

E-Brite™ CR

Bright Decorative Chrome Plating Process

E-Brite CR Chromium Plating Process is a bright, trouble-free, highly activating, stain-free system with exceptional covering power. The catalyst has been specifically formulated to activate the nickel-plated surface to accept bright chromium deposits over a wide current density range without low current density staining.

The **E-Brite CR** Chromium Plating Process offers the user both higher cathode current efficiencies and higher operational current densities without burning when compared to a conventional chromium plating process.

Product Features and Benefits

Higher cathode current efficiencies and operational current densities. Less time in plating tank – faster throughput.

Accepts chromium deposit over a wide range of current densities. No low current density staining – exceptional covering power.

Simple operation. Economical and easy to use.

Operational Parameters

	<u>Optimum</u>	<u>Range</u>
Chromic Acid	24 oz/gal (180 g/L)	20-36 oz/gal (150-270 g/L)
Sulfate	0.125 oz/gal (0.94 g/L)	0.1 – 0.2 oz/gal (0.75-1.5 g/L)
Ratio	190:1	170-200:1
E-Brite CR	2.5%	1.5 – 3% by vol.
Temperature	110° F	100-120° F
Cathode Current Density	150 ASF	120-180 ASF
Voltage	6-15 volts, depending upon tank conditions	
Agitation	Light air to prevent temperature stratification	

Chromic Acid

The Chromic Acid furnishes the chromium ion and must be maintained within the ranges specified. The concentration of Chromic Acid can be estimated by the use of hydrometer (see Figure 1).

Some grades of Chromic Acid may contain significant amounts of sulfate. Since the process operates with relatively low Chromic Acid concentrations, the amount of sulfate in the Chromic Acid should be considered when large additions of Chromic Acid are made, especially at makeup of the solution.

The choice of Chromic Acid concentration will depend on the specific installation. Generally, the lowest concentration of Chromic Acid should be used conducive with the production of acceptable work. Concentrations higher than the range specified are not harmful as long as other constituents are maintained in proportion. Generally, lower concentration Chromic Acid baths are more prone to the effects of metallic contamination. Therefore steps should be taken to minimize introduction

of contaminants. Consultation with your **EPI** technical representative on the procedures to minimize contamination is recommended.

Chromic Acid Analysis

1. Pipette 2 ml of the sample into a 100 ml volumetric flask and dilute to the mark with DI water. Pipette 10 ml of this 2% dilution into a 250 ml Erlenmeyer flask.
2. Add about 10 ml of concentrated hydrochloric acid and 10 ml of 10% potassium iodide solution.
3. Titrate with 0.1 N sodium thiosulfate until the color fades from brown to a light straw yellow.
4. Add about 2 ml of starch solution and slowly continue titrating until the dark blue color disappears resulting in a clear or light green endpoint.

Calculation: oz/gal Chromic Acid = (ml 0.1 N $\text{Na}_2\text{S}_2\text{O}_3$) x 2.23

Sulfate Analysis

1. Pipette 20 ml of the sample into a graduated Kocour tube.
2. Add 5 ml of concentrated hydrochloric acid and 5 ml of 20% barium chloride solution to the Kocour tube.
3. Stopper the tube and shake vigorously for 5-10 seconds.
4. Centrifuge for 5 minutes.
5. Read the oz/gal sulfate directly from the tube. Each numbered division is equal to 0.1 oz/gal and the smaller marks are equal to 0.02 oz/gal.

Chromic Acid/Sulfate Ratio

In general, the effects of the CrO_3/SO_4 ratio are similar to conventional chromic acid/sulfate plating solutions. High sulfate or low ratio will reduce the covering power but increase limiting current density. Conversely, low sulfate or high ratio will improve covering power but reduce limiting current density making the process more prone to "burning". Low ratio also makes the process more susceptible to "whitewash" type problems. A CrO_3/SO_4 ratio of 190:1 should prove adequate until experience dictates otherwise.

Sulfate should be raised by addition of dilute Sulfuric Acid and lowered by the addition of Barium Carbonate or Barium Hydrate. (see Table 1 for adjustment of sulfate).

E-Brite CR Catalyst

The **E-Brite CR** cooperates with the sulfate to produce a system with superior covering power and limiting current density utilizing lower than normal concentrations of Chromic Acid. The **E-Brite CR** should be maintained within the range specified.

The consumption of **E-Brite CR** is essentially due to dragout of solution. Therefore, the concentration of **E-Brite CR** can be maintained by additions in proportion to the Chromic Acid added to bring the solution back to the desired composition (see Figure 2). A periodic laboratory analysis will confirm concentration.

E-Brite CR may be added directly to the solution without dilution. However, as with all additions, mix well before operating the solution.

Temperature

The **E-Brite CR** process will operate over a wide temperature range. However, best results will be obtained when the temperature is maintained within the range specified. The use of automatic temperature controllers is highly recommended. Some form of agitation to maintain a uniform temperature is also suggested.

In general, temperature will behave as if catalyst was added. For example, high temperature acts similarly to high catalyst to produce less burning but with reduced covering power. Conversely, low temperature acts similar to low catalyst concentrations producing improved covering power but with increased tendency to high current density burning and “whitewash”.

Current Density

The **E-Brite CR** process will produce bright deposits over a wide current density range. The actual current density used will vary with solution composition as well as the shape of the work plated. In general, it is recommended that the current density be as high as possible consistent with the production of acceptable deposits.

Anodes

Only lead alloy anodes containing 6% tin should be used. The anodes should be of sufficient cross section to prevent over-heating. Anode area should be approximately twice the anticipated cathode area in order to minimize the buildup of trivalent chromium in the solution.

Before use, anodes should be “filmed” after the solution has been idle. This procedure removes the chromate film on the anode surface and produces a lead peroxide film that functions to reoxidize trivalent chromium.

Plating Time Versus Thickness

The **E-Brite CR** process has improved cathode efficiency over most conventional chromium plating solutions. Under most operating conditions, a thickness of approximately 6 microinches (μin) (0.15 microns) of chromium per minute can be attained.

Equipment

Tanks

PVC type linings are recommended. Lead lined tanks are not recommended but, if used, should be constructed of 7% antimony lead alloy. Metallic linings increase the possibility of stray currents. Previously used synthetic linings should be cleaned thoroughly before use.

Heating/Cooling

Internal heating coils should be fabricated from 7% antimony lead alloy. Tantalum coils can also be used. Metallic coils should be mounted between tank walls and anodes (without touching the anodes) and protected to reduce the possibility of puncture from dropped work (especially with tantalum which is generally thin-walled). Teflon coils may also be used. Automatic temperature controls are strongly recommended.

Power Supply

Sufficient amperage should be made available to provide about 200 ASF (22 A/dm²) with the largest anticipated cathode area. It may be necessary to provide contact on entering or exiting racks where plating occurs while other racks enter or exit the solution. This procedure is necessary to prevent bipolarity and so-called "whitewash" effects.

Rectifiers should have a maximum ripple of 10% at the minimum current used.

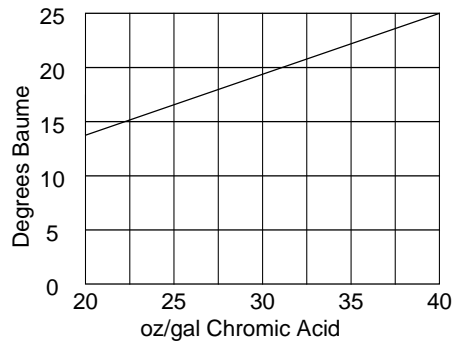
Solution Preparation

Existing chromium plating solutions should be submitted to the laboratory for development of a conversion procedure. New solutions can be prepared as follows:

1. Fill the plating tank 75% with water, preferably deionized.
2. Wear appropriate protective clothing such as rubber apron, rubber gloves, face shields, etc. Observe proper handling precautions.
3. While mixing, carefully add the required amount of Chromic Acid.
4. Heat the solution to about 110°F (43°C).
5. While heating and with mixing, carefully add the required amount of Sulfuric Acid. See Table 1. Allow for any sulfate present in the Chromic Acid. (**NOTE:** Use only dilute Sulfuric Acid. Dilute at least 1:4 by adding one part of Sulfuric Acid to 4 parts of water. Always add the Sulfuric Acid to the water with good mixing and use extreme care as the resulting mixture will heat up considerably. Cool before adding to the plating solution.)
6. Add the required amount of **E-Brite CR**.
7. Place anodes in the tank.
8. Add water to the working level. Mix well.
9. Electrolyze the solution for at least 30 minutes at approximately 6 volts using dummy cathodes.
10. The solution is now ready for use.

Figure 1

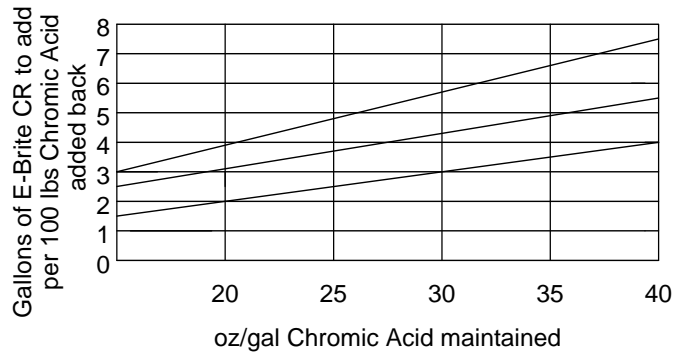
Conversion of Degrees Baume
to
oz/gal Chromic Acid



(Specific Gravity to Degrees Baume = $145 - (145/\text{Specific Gravity})$)

Figure 2

E-Brite CR Additions



3.00 %/vol E-Brite CR
2.25 %/vol E-Brite CR
1.50 % vol E-Brite CR

Table 1

Adjusting Sulfate in Chromium Plating Baths

Fluid Ounces 66° Be' Sulfuric Acid Required
TANK SIZE IN GALLONS

<u>oz/gal H₂SO₄ to be added</u>	<u>100</u>	<u>200</u>	<u>300</u>	<u>400</u>	<u>500</u>	<u>600</u>	<u>700</u>	<u>800</u>	<u>900</u>	<u>1000</u>
0.01	0.5	1.0	1.6	2.1	2.6	3.1	3.7	4.2	4.7	5.2
0.02	1.0	2.1	3.1	4.2	5.2	6.3	7.3	8.4	9.4	10.4
0.03	1.6	3.1	4.7	6.3	7.8	9.6	10.9	12.5	14.1	15.7
0.04	2.1	4.2	6.3	8.4	10.4	12.5	14.6	16.7	18.8	20.9
0.05	2.6	5.2	7.8	10.4	13.0	15.6	18.2	20.9	23.5	26.1
0.06	3.1	6.3	9.6	12.5	15.6	18.8	21.9	25.0	28.2	31.3
0.07	3.7	7.3	10.9	14.6	18.2	21.9	25.6	29.2	32.9	36.5
0.08	4.2	8.4	12.5	16.7	20.9	25.0	29.2	33.4	37.6	41.8
0.09	4.7	9.4	14.1	18.8	23.5	28.2	32.9	37.6	42.3	47.0
0.10	5.2	10.4	15.7	20.9	26.1	31.3	36.5	41.8	47.0	52.2

One fluid ounce = 29.6 ml

To **REDUCE** sulfate, add 0.2 oz/gal Barium Carbonate or Barium Hydrate for each 0.1 oz/gal of excess sulfate.

Packaging

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.**

Troubleshooting Summary

For the

E-Brite Cr Chromium Plating Process

The following information should help to recognize some of the more common plating symptoms that may occur and suggested remedies to overcome them.

<u>Effect/Symptom</u>	<u>Possible Cause</u>	<u>Remedy</u>
Poor covering power; low thickness	<ol style="list-style-type: none"> 1. Current density too low. 2. Poor contact. 3. High sulfate (low ratio). 4. High temperature. 5. High E-Brite CR. 	<ol style="list-style-type: none"> 1. Increase current density. 2. Ensure positive contact. 3. Lower sulfate (add Barium Carbonate). 4. Lower temperature. 5. Temporarily, add Chromic Acid.
Burning in high current density areas. (Burn is uniform in shape)	<ol style="list-style-type: none"> 1. Low temperature. 2. Current density too high. 3. Chromic Acid too low. 4. Low sulfate (high ratio). 5. Low E-Brite CR. 	<ol style="list-style-type: none"> 1. Increase temperature. 2. Reduce current density. 3. Raise chromic acid, readjust ratio. 4. Raise sulfate. 5. Add E-Brite CR to within range.
Non-uniform color; "whitewash"	<ol style="list-style-type: none"> 1. Substrate not clean or "active". 2. Bipolarity (exiting from nickel tank or entering chromium tank). 3. Low sulfate (high ratio). 4. Low E-Brite CR. 	<ol style="list-style-type: none"> 1. Remove films on surface; activate surface. 2. Exit nickel tank with post-contact; enter chromium tank with pre-contact. 3. Add sulfate to proper ratio. 4. Add E-Brite CR to within range.