

## E-Brite 209

### Bright Acid Copper for Foils and Sheets

**E-Brite 209** produces exceptionally bright, ductile deposits with wide operation window.

**E-Brite 209** produces consistent results due to excellent bath stability which minimizes start-up problems after idle periods or weekend shut-downs.

There are no harmful break down products which eliminates frequent carbon treatment. The **E-Brite 209** bath is tolerant of variations in working conditions and impurities lending to ease of operation and process control.

The **E-Brite 209** process utilizes two additives. The bath is very tolerant of additive overload as long as the balance is maintained. Corrective additions produce immediate results.

**E-Brite 209** exhibits reduced nodulation in high current density areas.

#### SOLUTION COMPOSITION

	<u>Range</u>	<u>Optimum</u>
Copper Sulfate	37-46 oz/gal (280-345g/l)	42 oz/gal (315g/l)
Sulfuric Acid (PC or Reagent Grade)	10-13 oz/gal (by wt) (75-98g/l)	12 oz/gal (90g/l)
Chloride Ion	40-100 PPM	70 PPM
<b>E-Brite 209M</b>	0.2-0.4% by vol.	0.3%
<b>E-Brite 209B</b>	0.15-0.25% by vol.	0.2%

Chloride Ion: Use C.P. Concentrated Hydrochloric Acid. As a general rule, 10 ml of HCl per 100 gallons (2.6 ml per 100 liters) will raise Chloride Ion concentration by 10 PPM. Always analyze solution for Chloride Ion before adding HCl.

**NOTE:** Do Not mix **E-Brite 209M** with **E-Brite 209B** prior to adding to the solution.

## OPERATING CONDITIONS

Cathode current density	250-800 ASF (25-80 amps/dm <sup>2</sup> )
Anode current density	10-100 ASF (1-10 amps/dm <sup>2</sup> )
Temperature	120-130° F (50-55°C)
Agitation	Air from low pressure blower or
high	pressure solution
movement	
Anodes	Inert anodes: titanium or lead
Anode bags	Not required
Anode:Cathode ratio	2-8:1
Filtration	1 – 2 turnovers per hour

## 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 at a concentration of 0.75 pounds or 0.0475 gallons per gallon of final tank working volume.

**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 2.5 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 209** addition agents:

<b>E-Brite 209M</b>	0.3% by volume
<b>E-Brite 209B</b>	0.2% by volume

Solution is now ready for production.

## **CONVERSION OF EXISTING ACID COPPER SOLUTIONS**

Conversions to the **E-Brite 209** 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.

Concentrations below 32 ounces per gallon can produce HCD burning, and reduced deposition rates. High concentrations (above 46 ounces per gallon) can cause Copper Sulfate crystals to form on the anodes and tank walls causing poor anode corrosion and rough plating.

**Sulfuric Acid** provides conductivity to the solution and dissolution of the anodes. Concentrations higher than 13.0 ounces per gallon (97g/l) can produce HCD burning and cause passivity which results in depletion of the copper in the solution.

**Chloride Ion** concentrations higher than 100 PPM can produce grainy deposits and can contribute to passivation of the anodes.

### **FUNCTION OF E-BRITE 209 ADDITION AGENTS**

**E-Brite 209M** is used 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. It is used at approximately 60ml-80ml per 1000 ampere hours.

**E-Brite 209B** is a maintenance additive for brightness especially at low current density area. It is used at approximately 30-50ml per 1000 ampere hours.

### **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 smooth deposits from the **E-Brite 209** acid copper system. The filtration rate must be a minimum of one turnover per hour.
- 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.

An activated carbon pack on the filter should not be used during production periods because it will remove some of the brightener additives. The filter intake hose must be located properly to prevent air from being drawn into the filter.

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

- **Anodes:** Inert anodes such as lead or titanium should be used.

## **TEMPERATURE**

The solution temperature is maintained in the 120-140°F (50-60°C) range. Operating at a higher temperature will result in increased brightener consumption to achieve comparable results. Lower temperatures may cause copper sulfate to crystallize which in turn will cause anode polarization.

**NOTE:** Heat must be maintained in the solution at all times to prevent copper sulfate crystallization due to its high concentration.

## **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<sub>4</sub>.

### **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 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 209** 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 209M** and **209B** 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 209M** or **209B** without first reading and understanding the **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.**

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