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TECHNICAL DATA

E-Brite 205-K

Ultra Bright and Leveling Acid Copper Plating Process

E-Brite 205-K produces exceptionally fast, bright, ductile deposits with low internal stress which is necessary for successful plating on plastics (POP).

It is the best leveling acid copper available at all normal and especially low current densities. It smoothes out surface defects for subsequent nickel/chrome plating.

E-Brite 205-K has excellent brightness and coverage in low current density areas making it an ideal process for plating parts with complicated shapes.

E-Brite 205-K is a non dye-type acid copper process. The deposit is softer and easier to buff than dye acid copper processes.

It produces consistent results due to excellent bath stability which minimizes start-up problems eliminating the need for major adjustments after idle periods or weekend shut-downs.

There are no harmful breakdown products thus eliminating the need for frequent carbon treatment. The bath is tolerant to variations in working conditions and impurities lending to ease of operation and process control.

The bath is very tolerant to additive overload as long as the balance is maintained. Corrective additions produce immediate results.

E-Brite 205-K is economical to operate. The consumption of the brightener component is superior to that of dye acid copper processes.

Before using the **E-Brite 205-M-10X, E-Brite 205-KA-5X and E-Brite 205-KR-5X** concentrates, they should be diluted to single strength using DI Water. These additives must not be mixed together for any reason. Their effectiveness for brightness and leveling will be greatly diminished.

Our technical service lab can quantitatively determine the concentration of this brightening component, thus removing the guesswork. This allows the process to run even more easily, efficiently and economically.

E-Brite 205-K complies with specifications **MIL-C-14550B** and **SAE-AMS-2418H** for copper plating.

SOLUTION COMPOSITION	**Range**	**Optimum**
Copper Sulfate	22-30 oz/gal	27 oz/gal
Sulfuric Acid (PC or Reagent Grade)	7-11oz/gal (by wt)	8.5oz/gal
Chloride Ion	60-120 PPM	80 PPM
E-Brite 205-M (make-up)	3-6ml/liter	5ml/l
E-Brite 205-KA	0.75-1.25ml/liter	1ml/liter
E-Brite 205-KR	0.75-125ml/Liter	1ml/Liter

OPERATING CONDITIONS

Cathode current density	5 - 100 ASF
Anode current density	10 - 30 ASF
Temperature	60°F - 85°F (optimum 75°F)
Agitation	Air - low pressure blower
Anodes	Phosphorized copper (0.025 - 0.06% phos.)
Anode bags	Napped polypropylene
Anode: Cathode ratio	2:1
Filtration	1-2 turnovers per hour, continuous

NEW SOLUTION MAKE-UP

1. Charge mixing tank with water at approximately 3/4 of the final working volume of the plating tank.
2. Agitate the water mechanically or with air while slowly and carefully adding 66°Be Sulfuric Acid (PC or Reagent Grade) at a concentration of 0.53 pounds or 0.033 gallons per gallon of final tank working volume. Use of purified liquid copper sulfate concentrate can eliminate steps 4 and 6 below. Ask your **EPI** representative for further information.

WARNING: Sulfuric Acid causes severe burns and a full face shield, rubber gloves, rubber apron and rubber boots must be worn while making the additions. In case of contact with skin or eyes, flush thoroughly with running water and obtain immediate help from a physician.

Heat will be generated by the Sulfuric Acid addition, which will aid in dissolving the Copper Sulfate.

3. While mixing, slowly add and dissolve 1.7 pounds of Copper Sulfate Pentahydrate per gallon of final tank working volume.
4. Once all the Copper Sulfate is dissolved, the solution is treated with carbon at a rate of 0.03 pounds activated carbon per gallon. The solution is mixed for 1 to 2 hours and then allowed to settle before it is pumped through a filter into the plating tank. **Make sure all carbon is removed from solution and filters before adding brighteners.**
4. Add water to final working volume and mix well with air agitation. Analyze solution for Copper Sulfate, Sulfuric Acid and Chloride Ion and make additions if required.
5. Purify the solution by using preplated dummy cathodes at 10-30 ASF for 1-2 hours followed by 5-10 ASF for 1-2 hours.
6. Add **E-Brite 205-K** addition agents:

E-Brite 205-M	0.5% by volume
E-Brite 205-KA	0.1% by volume
E-Brite 205-KR	0.1% by volume

Solution is now ready for production.

FUNCTION OF SOLUTION COMPONENTS

Copper Sulfate is normally added only during make up because the copper ions required for plating thereafter will be maintained by electrolytic and chemical dissolution of the copper anodes.

Concentrations below 20 ounces per gallon can produce HCD burning, reduced leveling and result in a narrow plating range and reduced deposition rates. Concentrations above 34 ounces per gallon can reduce brightness and leveling. Copper Sulfate crystals may form on the anodes and tank walls causing poor anode corrosion and rough plating. Extremely high concentrations can cause anode polarization due to crystals forming on the anodes.

Sulfuric Acid provides conductivity to the solution and dissolution of the anodes. Concentrations below 7 ounces per gallon will result in a loss of conductivity.

Chloride Ion concentrations higher than 250 PPM can produce striations, grainy deposits and reduced leveling and can contribute to polarization of the anodes. Concentrations Lower than 20 PPM can produce dull, rough or striated deposits and treeing.

FUNCTION OF E-BRITE 205-K ADDITION AGENTS

E-Brite 205-M is used primarily for new solution make up, following carbon treatment and upon conversion from other systems. It is the primary grain refiner which, together with **E-Brite 205-KA** and **E-Brite 205-KR,** helps produce best brightness and leveling.

E-Brite 205-KA is the primary brightness and leveling additive which provides a bright, leveled and ductile copper deposit. A low concentration will cause a loss of leveling and brightness in the low current density areas. High concentration will cause distinct step plate in the low current density area but the LCD area will still be bright.

E-Brite 205-KR is an auxiliary brightener which, when used in the presence of **E-Brite 205-KA**, will give optimal brightness and leveling. A low concentration will cause burning in HCD area. A high concentration will reduce brightness in the LCD area.

NOTE: These 3 additives must not be mixed together in any combination.

Consumption rate of addition agents

E-Brite 205-KA:	125-200 ml/KAH (ml per 1000 ampere-hour)
E-Brite 205-KR:	150-250 ml/KAH (ml per 1000 ampere-hour)
E-Brite 205-M:	10-20 ml/KAH (ml per 1000 ampere-hour)

EQUIPMENT

- **Tanks:** Tanks should be constructed of PVC, PVDC, or polypropylene. Such tanks should be reinforced to prevent bulging. Rubber, PVC or polypropylene lined steel tanks are also satisfactory.

- **Filtration:** Continuous filtration is necessary for the production of bright, smooth and leveled deposits from the **E-Brite 205-K** acid copper system. The filtration rate must be a minimum of one turnover per hour. The filter intake hose must be located properly to prevent air from being drawn into the filter.

- Filter parts that come in contact with the solution must be acid resistant. Polyethylene, polypropylene or 316 stainless are recommended. Acid resistant filter bags, discs, or cartridges must also be used. The filter media should be diatomaceous earth. Cellulose type materials **should not** be used.

A carbon pack on the filter should not be used during production periods because it will remove some of the brightener additives.

- **Agitation:** Air agitation is essential in order to prevent burning and roughness. It permits the use of higher current densities and is an aid in the promotion of bright, fine grained deposits.

- Air must be supplied from a low pressure blower equipped with an intake filter to prevent solid contaminants from entering the plating bath. Compressed air, even with a filter, must not be used as it will introduce oil into the solution and may cause streaked deposits or pitting.

- **Anodes:** Phosphorized copper anodes (CDA-12220) are essential for satisfactory operation. Rolled phosphorized copper anodes or phosphorized copper nuggets in titanium baskets may be used. The anode level in the baskets must be maintained above the solution level to avoid chloride attack on the titanium baskets.

  The phosphorous content of the anodes should be within a range of 0.025% to 0.06%. Other types of copper anodes should not be used as they can cause roughness, high brightener consumption and increased copper build up. Consult your **EPI** representative for recommendations on sources of anodes.

- **Anode Bags:** Anodes should be bagged, preferably with 10-12 ounce napped polypropylene.

NOTE: New anode bags and filter cartridges must be leached before using by soaking in a 2 oz/gal solution of Sodium Hydroxide followed by a water rinse, a 5% Sulfuric Acid soak and another water rinse. This will prevent a very fine pitting condition caused by the sizing material (in the cloth bags and in the filter cartridges) which is not soluble in the acid copper solution.

TEMPERATURE

The solution temperature will depend upon the ambient temperature and the amount of amperes per gallon used for plating. The solution temperature is maintained in the 60-80° range. Operating at a higher temperature will result in increased brightener consumption to achieve comparable results.

ANALYTICAL METHODS

Copper Sulfate

1. Pipette a 2 ml sample of plating solution into a 250 ml Erlenmeyer flask.
2. Add, drop by drop, concentrated Ammonium Hydroxide to a deep blue color.
3. Swirl Flask as you add 10 ml concentrated Acetic Acid.
4. Add 50 ml Deionized water.
5. Add 10 ml 20% Potassium Iodide Solution.
6. Titrate with 0.1N Sodium Thiosulfate to a yellow straw color.
7. Add 1 ml of FRESHLY MADE STARCH INDICATOR - solution is now a dark blue color. Continue titrating with the Sodium Thiosulfate to a white end point.

Calculation: ml of Sodium Thiosulfate (total) x 1.68 = oz/gal $CuSO_4$.

Sulfuric Acid

1. Pipette a 2 ml sample of plating solution into a 500 ml Erlenmeyer flask and add 100 ml of distilled water.
2. Add 3-4 drops of Methyl Orange Xylene Cyanole Indicator solution.

3. Titrate with 0.1N Sodium Hydroxide (NaOH) until the solution changes from purple to greenish yellow:

Calculations: Sulfuric Acid in oz/gal (wt) = ml of 0.1N NaOH x 0.329
Fl oz/gal Sulfuric Acid = oz/gal (wt) Sulfuric Acid x 0.522

Chloride Ion

1. To each of two glass stoppered 25 ml graduated cylinders, add 5 ml Nitric Acid and a 5 ml sample of the bath.
2. Stopper and mix well.
3. Add 10 ml of Ethylene Glycol to each.
4. Dilute one cylinder to 25 ml (sample A), and the other to 24 ml (sample B) with distilled water.
5. Stopper and mix.
6. Add 1 ml of 0.1N Silver Nitrate solution to sample B and mix well. Allow to stand in a dark place for at least 30 minutes.
7. Transfer each sample to a spectrometer and read the absorbance of sample B versus Sample A at 440 nm.

Calculations: Absorbance (B) - Absorbance (A) x 152 = PPM Chloride Ion

Note: A quick check procedure for testing Chloride Ion concentration, the newspaper method, is available from **EPI**.

CAUTION

The **E-Brite 205-K** Acid Copper plating solution is corrosive. A full face shield, protective goggles or glasses must be worn to protect the eyes. In case of contact with the eyes, flush with running water for 15 minutes and call a physician. Rubber gloves and a rubber apron must be worn to protect the skin and clothing. In case of contact, flush skin with water and get medical attention. Wash clothing before reuse.

The **E-Brite 205-M, 205-KA** and **205-KR** brighteners are relatively non-hazardous. However, good industrial hygienic procedures should be followed to include safety glasses. Solution contact with skin should be washed off with soap and water. Do not work with the **E-Brite 205-M, 205-KA** and **205-KR** without first reading and understanding the **MATERIAL SAFETY DATA SHEETS** furnished by **EPI**.

IMPORTANT NOTICE! For Industrial Use Only

The following is made in lieu of all warranties, expressed or implied, including the implied warranties of merchantability and fitness for purpose: seller's and manufacturer's only obligation shall be to replace such quantity of the product as proved to be defective. Before using, user shall determine the suitability of the product for its intended use, and user assumes all risk and liability whatsoever in connection therewith. **Neither seller nor manufacturer shall be liable either in tort or in contract for any loss or damage, direct, incidental or consequential, arising out of the use or the inability to use the product.**