

E-Brite™ 200

Bright Acid Copper Plating

Although make up and maintenance additives are required upon startup, the majority of **E-Brite 200** bright acid copper baths can be maintained using a single additive, **E-Brite 200 RX-W**. This eliminates the need for exact measuring of components so that imbalances do not occur. Also, only one feeder would be needed which eliminates trying to calibrate two feeders to deliver an exact ratio of the additives. Other brightener systems require adding two or more additives (which can not be mixed) to maintain the bath.

E-Brite 200 produces exceptionally bright, ductile deposits with low internal stress which is necessary for successful plating on plastic.

It is the best leveling acid copper available at all normal current density ranges which smoothes out rough surfaces for subsequent nickel/chrome plating.

E-Brite 200 has very good brightness and coverage in low current density areas making it an ideal process for plating complicated shaped parts.

The soft deposit is very easy to buff.

E-Brite 200 does not contain dye-type materials which are messy to work with and which can cause staining of the plated surfaces and possibly loss of adhesion on subsequent plates. Dyes also can cause a hard deposit, which can be difficult to buff.

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 which eliminates the need for frequent carbon treatment. The bath is tolerant of variations in working conditions and impurities lending to ease of operation and process control.

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

In many applications, the bath may be operated at 90-100°F reducing the expense of cooling.

E-Brite 200 virtually eliminates nodulation (treeing and burning) in high current density areas even at copper sulfate concentrations of 20-22 oz/gal. Most acid copper processes are run using guesswork or trial and error to determine brightener concentration. If the main brightening agent is at too low or too high of a concentration, problems with balancing the other components can occur. With the **E-**

Brite 200 process, the main brightening component is incorporated into the **E-Brite 200M** but is also replenished by maintenance additions of **E-Brite 200R** or **E-Brite 200RX-W**. Our technical service lab can quantitatively determine the concentration of this brightening component, thus, removing the guesswork. This allows the process to run more easily, efficiently and economically.

E-Brite 200 complies with specifications **MIL-C-14550B** and **SAE-AMS-2418H** for copper plating.

| <u>SOLUTION COMPOSITION</u> | <u>Range</u> | <u>Optimum</u> |
|--|-----------------------|----------------|
| Copper Sulfate | 22-30 oz/gal ** | 27 oz/gal |
| Sulfuric Acid (PC or Reagent Grade) | 7-11oz/gal (by wt) ** | 9 oz/gal |
| Chloride Ion | 30-100 PPM | 80 PPM |
| E-Brite 200M (make-up) | 0.5-0.7% by volume | 0.6% |
| E-Brite 200R or 200RX-W (replenisher) | 0.05-0.2% by volume | 0.15% |
| E-Brite 200AX (auxiliary) * | 0.02-0.1% by volume | |

*Occasional use for a quick boost in leveling or LCD brightness or after bath has been idle for several days. Not normally required in starting up a new bath or in a conversion to **E-Brite 200**.

For **barrel or **high throw rack plating** use 11-15 oz/gal Copper Sulfate and 20-30 oz/gal Sulfuric Acid.

Chloride Ion: Use C.P. Hydrochloric Acid. As a general rule, 10 ml of HCl per 100 gallons will raise Chloride Ion concentration by 10 PPM. Always analyze solution for Chloride Ion before adding HCl.

Note: Do not mix **E-Brite 200M** with **E-Brite 200R**, **200RX-W** or **200AX** prior to adding to the solution. It is permissible to mix **E-Brite 200R** and **200AX** and this is sometimes done for ease of additions for use with automatic feed systems. For convenience, a special blend of **E-Brite 200R** and **200AX** can be used for this purpose. It is called **E-Brite 200RX-W**.

OPERATING CONDITIONS

| | |
|-------------------------|--|
| Cathode current density | 5 - 100 ASF |
| Anode current density | 10 - 30 ASF |
| Temperature | 70°F - 90°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 0.56 pounds or 0.038 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.
5. 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.
6. 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.
7. Add **E-Brite 200** addition agents:

| | |
|--------------------------------|-----------------------------|
| E-Brite 200M | 0.6% by volume |
| E-Brite 200R or 200RX-W | 0.15% by volume |
| E-Brite 200AX | 0.05% by volume (if needed) |

Solution is now ready for production.

CONVERSION OF EXISTING ACID COPPER SOLUTIONS

Conversions to the **E-Brite 200** process are easy to accomplish. A one quart sample of the bath should be sent to **EPI's** Technical Service Laboratory for conversion, analysis and recommendations.

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, 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 200 ADDITION AGENTS

E-Brite 200M is used primarily for new solution make up, following carbon treatment and upon conversion of other systems. It is the primary grain refiner and high current density brightener.

The amount of **E-Brite 200M** to be added after carbon treatment or for a conversion should be based on Hull Cell tests.

E-Brite 200R is the primary replenishment/maintenance additive used at approximately one (1) quart per 2000 ampere hours to provide a bright, leveled and ductile copper deposit. A low concentration will cause a loss of leveling and brightness in the low current density areas.

E-Brite 200R is effective for production which consists primarily of average current density areas.

E-Brite 200AX is an auxiliary brightener which in the presence of **E-Brite 200R** will increase leveling and brightness in the low current density areas.

If the production parts or the racking presents a higher-than-normal amount of low current density area, the normal **200R** replenisher may not be able to maintain satisfactory plating in the low current area and **E-Brite 200AX** will have to be added. If the plating conditions require small amounts of **E-Brite 200AX** on a regular basis, then it is recommended that the **200AX** be blended in the correct ratio with the **200R** for either manual or automatic feeding. As an option, **E-Brite 200RX-W** can be used instead, (approximately 1 quart per 2000 amp hours) since it is pre-mixed.

If the production is primarily of high current density area, then **E-Brite 200M** (0.02-0.05%) may have to be added once or twice a week. (Do not mix **200M** with the other additives). **EPI** can analyze samples of the bath to help establish a trend of the **200M** concentration on new installations.

Based on your experience, if LCD area brightness and leveling need improvement after a shutdown (such as a weekend), 0.02-0.05% **E-Brite 200R**, **200RX-W**, or **200AX** may be added upon start up. Hull Cell testing can be used to confirm how much is needed.

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 200** 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, 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 or 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 70-90° 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 CuSO₄.

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
FI 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 0.5 inch Spectronic 20 tube 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 200** 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 200M, 200R, 200RX-W** and **200AX** 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 200M, 200R, 200RX-W** or **200AX** 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.**