Uberkote™ Cr

Catalyst Process for Chrome Plating

Uberkote™ Cr process improves cathode efficiency and enhances chromium metal deposit. It can be regulated to target functional or decorative properties. The bath can be economically made up using Chromic Acid and Uberkote™ Cr Catalyst, or using Uberkote™ Cr Regulator, a complete self balancing additive.

Features/Benefits

Decorative applications:

- Bright stain free chromium deposits.
- Good nickel activation.
- Excellent covering power.
- Excellent high current performance for greater output
- Excellent tolerance to impurities

Functional applications:

- High cathode efficiency for fast plating
- Reduced edge build up
- Smooth deposits
- Good activation of stainless steel

Operating Conditions - Decorative

	Range	Optimum
Chromic Acid (or)	180 - 270 g/L	240 g/L
Uberkote™ Cr Regulator (Contains Catalyst)	(24 - 36 oz/gal)	(32 oz/gal)
Sulphate	0.7 - 1.4 g/L	1.0 g/L
	(0.08 - 0.18 oz/gal)	(0.14 oz/gal)
Uberkote™ Cr Catalyst (liquid)	1.3 -1.7 % b.v.	1.5 % b.v.
Do not use Uberkote™ Cr Catalyst if solution is made up with Uberkote™ Cr Regulator		
Chrome : Sulphate Ratio	180:1 - 300:1	250:1
Temperature	32 - 52°C	46°C
	(90 - 125°F)	(115°F)
Cathode Current Density	40 - 600 ASF	50 -600 ASF
Anode : Cathode	1:5 - 2:1	

Operating Conditions - Functional

	Range	Optimum
Chromic Acid (or)	150 - 375 g/L	240 g/L
Uberkote™ Cr Regulator (Contains Catalyst)	(20 - 50 oz/gal)	(32 oz/gal)
Sulphate	0.9 - 1.5 g/L	1.2 g/L
	(0.12 - 0.20 oz/gal)	(0.16 oz/gal)
Uberkote™ Cr Catalyst (liquid)	3.0 - 5.0 % b.v.	4.0 % b.v.
Do not use Uberkote™ Cr Catalyst if solution is made up with Uberkote™ Cr Regulator		
Chrome : Sulphate Ratio	125:1 - 250:1	200:1
Temperature	49 - 66°C	54°C
	(120 - 150°F)	(130°F)
Cathode Current Density	100 - 900 ASF	250 - 400 ASF
Anode : Cathode	2:5 - 2:1	

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Solution Preparation

1) Fill the clean plating tank with clean water to approximately 2/3 of operating volume.
2) Heat the solution to about 46°C (115°F) for a decorative solution, or 57°C (135°F) for a functional solution.
3) Slowly add the required amount of chromic acid, or Uberkote™ Cr Regulator while agitating the solution to aid dissolving of the chromic acid.

   CHROMIC ACID IS A STRONG OXIDIZING AGENT AND SHOULD BE ADDED TO THE SOLUTION CAREFULLY SO AS TO AVOID SPLASHING. APPROPRIATE PERSONAL PROTECTIVE EQUIPMENT SHOULD BE USED; SUCH AS: GLOVES, APRONS, BOOTS, GOGGLES AND/OR FACE SHIELD, AND NIOSH APPROVED RESPIRATOR.

4) Add the required amount of sulfuric acid to attain the desired sulfate level.

   POUR THE SULFURIC ACID INTO THE SOLUTION SLOWLY AND CAREFULLY WHILE AGITATING THE SOLUTION. USE PERSONAL PROTECTIVE AS DESCRIBED IN STEP #3 ABOVE.

5) Add the required amount of Uberkote™ Cr Catalyst catalyst, while agitating the solution. Do not add Uberkote™ Cr Catalyst if the self regulating Uberkote™ Cr Regulator is used for make up.
6) Install the clean anodes, and adjust the solution to operating volume with clean water.
7) Mix the solution for 1 – 2 hours at operating temperature.
8) Analyze the solution for sulfate; and adjust to desired level with sulfuric acid.
9) Electrolyze the solution at 2 – 4 amp/gal for at least 4 hours.

Solution Maintenance:

The chromic acid and sulfate should be maintained by periodic analysis. The sulfate is raised by additions of sulfuric acid, and reduced by additions of barium carbonate.

The catalyst is maintained by regular additions of Uberkote™ Cr Catalyst, based on chromic acid additions. For self regulating baths, Add Uberkote™ Cr Regulator only, to maintain chromic acid concentration and catalyst. To increase chrome content by one ounce per gallon, add one ounce per gallon Uberkote™ Cr Regulator.

Note: Frequent small additions of chromic acid or Uberkote™ Cr Regulator will result in better control and superior plating results than infrequent large additions.

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Decorative Plating:
Add 3.2 litres (0.85 gallons) of Uberkote™ Cr Catalyst to the chromium plating solution for every 45.4 kg (100 lb.) of chromic acid added.

Functional (Hard chromium) Plating:
Add 7.5 litres (2 gallons) of Uberkote™ Cr Catalyst to the chromium plating solution for every 45.4 kg (100 lb.) of chromic acid added.

Plating speed (Thousandths of an inch each hour)

Amps per square foot	Uberkote™ Cr at 130°F	Uberkote™ Cr at 150°F	Standard at 130°F	Standard at 150°F
144	.43	.38	.31	.3
288	1.2	1.1	.8	.75
432	2	1.9	1.4	1.24
576	2.9	2.8	2.06	1.82
720	3.8	3.7	2.78	2.44
864	4.7	4.5	3.54	3.08

Operation

Tanks: Steel tank lined with Koroseal, or equivalent flexible PVC lining.

Auxiliary Equipment: For equipment such as pumps and piping, it is recommended that any surface that will be in contact with the chromium plating solution should be constructed with Kynar, Hypalon or equivalent material.

Power Requirements: D.C. power source of 9 – 18 volts will be adequate for most requirements. The D.C. power source should have a ripple of less than 5%. Racks and buss bars should be of sufficient size to carry the applied current.

Agitation: Oil-free air agitation from a low-pressure blower, or other solution movement, is recommended for mixing purposes. This is important, with deep tanks, to avoid temperature stratification. (Note: solution should not be agitated when work is in the tank).

Impurities: Metallic impurities, such as iron and aluminum, will complex with the catalyst causing whitewash, burning and poor coverage.

In functional plating, where reverse etching is required, it is best to etch the parts in a separate tank containing only chromic acid (no sulfate).

Copper, nickel, iron and other metallic impurities will reduce the conductivity of the plating solution.

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Chloride contamination will over activate the catalyst and must be avoided. High anode current dummying will remove chlorides. Chloride and excess sulphate will accumulate if rinsing between nickel plate and chrome is inadequate.

Excess sulphate will reduce throw and reduce the bright plating range.

Insufficient sulphate will result in staining in the low to mid current densities or white blotchy deposits

Anodes: Extruded lead-alloy anodes are recommended. Recommended alloys are 93% lead and 7% tin; or 93% lead, 4% antimony and 3% tin. Plastisol-coated copper hooks are recommended.

Low anode area can lead to the rapid introduction of trivalent chromium; which will reduce the conductivity of the solution, and lead to plating defects. Inactive anodes will also produce the same problem.

A healthy lead anode will have a uniform “chocolate-brown” color. If the anode has a yellow film, electrolyzing the solution should reactivate it. If the scale is heavy, the anode(s) should be removed from the solution and cleaned. Contact your representative for a convenient easy-to-use anode cleaner.

Note: A period of extended idleness leads to formation of the non-conductive, yellow lead chromate film. After a period of idleness, it is best to electrolyze the solution to reactivate the anodes.

As a preventative maintenance measure, it is recommended that the performance of the lead anodes be observed. A healthy anode will gas vigorously. If any anodes are not gassing vigorously, clean the hook contact area. In most cases, this will correct the problem. If this does not correct the problem, check the anode for the color of the film. It may be necessary to clean the anode. The integrity of the hook should also be checked; for example, it may be loose.

Spotless™ LAC removes lead chromate scaling formed on lead alloy anodes used in hexavalent chromium solutions. The insulating film is stripped to promote throwing power, lower plating voltages, reduces pits and burns on parts, and propagates trivalent re-oxidation. Follow this QR Code for more info:

Temperature: A lower operating temperature improves covering power; while a higher temperature allows operation at a higher current density, when a faster plating rate is required.

Heating and cooling: Teflon coils, teflon coated coils, tantalum, or lead alloys are suitable. Titanium coils should not be used.

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Ventilation: Adequate ventilation, and use of a fume scrubber, is recommended in order to meet local air emission regulations.

Handling and Storage: Chromic acid is a strong oxidizing agent. Avoid contact with paper, wood, oils, solvents, or any other organic material or combustible material. Uberkote™ Cr Regulator and chromic acid should be stored in a dry place, away from any flammable or combustible materials. Containers should be kept tightly closed when not in use.

Disposal: Plating solutions in which Uberkote™ Cr is used contain hexavalent chromium. Any spills should be contained, and disposed of in compliance with applicable regulations. Aqua Bond can suggest treatment programs that reduce and remove hexavalent chromium in both traditional clarifier systems and in microfiltration (MF) treatment systems.

Chromic Acid Analysis

Apparatus:
- 2ml Volumetric Pipette
- 10ml Volumetric Pipette
- 100ml Volumetric Flask
- 250ml Erlenmeyer Flask

Reagents:
- 40% (w/v) Ammonium Bifluoride, Purified
- Concentrated Hydrochloric Acid, ACS
- 10% (w/v) Potassium Iodide, ACS
- 0.1N Sodium Thiosulphate
- 2% (w/v) Starch Indicator (Soluble), ACS

Procedure:
1. Pipette a 2ml sample of chrome solution into a 100ml volumetric flask, dilute to mark with D.I. water and mix well.
2. Pipette 10ml aliquot into a 250ml Erlenmeyer flask, add ~80ml D.I. water, 5ml of 40% Ammonium Bifluoride, 10ml concentrated Hydrochloric Acid and 10ml 10% Potassium Iodide.
3. Allow the solution to cool to room temperature.
4. Titrate the solution with 0.1N Sodium Thiosulphate to a light yellow colour.
5. Add 1ml of 2% Starch Indicator.
6. Continue to titrate until a clear green endpoint and record volume as “V”.

Calculation:
V x N (normality of Sodium Thiosulphate) x 166.5 = CrO_3 in g/L
V x N x 22.2 = CrO_3 in oz/gal

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Sulphate Analysis

Apparatus: 20ml Volumetric Pipette
5ml Volumetric Pipette
Kocour Centrifuge
Kocour Centrifuge Tubes

Reagents: 20% (v/v) Hydrochloric Acid, ACS
20% (w/v) Barium Chloride, ACS

Procedure:

1. Pipette a 20ml sample of chrome solution into the Kocour centrifuge tube, Tube #1.

   Note: Withdraw the sample without disturbing any sediment. Withdrawal of unequal amounts of sediment in each centrifuge tube will produce erroneous results.

2. Pipette 5ml of 20% Hydrochloric Acid to Tube #1, stopper and shake vigorously for one minute.
3. Insert Tube #1 in the centrifuge.
4. Insert a centrifuge tube filled with 20ml water, Tube #2, and place it into opposite sides of the centrifuge for balancing purposes.
5. Centrifuge at 1000 RPM for 10 minutes, read and record the content in Tube #1 as "A".
6. Pipette 5ml of 20% Barium Chloride to Tube #1, stopper and shake vigorously for one minute.
7. Centrifuge at 1000 RPM for 15 minutes and allow to stand for 10 minutes.
8. Remove Tube #1 and tap the stem with the nail of the forefinger until the precipitate at the bottom of the tube has a flat surface.
9. Centrifuge at 1000 RPM for 5 minutes, read and record the content in Tube #1 as "B".
10. Repeat Step 8 to 9 until the readings are consistent.

Calculation: ("B" – "A") x 0.1 x tube correction factor = SO_4 in oz/gal
SO_4 oz/gal x 7.5 = SO_4 in g/L

Sulphate and Catalyst Analysis using Ion Chromatography

Accurate measurement and control of Sulphate and Catalyst concentrations are critical to the operation of chrome plating baths. Ion Chromatography can measure these two parameters to a parts per billion (ppb) level of detection. Aqua Bond provides independent analytical lab services for chrome plating baths including IC testing. Follow this QR Code to see a video of our laboratory and IC unit:

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Table 1: Conversion of excess sulfate to barium carbonate required

excess sulfate to be removed (g/L)	bath volume (L)									
	379	757	1136	1514	1893	2271	2650	3028	3407	3785
	barium carbonate required (g)									
0.075	62	125	187	249	312	374	437	499	561	624
0.150	125	249	374	499	624	748	873	998	1123	1247
0.225	187	374	561	748	936	1123	1310	1497	1684	1871
0.300	249	499	748	998	1247	1497	1746	1996	2245	2495
0.375	312	624	936	1247	1559	1871	2183	2495	2807	3118
0.450	374	748	1123	1497	1871	2245	2619	2294	3368	3742
0.525	437	873	1310	1746	2183	2619	3056	3493	3929	4366
0.600	499	998	1497	1996	2495	2294	3493	3992	4491	4990
0.675	561	1123	1684	2245	2807	3368	3929	4491	5052	5613
0.750	624	1247	1871	2495	3118	3742	4366	4990	5613	6237

Table 2: Conversion of sulfate requirement to sulfuric acid equivalent

sulfate to be added (g/L)	bath volume (L)									
	379	757	1136	1514	1893	2271	2650	3028	3407	3785
	66º Be sulfuric acid required (ml)									
0.075	15	30	47	62	77	92	109	124	139	154
0.150	30	62	92	124	154	186	216	248	278	308
0.225	47	92	139	186	231	284	322	370	417	464
0.300	62	124	186	248	308	370	432	494	556	618
0.375	77	154	231	308	384	488	538	618	695	769
0.450	92	186	284	370	464	556	648	739	834	926
0.525	109	216	322	432	538	648	757	864	973	1079
0.600	124	248	370	494	618	739	864	988	1112	1236
0.675	139	278	417	556	695	834	973	1112	1251	1390
0.750	154	308	464	618	772	926	1079	1236	1390	1544

The data and statements contained in this bulletin are based on testing information and are believed to be accurate and reliable. This bulletin is not a Guarantee or Warranty, express or implied regarding the products use. The product is sold on the condition that the purchaser will do their own tests to determine the suitability of the product in a particular application.

READ THE SDS BEFORE USING THIS PRODUCT

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