

E-Brite™ 757

Bright Nickel Plating

E-Brite 757 will produce bright ductile deposits which are free from laminations. It produces brilliant, white deposits of high clarity, reflectivity and depth. The deposit is active and can be chromium plated if specified. It can be used in barrel applications as well as cathode rod and air agitated rack installations.

Because it is a single maintenance additive process, **E-Brite 757** eliminates plating variations common with multi-additive bright nickel processes. There will be less of a chance for operator-caused imbalance of brighteners and additives.

The **E-Brite 757B** maintenance brightener additive normally provides the correct amount of **E-Brite 757Cr** carrier. Extra additions of carrier, **E-Brite 757Cr**, may be required on rare occasions if it is consumed at a higher than normal rate, due to changes in type of workloads or the conditions of the bath or anodes. It may also have to be added following batch carbon treatment to bring the bath back into balance. Running conversions from other Watts-type baths to the **E-Brite 757** process are easy to accomplish. A one (1) gallon sample of the bath should be sent to **EPI's** technical service lab, for conversion recommendations. It would be helpful to send samples of the addition agents being used to determine their effect on the analysis of the bath.

TYPICAL BATH FORMULATION AND OPERATING INSTRUCTIONS

	<u>Range</u>	<u>Make-Up</u>
Nickel Sulfate	32 to 50 oz/gal.	40 oz/gallon
Nickel Chloride	6 to 10 oz/gal.	8 oz/gallon
Nickel Metal	8 to 13 oz/gal.	10.8 oz/gallon
Boric Acid	5 to 7 oz/gal.	6 oz/gallon
E-Brite 757Cr Carrier	3 to 6% by volume	5% by volume
E-Brite 757B		0.1% by volume
E-Wet 701W Air wetting agent, rack lines		0.1% by volume
E-Wet 702W BBL wetting agent, barrel lines		0.1% by volume
pH	3.5 - 4.5	4.0
Temperature	110 to 150°F	
Voltage	9 - 12	

Anodes: Electrolytic squares, R-Rounds or S-Rounds in titanium baskets are recommended.

Anode Bags: Double cotton or napped polypropylene bags are recommended. Bags may shrink by as much as 20% and allowances should be made. Bags should be 5 inches longer than the anodes. Bags must be leached in hot water prior to use.

FILTRATION

Continuous carbon filtration of the solution with a turnover of 1 to 2 times its volume per hour is recommended to remove suspended particles and organic impurities. For best results the filter should be charged with a mixture of 1 pound each of regular filter aid and activated carbon/1,000 gallons of the solution. The activated carbon is added weekly until the rate of filtration slows down, then the filter is cleaned and recharged.

PROCESS EQUIPMENT

Tanks

Both plating and treatment tanks are preferably made of steel lined with rubber or plastic. PVC, polyethylene and polypropylene are generally acceptable. The treatment tank, with a capacity equal to the plating tank, is used for both new bath make up and for solution purification. Tanks should be insulated from electrical and stray currents.

Heating

Immersion heating by quartz, PTFE or titanium heaters. The titanium should be grounded. For large installations, the bath is best heated by external heat exchangers. Immersion heating by titanium or tantalum steam coils, well insulated from electrical and stray currents, is acceptable. Lead heating coils should not be used, particularly when the bath is operated at a high chloride concentration.

PREPARATION OF A NEW BATH

A new bath should be treated for removal of any organic and inorganic impurities prior to the addition of brighteners. This treatment is preferably done in a clean, rubber or plastic lined tank, other than the plating tank (see processing equipment), whose volume is at least equal to that of the plating tank. Also, a new or relined treatment tank or plating tank should be treated overnight with a hot, 140°F to 150°F (60° to 65°C), 10% Sulfuric Acid solution filled to the top of the tank. The tank is then drained and rinsed with clean water. The new bath is then prepared as follows:

1. Fill treatment tank with water to 2/3rds that of the operating volume. Heat to about 150°F (65°C).
2. Add the required amounts of nickel sulfate and nickel chloride and agitate until the salts are dissolved completely.
3. Add nickel carbonate slurried with water and raise pH to between 5.2 and 5.5.
4. Add 2 to 3 lbs. of activated carbon and 1 quart (about 900 ml.) of 30% Hydrogen Peroxide per every 100 gallons of the bath and treat with agitation for about 2 hours and then allow to settle. The solution is now ready for filtration into the clean plating tank.
5. Prior to filtration, hang the nickel anodes from the anode rails. Charge the filter with some filter aid and filter the solution.
6. Predissolve the required amount of boric acid in hot water and add to the plating tank.
7. Bring bath volume to the operating level and adjust the pH to 4 with 10% Sulfuric Acid.

8. Heat the solution to 140°F (60°C) and electrolyze (dummy) at about 3 to 4 amp/ft² using corrugated steel cathodes. Electrolyze overnight or until such time the deposit in the recessed areas of the corrugated cathodes is light in color indicating the final removal of all trace impurities. The bath is now ready for addition of the brighteners.
9. Add 5% volume **E-Brite 757Cr**, 0.1% volume of **E-Brite 757B** brightener and 0.1% wetter. Recheck the pH and adjust it to 4.0, if necessary, with 10% Sulfuric Acid. The bath is now ready for plating.

FUNCTION OF BATH COMPONENTS

Nickel Sulfate

Nickel Sulfate is used as the primary source of nickel ions for the bath which are reduced to metallic nickel at the cathode - the work being plated.

Nickel Chloride

Nickel Chloride also provides nickel ions, but its primary purpose is to supply the chloride ions for maintaining good anode corrosion and bath conductivity.

Nickel Metal

The nickel metal content of the bath should be maintained by anode corrosion as far as possible. The nickel concentration of the bath is one of the factors which determines the maximum operating current density. Low anode areas and poor anode corrosion, both cause the nickel content to decrease.

Boric Acid

Boric Acid functions as a strong buffering agent in the bath to maintain a stable pH at the cathode film. The boric acid should be maintained between 5.5 to 6.5 oz/gal. Boric Acid is depleted mainly by drag out and is added by first dissolving it in hot water and then adding the resultant solution directly to the plating bath. If the bath is allowed to cool to room temperature the boric acid will precipitate out. Reheating the bath with agitation will, however, redissolve the Boric Acid.

The Boric Acid helps to maintain brightness and ductility of the nickel deposit. Low Boric Acid content can cause burning, pitting, and orange peel at high current densities. Rapid fluctuations of pH during acid additions or bath operation are indicative of low boric acid content.

NICKEL BATH ANALYSIS

A. Determination of Nickel Metal

1. Pipette 2 ml. bath sample into a 250 ml. Erlenmeyer flask.
2. Add 20 ml. of 50% Ammonium Hydroxide and about 1/2 gram of Murexide Indicator and swirl to dissolve.

3. Titrate with 0.1 M EDTA until the color changes from yellowish-green or brown to deep blue-purple at the end point.

ml of EDTA x 0.39 = oz/gal. Nickel Metal

$[A - (B \times 0.25)] \times 4.5 = \text{oz/gal. of Nickel Sulfate, } 6\text{H}_2\text{O}$

A = oz/gal. of Nickel Metal B = oz/gal. $\text{NiCl}_2 \cdot 6\text{H}_2\text{O}$

B. Determination of Nickel Chloride

1. Pipette 2 ml. of bath sample into a 250 ml. Erlenmeyer flask.
2. Add 100 to 150 ml. of distilled or deionized water and 5 to 8 drops of Potassium Chromate Indicator.
3. Titrate with 0.1 N Silver Nitrate until the color changes from clear yellow to a brick red color.

ml of $\text{AgNO}_3 \times 0.8 = \text{oz/gal. Ni Cl}_2 \cdot 6\text{H}_2\text{O}$

ml of $\text{AgNO}_3 \times 0.24 = \text{oz/gal. of Chloride}$

C. Determination of Boric Acid

1. Pipette a 2 ml. bath sample into a 250 ml. Erlenmeyer flask.
2. Add 40 ml. of 12% Mannitol Solution and 8 to 10 drops of Bromocresol Purple Indicator.
3. Titrate with 0.1N Sodium Hydroxide until the color changes from yellow-green to a pale blue at the end point.

ml of NaOH x 0.42 = oz/gal. Boric Acid

PREPARATION OF REAGENTS AND INDICATORS

Reagents

0.1 m EDTA: Dissolve 37.2 grams of EDTA (Ethylenediaminetetraacetic acid, Disodium Salt) in distilled water and dilute to 1 liter.

0.1 N Silver Nitrate: Dissolve 17 grams of Silver Nitrate in distilled water and dilute to 1 liter.

Note: The Silver Nitrate should be dried in an oven to free all moisture.

0.1N Sodium Hydroxide: Dissolve 4 grams of Sodium Hydroxide in distilled water and dilute to 1 liter.

INDICATORS

Murexide Indicator: It is available from most laboratory chemical suppliers.

Potassium Chromate Indicator: Dissolve 20 grams of Potassium Chromate in distilled water and dilute to 100 mls.

Mannitol Indicator: Dissolve 12 grams of Mannitol in 100 ml. of distilled water.

Bromocresol Purple Indicator: Dissolve 0.1 gram of Bromocresol Purple in 100 mls. of Methanol.

TROUBLE SHOOTING FOR E-BRITE 757 BRIGHT NICKEL PROCESS

<u>Problem</u>	<u>Possible Causes</u>	<u>Corrective Action</u>
1. Lack of low current density brightness often accompanied by foggy deposits in areas.	Bath low in E-Brite 757B	Add E-Brite 757B in increments of 1 gal/1000 gal. until full brightness is restored.
2. Brittle deposits	Excessive E-Brite 757B	Discontinue E-Brite 757B addition until the brightener level is reduced through normal plating and drag out.
3. Burning in high current density Areas.	Low nickel content	Adjust nickel content. Check for sufficient anode area and also chloride concentration.
4. Pitting, foggy deposit, poor adhesion	Chromium Contamination	High pH treatment or low current density electrolysis.
5. Pitting	E-Wet concentration low	Add 0.1% of appropriate wetter
6. Pitting, burning, orange peel	Bath low in Boric Acid	Adjust Boric Acid Concentration
7. Pitting	Organic contamination	Activated carbon treatment
8. Rough Deposits	Iron contamination	High pH treatment
	Copper contamination	High pH treatment or low current density electrolysis
	pH too high	Lower pH with 10% Sulfuric Acid
	Dust, Nickel Oxides, Etc.	Check and correct filtration. Also check anode bags for damage and replace if necessary.
9. Dark or gray low current density deposits	Copper, zinc contaminations	High pH treatment and/or low current density electrolysis or add E-Brite 757 Purifier at 0.1% to 0.3% by volume.

CAUTION

Inhalation of the vapors or fumes may be irritating to the upper respiratory tract. Nickel salts in crystalline form or water solution can be irritating to the eyes and skin. There may be "nickel itch" noted in some workers handling nickel salts. Prevention of skin contact is the best way to avoid the problem.

Adequate measures must be taken to protect workers from eye or skin contact and to prevent the inhalation of fumes. The use of the following protective equipment is recommended: chemical safety goggles or face shield, rubber gloves, protective clothing and shoes. Work in a well

ventilated area or provide general purpose respirators. Wash thoroughly after handling chemicals and at the end of the work period. Launder contaminated clothing before re-use.

In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. If irritation persists get medical attention. For inhalation, move exposed individual to a non-contaminated area. Get prompt medical assistance.

NOTE: A Material Safety Data Sheet furnished by **EPI** must be read and understood prior to working with **E-Brite 757**.

PACKAGING

One (1), Five (5) and 55 gallon non-returnable containers.

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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