Place the anodes in the appropriate positions of the acid copper tank.

IV. Filter Cartridge Preparation

Polypropylene Filter Cartridge Leaching Procedure

- a) Wash/flush the cartridges thoroughly with hot water.
- b) Rinse well until there is no foam/sizing.
- c) Leach the cartridges with 10% v/v sulfuric acid for a minimum of 1 hour.
- d) Rinse thoroughly with deionized water.

V. Preparation of Copper Sulfate / Sulfuric Acid Solution

NOTE: If ELECTROPOSIT™ 1100 Starter Solution is supplied by Dow Electronic Materials, proceed to Step III, Preparation of the Plating Bath. If not, the plating bath can be made up from the individual components.

For the optimum bath composition, the amount per 100 gallons of each component is:

Deionized (D.I.) water	53.2 gal. (201 liters)
Concentrated sulfuric acid	12.2 gal. (46 liters)
Electrolytic grade liquid copper sulfate (2.25 lb./gal.)	29.6 gal. (112 liters)
Chloride Ion Concentration	50 ppm (45 ml of 37% HCl, S.G. of 1.2)
ELECTROPOSIT™ 1100 C Additive	5.0 gal. (19 liters)

Follow the directions below for mixing the components. Consult the appropriate Material Safety Data Sheets before using any commodity chemicals.

- a) Add two-thirds of the required D.I. water to a preparation tank (35.5 gallons).
- b) Carefully add the concentrated sulfuric acid slowly and with good mixing to prevent localized overheating of the solution and the possible risk of solution eruption of the sulfuric acid dilution.

DANGER! Concentrated sulfuric acid is corrosive to organic tissue and causes severe burns on contact with eyes, skin or mucous membranes. Consult appropriate Material Safety Data Sheet for this material.

- c) Add the liquid copper sulfate and mix in with stirring. If copper sulfate crystals are used, be sure to completely dissolve them by stirring.

WARNING! Copper sulfate may irritate eyes, skin or mucous membranes. Consult the appropriate Material Safety Data Sheet for this material.

- d) Add the remainder of the deionized water. Be sure to leave enough tank volume for the addition of 5% by volume of ELECTROPOSIT™ 1100 C Additive.

VI. Preparation Of The Plating Bath

- a) For each 100 gallons of tank volume, add 95 gallons of ELECTROPOSIT 1100 Starter Solution and, just before starting up the bath, add 5 gallons of ELECTROPOSIT 1100 C Additive. Mix thoroughly.
- b) The amount of chloride ion in the solution is very important. Chlorides may already exist as contaminants, therefore analyze for chlorides before addition. Use 37% reagent grade hydrochloric acid (specific gravity of 1.2) to adjust.

DANGER! Concentrated hydrochloric acid is very corrosive and causes severe burns on contact with eyes, skin or mucous membranes. Consult the appropriate Material Safety Data Sheet for this material.

To raise chloride ion by 10 ppm add: 9.0 ml of 37% reagent grade HCl (specific gravity 1.2) per 100 gallons of bath.

- c) The anodes must be etched in a standard per-sulfate micro-etch, such as Dow Electronic Materials PREPOSIT™ Etch 748. The etch should remove all foreign material and leave a uniform matte pink surface. The anodes should be thoroughly rinsed with water after etching.
- d) Install the anodes in anode bags previously soaked in hot deionized water followed by an overnight soak in 10% by volume reagent grade sulfuric acid.
NOTE: Napped anode bags are preferred.
- e) Adjust to operating temperature and add 5% by volume of ELECTROPOSIT 1100 C Additive.
NOTE: ELECTROPOSIT 1100 C Additive should be added to the tank just prior to starting up the bath.
- f) Current density should be ramped up to operating level to activate the additive system components. Using dummy panels from scrap laminate at an anode to cathode ratio of 1:1, operate the bath at each of the following current densities for 1 hour; 5 A/ft², 10 A/ft², 15 A/ft² and 20 A/ft².
- g) After the four hour dummy plating cycle, add 190 ml per 100 gallons (0.5 ml/l) of ELECTROPOSIT 1100 B-3 Additive and begin replenishment with either 1000ml/1000Ahr of ELECTROPOSIT 1100 B-3 Additive or ELECTROPOSIT 1100 R Additive. Put in a new dummy panel and plate at 20 A/ft² for 1 hour.

If the deposit on the panel is uniformly bright and smooth, the bath is ready for use. If the panel is not uniformly bright and/or nodular, adjust to optimum conditions based on Hull Cell analyses (see Bath Control section, below) or ELECTROPOSIT Bath Analyzer. Depending on the results, continue to dummy or make an addition of ELECTROPOSIT 1100 B-3 Additive as indicated by the Hull Cell Analysis or ELECTROPOSIT Bath Analyzer.

NOTE: During Start-up of an ELECTROPOSIT™ EP1100 Bath, it is not unusual to observe high-consumption of ELECTROPOSIT 1100 Additives (500 to 2000ml / 1000Amp-hrs) for several days to a week, and more frequent Hull cell and/or Bath Analyzer analyses should be performed. All supplemental additions to the bath indicated by Hull Cell and/or ELECTROPOSIT Bath Analyzer should be made using ELECTROPOSIT 1100 B-3 Additive. (Standard dosing is with either ELECTROPOSIT 1100 B-3 Additive or ELECTROPOSIT 1100 R Additive; but, any extraneous additions are made using ELECTROPOSIT B-3 Additive only.)

Bath Conversion

Do not use plating solution that contains other additives. The bath should be discarded and a fresh solution made-up.

Bath Control

To ensure that the main constituents of the bath are within the recommended ranges, analysis and control of the following is necessary:

- Copper sulfate
- Sulfuric acid
- Chloride ion
- Additive level

ELECTROPOSIT™ 1100 Bath Analyzer analysis, Hull Cell Testing, metallographic cross-sectioning, and thermal shock testing should be performed to maintain the bath at optimum operating conditions.

The Dow Electronic Materials ELECTROPOSIT Bath Analyzer must be used to determine the concentration of the active components (brightener and leveler) of the ELECTROPOSIT 1100 Acid Copper plating additives. If necessary, adjustments to the concentration of the brightener and leveler should be made using ELECTROPOSIT 1100 B-3 Additive and ELECTROPOSIT 1100 R Additive. Refer to the ELECTROPOSIT Bath Analyzer Manual for operating details or Hull Cell control procedure. Contact your Dow Electronic Materials Technical Representative for more information.

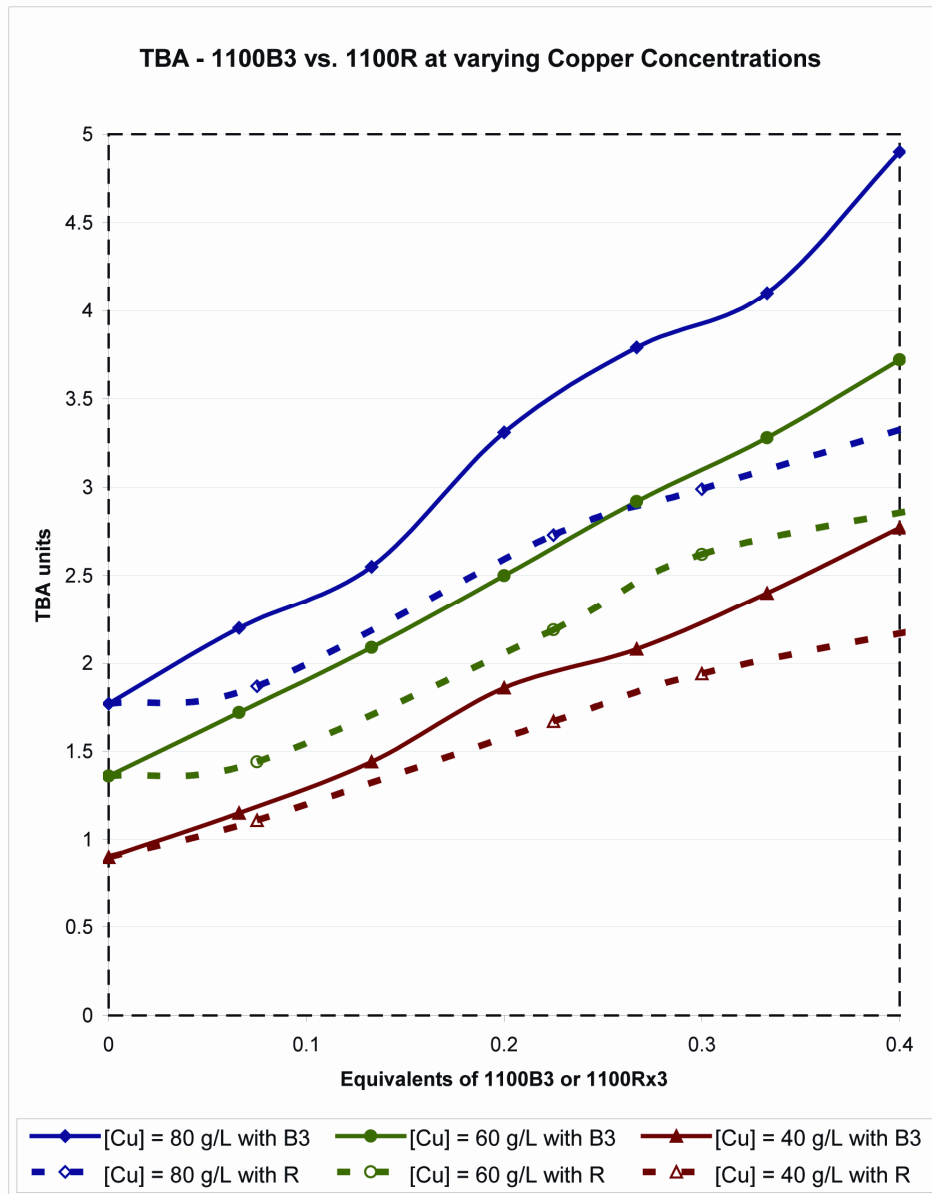
I. ELECTROPOSIT Bath Analyzer Test

The brightener and leveler concentrations should be optimized for your particular process. The degree of agitation, dwell time, anode type, temperature, etc. will affect the optimum additive levels for plating. Once the bath is dummied in and is plating bright panels, typical dosing rates are:

Operating Parameters

Component	Range
1100 B-3	100-300 ml / 1000 Amp-hrs (0.1– 0.3 ml/Amp-hr)
1100 R	300-900 ml / 1000 Amp-hrs (0.3– 0.9 ml/Amp-hr)

Nominal TBA values will vary depending on bath temperature, copper concentration, current density, and solution agitation for a given tank design. In addition, the replenishment choice, ELECTROPOSIT 1100 B-3 Additive or ELECTROPOSIT 1100 R Additive will result in different optimum TBA values with all other conditions (bath temperature, copper concentration, current density, solution agitation, and tank design) being similar. The following chart indicates the differences observed for varying copper concentrations and replenishment choice.



II. Hull Cell Test

NOTE: Concentration of bath constituents should be within recommended ranges before utilizing Hull Cell Test.

- Temperature: 27°C (80°F)
- Current: 2.0 amp (1.0 amp for standard operating current densities <10 ASF (1.0 ASD))
- Anode: Phosphorized copper (0.03%–0.08% P)
- Cathode: 3" x 4" polished copper or brass panel Plating
- Time: 10 minutes
- Agitation: Air agitation is necessary

a) Pretreatment of Hull Cell Panel



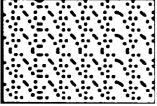
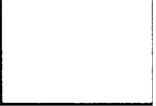
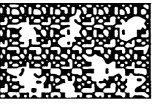
Plastic gloves and forceps should be used to handle the copper or brass panel.

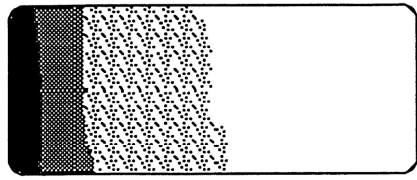
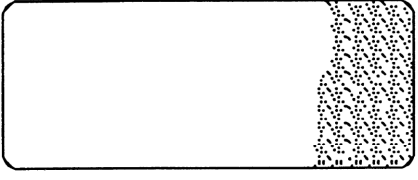
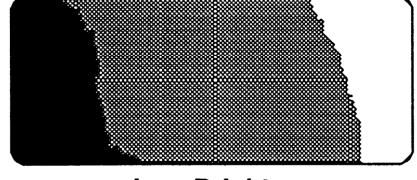

- 1) Remove protective film from copper or brass panel and pumice scrub.

- 2) Immerse panel in 50% by volume NEUTRA-CLEAN™ 68 Cleaner or equivalent for 90 seconds at 160°F (71°C) with agitation.
- 3) Thoroughly rinse with hot water.
- 4) Rinse with deionized water.
- 5) Immerse in 10% H₂SO₄ for about 30 seconds.
NOTE: Copper or brass panel should be free of water breaks at this point.
- 6) Transfer to Hull Cell and test.

b) Interpretation of Hull Cell Results

NOTE: Hull cell results will vary for different solution agitation and temperature given similar copper concentrations, sulfuric acid concentrations, current density, brightener concentrations, and carrier/leveler concentrations. It is important that the hull cell being used be standardized or calibrated at a given set of conditions.

				
Burn	Matte	Bright with Slight Haze	Bright	Matte with Bright Areas

 Normal Panel	 Excess Brightener
 Low Brightener	 Organic Contamination in Bath

III. **Metallographic Cross-Section**

Prepare the cross-section in the normal way; after polishing, the sample should be micro-etched so that the copper grain structure can be examined.

Interpretation of Results

A bath operating at optimum conditions will exhibit a fine-grained deposit. An increase in the concentration of organic or metallic impurities will result in a columnar structure, perpendicular to the substrate surface.

IV. Thermal Shock (Solder Float) Test

- a) The deposit may be subjected to IPC Standard Specification ANSI/IPC-SD-320B (latest issue), U.S. Military Specification MIL-P-55110D Par. 4.8.6, and MIL-C-14550B.
- b) Examination and Interpretation of the Thermal Shock Test.

Microscopic examination of the metallographic cross-section of through-holes after thermal shock test should reveal no cracks. In addition, the boards should exhibit no measling, fractures or separation of plating and conductors, blistering or delamination.

Bath Treatment to Remove Organic Contamination

If previous tests indicate that contamination is present in the bath, check by analysis that the problems are not caused by incorrect concentrations of copper sulfate, sulfuric acid, chloride ion or additive. If within range, proceed as follows:

Carbon Treatment to Remove Organic Contamination

In the case of bath purification, a full carbon treatment of the electrolyte should be conducted periodically in accordance with Dow Electronic Materials' procedure provided by the local sales/service staff at your facility. Carbon treatment is also recommended in the event of:

- 1) The physical properties of the copper deposit falling below specification
- 2) Analytical procedures or bath performance indicating organic contamination

Hydrogen peroxide may be included in the bath carbon treatment procedure, as appropriate for your operation. Heat is required if peroxide is included in the treatment. The use of other oxidizing agents should be discussed with Dow Electronic Materials technical service.

A typical carbon treatment procedure is given below:

- 1) Transfer plating solution to a treatment tank
- 2) Add 2.5 ml/l hydrogen peroxide and mix for 1½ hours at room temperature.
- 3) Heat solution to 130°F (55°C)
- 4) Maintain temperature for 4 hours
- 5) Discontinue heat and allow solution to cool

CAUTION: Do not proceed to the next step until the bath temperature drops below 100°F (38°C).

- 6) Add 22 g/l Norit RO 0.8 (Norit SX Ultra is also recommended and may require additional filtration) carbon into the solution and mix thoroughly for 1 hour.
- 7) Allow the carbon to settle for approximately ½ hour.
- 8) Filter the solution with a 5 micron filter pre-coated with diatomaceous earth into an off-line holding tank.

NOTE: In lieu of diatomaceous earth, two separate filtrations or a filtration by series of smaller filters may be acceptable. i.e. a 5 micron filter cartridge in line and followed by a 1 micron filter cartridge may be sufficient to remove all carbon residues.

Absolute-rated filters may be required to ensure fine removal.

- 9) Recirculate the solution through a filter chamber within the holding tank until the filter output is free of any carbon fines.

If separate treatment and holding tanks are not available or if your facility is not equipped to perform a bath carbon treatment in the manner described above, a carbolator may be substituted as follows:

- Pack a carbolator with Norit RO 0.8 granular carbon.
- Recirculate the plating bath through the carbolator.
- Replace the carbon charge with fresh carbon every 4 to 6 hours.
- Continue to carbon polish until a sample of the bath shows no signs of residual additive, carrier or organic contaminants.

NOTE: Carbolators should be properly fitted with both pre-filters (5 microns recommended) and post-filtration (typically multi-cartridges of at least two sized filters are used in series) is recommended

- 10) Check solution for any signs of residual additive, carrier or organic contaminants by performing a Hull Cell Analysis (and a quick check on the CVS if available).

(NOTE: For the CVS - Quick check test use the solution as is.
For the Hull Cell test add 50 ml/l ELECTROPOSIT™ 1100 C Additive and 0.15 ml/l ELECTROPOSIT 1100 B-3 Additive to sample taken from bath before running analysis. Please refer to Analysis Section for proper procedures.)

- 11) Before the solution is transferred back to the production tank, make sure that the anodes are pulled and the tank has been thoroughly rinsed.
- 12) Follow preparation of anode procedure found in the Section 2 and place anodes in the tank.
- 13) Transfer the solution through filters back into the production tank.
- 14) Follow dummy procedure found in the bath make-up section above.

NOTE: Carbon used must be acid washed and sulfur free.

Bath Analysis and Control Procedures

Chloride Control Procedure (Preferred Method)

I. Principle

This is titration to complex suspended silver chloride with mercuric ion.

II. Reagents

- Mercuric nitrate solution (0.01N), standardized
- Nitric acid (50%), by volume: 500 ml of deionized water, and add slowly with stirring 500 ml of reagent grade nitric acid (SG 1.42); mix thoroughly
- Silver nitrate solution, (0.10N)

III. Procedure

- Pipette 50 ml of sample into a 250 ml beaker. Add 30 ml of deionized water and 20 ml of nitric acid (50%).
- Add 3 to 5 drops of 0.1N silver nitrate solution with stirring.
- Immediately titrate with 0.01N mercuric nitrate solution in front of a lighted background until the turbidity disappears.

IV. Calculation

$$\text{Chloride (ppm)} = \frac{\text{ml of mercuric nitrate} \cdot \text{N of mercuric nitrate} \cdot 35,453}{\text{sample size (50 ml)}}$$

Sulfuric Acid Control Procedure

I. Principle

This is an acid-base titration using bromophenol blue as the indicator.

II. Reagents

- Sodium hydroxide (NaOH), 1.0N, standardized
- Bromophenol blue indicator, 0.1% aqueous solution

Copper Control Procedure

III. Procedure

- Pipette a 10 ml sample of bath into a 100 ml volumetric flask, dilute to mark with distilled water and mix.
- Pipette 10 ml of the dilute solution into a 250 ml Erlenmeyer flask and dilute to 150 ml.
- Add 5 to 10 drops of indicator and titrate with sodium hydroxide, 1.0N, until the color changes from a yellow to a violet end point.
- Record the number of ml of NaOH titrated.

IV. Calculation

$$\text{g/l H}_2\text{SO}_4 = \frac{\text{ml of NaOH} \times \text{N of NaOH} \times 49.1}{\text{aliquot (1.0 ml)}}$$

$$(\text{g/l}) \times (0.054) = \% \text{ by volume}$$

I. Principle

This is an iodometric titration to determine the copper sulfate pentahydrate concentration in an acid medium.

II. Reagents

- Solid potassium iodide
- 50% by volume sulfuric acid
- Starch indicator
- Sodium thiosulfate ($\text{Na}_2\text{S}_2\text{O}_3$), 0.1N

III. Procedure

- Pipette a 10 ml sample of plating bath into a 500 ml Erlenmeyer flask.
- Add 100 ml of D.I. water.
- Add 20 ml of 50% sulfuric acid.
- Add 6 grams of potassium iodide solid and mix.
- Begin titration with sodium thiosulfate titrant until the solution just begins to lighten from dark brown to light brown.
- Add 4 ml starch indicator and quickly titrate to the end point. The solution will change from a dark brown/purple color to a light pink color at the end point.
- Record the number of ml of $\text{Na}_2\text{S}_2\text{O}_3$ titrated.

IV. Calculation

To determine the concentration of copper sulfate pentahydrate in units of grams per liter:

$$\text{g/l CuSO}_4 \cdot 5\text{H}_2\text{O} = \frac{\text{ml of Na}_2\text{S}_2\text{O}_3 \times \text{N of Na}_2\text{S}_2\text{O}_3 \times 249.7}{\text{sample size (10 ml)}}$$

$$(\text{g/l}) \times (0.133) = \text{oz./gal.}$$

**Deposit Data
(Typical Values)**

Elongation (50 micron):	20% on 0.002" thick foil
Ultimate tensile strength:	46,000–50,000 PSI
Microscopic structure:	Fine grained, equiaxed
Solderability:	Excellent
Purity:	99.9+ pure copper

**Product Data
(Typical
Properties)**

ELECTROPOSIT™ 1100 C Additive

Specific gravity @ 20°C:	1.00
Description:	Clear to milky-white, nonflammable, aqueous solution
pH (approximately):	9.0
Weight per gallon:	8.34 lb./gal.

ELECTROPOSIT 1100 B-3 Additive

Specific gravity @ 20°C:	1.00
Description:	Clear (milky white) to yellow-green
pH (approximately):	2–3
Weight per gallon:	8.34 lb./gal.

ELECTROPOSIT 1100 R Additive

Specific gravity @ 20°C:	1.00
Description:	Clear (milky white) to yellow-green
pH (approximately):	2–3
Weight per gallon:	8.34 lb./gal.

ELECTROPOSIT 1100 Starter Solution

Specific gravity @ 20°C:	1.00
Description:	Blue, non-flammable, aqueous solution
pH (approximately):	<1
Weight per gallon:	~10 lb./gal.

Handling Precautions

Before using this product, consult the Material Safety Data Sheet (MSDS)/Safety Data Sheet (SDS) for details on product 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

Dow strongly encourages its customers to review both their manufacturing processes and their applications of Dow products from the standpoint of human health and environmental quality to ensure that Dow products are not used in ways for which they are not intended or tested. Dow personnel are available to answer your questions and to provide reasonable technical support. Dow product literature, including safety data sheets, should be consulted prior to use of Dow products. Current safety data sheets are available from Dow.

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