

## E-Brite™ 202G

### Bright Acid Copper for Wire and Grounding Rods

**E-Brite 202G** produces exceptionally bright, ductile deposits with low internal stress.

**E-Brite 202G** does not contain dye-type materials which are messy to work with and can cause staining of the plated surfaces.

It 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 bath is tolerant of variations in working conditions and impurities lending to ease of operation and process control.

The 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 202G** exhibits reduced nodulation in high current density areas.

#### SOLUTION COMPOSITION

	<u>Range</u>	<u>Optimum</u>
Copper Sulfate	32-46 oz/gal (240-345g/l)	40 oz/gal (300g/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 202M</b> (make-up)	0.1-0.2% by vol.	0.2%
<b>E-Brite 202G</b> (replenisher)	0.05-0.1% by vol.	0.1%

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 202M** with **E-Brite 202G** prior to adding to the solution.

#### OPERATING CONDITIONS

Cathode current density	10-80 ASF (1-80 amps/dm <sup>2</sup> )
Anode current density	5-100 ASF (0.5-10 amps/dm <sup>2</sup> )
Temperature	120-140° F (50-60°C)

Agitation	Air from low pressure blower or high pressure solution movement
Anodes	Phosphorized copper (0.025-0.06% phos)
Anode bags	Napped polypropylene
Anode:Cathode ratio	2-8:1
Filtration	5 micron or lower; 1 – 2 turnovers per hour, continuous

### **NEW SOLUTION MAKE-UP**

1. Charge mixing tank with water at approximately  $\frac{3}{4}$  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 0.75 pounds or 0.0475 gallons per gallon (0.34kg or 0.0475 liters per liter) 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.

3. While mixing, slowly add and dissolve 2.5 pounds of Copper Sulfate pentahydrate per gallon (0.3 kg/l) of final tank working volume. Maintain solution temperature above 110° F (43°C).
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 (0.0036 kg/l). The solution is mixed by agitation with air for 2 hours and then allowed to settle and cool before it is pumped through a filter into the plating tank.
5. Add water to final working volume and mix. Analyze solution for Copper Sulfate, Sulfuric Acid and Chloride Ion and make additions if required.
6. Purify the solution by using pre-plated dummy cathodes at 10-30 ASF (1-3 amps/dm<sup>2</sup>) for 1-2 hours followed by a 5-10 ASF (0.5-1 amp/dm<sup>2</sup>) for 1-2 hours.
7. Add addition agents (carbon must be removed from filter before making brightener adds):
 

<b>E-Brite 202M</b>	0.2% by volume
<b>E-Brite 202G</b>	0.1% by volume

Solution is now ready for production.

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

Conversions to the **E-Brite 202G** 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 32 ounces per gallon (240 g/l) can produce HCD burning, reduced leveling and a narrow plating range and reduced deposition rates.

Concentrations above 46 ounces per gallon (345 g/l) can reduce brightness and leveling. Copper Sulfate crystals may form on the anodes and tank walls causing poor anode corrosion (or anode polarization) and rough plating.

Sulfuric Acid provides conductivity to the solution and dissolution of the anodes.

Concentrations higher than 13.0 ounces per gallon (97 g/l) can produce HCD burning and cause anode passivity which results in depletion of the copper in the solution.

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

Concentrations lower than 40 PPM can produce rough or striated deposits.

### **FUNCTION OF E-BRITE 200 ADDITION AGENTS**

**E-Brite 202M** 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 202M** to be added after carbon treatment or for a conversion should be based on Hull Cell tests.

**E-Brite 202G** is the maintenance additive and is added based on approximately 40,000 – 50,000 amp hours per gallon (10,500-13,000 amp hours per liter).

## **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, 5 micron or lower, is necessary for the production of bright, smooth and leveled deposits from the **E-Brite 202G** acid copper system. The filtration rate must be a minimum of two turnovers 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. Filter bags or cartridges should be leached. Use the same procedure for anode bags below.

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.

If air is used, it 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.

**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 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.

**Anode Bags:** Anodes should be bagged, preferably with napped polypropylene. New anode bags must be leached before using by soaking in a 2 oz/gallon (15g/l) solution of Sodium Hydroxide followed by a water rinse and then leached in 5% Sulfuric. Rinse again with water.

**Temperature:** The solution temperatures are maintained in the 120°-140° F (50-60°C) range. Higher operating temperatures 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 the 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> or  
ml of Sodium Thiosulfate (total) x 12.58 = g/l 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 DI 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 green.

Calculations: Sulfuric Acid in oz/gal (wt) = ml of 0.1N NaOH x 0.329 or  
Sulfuric Acid in g/l (wt) = ml of 0.1N NaOH x 2.46

**Chloride Ion** – Use newspaper method available from **EPI**.

## **CAUTION**

The **E-Brite 202G** 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 202M** and **202G** brighteners are relatively non-hazardous. However, good industrial hygienic procedures should be followed to include rubber gloves and safety glasses. Solution contact with skin should be washed off with soap and water.

Do not work with the **E-Brite 202M** or **202G** 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: sellers and manufacturers 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.**

7/25/19