

HE CHROME

HARD CHROMIUM PLATING SOLUTION

INTRODUCTION

HE Chrome is a high speed etch free hard chromium plating process. HE Chrome Catalyst is supplied as a liquid which is added to chromic acid solution.

BENEFITS

- Fluoride free catalyst
- Excellent throwing power
- High cathode efficiency
- Microcracked crack pattern
- Reduces build up on sharp corners

SOLUTION MAKE-UP

HE Chrome Catalyst is used in plating solutions of chromic acid as follows:

Chromic acid	275g/L
HE Chrome catalyst	40ml/L
Sulphuric acid	3g/L
Spray suppressant	2-3ml/L

OPERATING DATA

Chromic acid	270-285g/L
Sulphuric acid	1.1-1.2% w/w of chromic acid
Current density	30-60 ASD (See NOTES)
Plating rate @ 40 ASD	0.8µm/min
Plating rate @ 50 ASD	1.0µm/min
Temperature	55 - 60°C
Time	As required
Density	Bé 23-24
Voltage	6-12 volts

EQUIPMENT

Tanks	Steel, lined with PVC or polypropylene.
Heaters	PTFE, lead alloy or tantalum immersion with thermostatic control.
Extraction	Mandatory, in conjunction with Spray Suppressant
Agitation	Solution agitation is necessary to ensure uniform temperature and avoid layering. It is also useful for mixing the solution after additions, topping up with water etc.
Rectifier	12 - 15 volt units with maximum 5% ripple.
Anodes	4-7% tin/lead

INSTALLATION

It is essential that the tanks to be used for HE Chrome are thoroughly cleaned and leached before any product is introduced. For new tanks or linings extended warm leaching is required.

If in any doubt as to the cleaning procedure please contact PMD (UK) Ltd technical department.

1. Remove anodes and ancillary equipment (coils, thermostats, etc) to allow thorough cleaning of tank by scrubbing walls and bottom.
2. Rinse thoroughly with water.
3. Fill the tank to approximately 70% of required final volume with water and heat to approximately 50°C.
4. Add the calculated quantity of chromic acid and stir to dissolve.
5. Add the HE Chrome Catalyst and mix thoroughly.
6. Analyse for sulphate and add sulphuric acid accordingly.
7. Add Spray Suppressant.
8. Replace anodes and electrolyse using dummy cathodes at 6-12 volts for 3-4 hours at required plating temperature.

MAINTENANCE AND CONTROL

The chromic acid concentration can be estimated from the specific gravity of the solution, using table one below. For every kilogram of chromic acid added, 33ml of HE Chrome Catalyst should be added.

The specific gravities shown in the table are for new solutions. As contaminants build up in the solution the S.G will not be a true measure of the chromic acid concentration and periodic chemical analysis is recommended.

Regular analysis for sulphuric acid is recommended and a ratio of 1.1-1.2% w/w to chromic acid content should be maintained. To reduce sulphate, add barium carbonate as per table 2.

Periodic analysis of HE Chrome Catalyst will be carried out by PMD Technical Department.

Table 1

<u>SPECIFIC GRAVITY OF CHROMIC ACID SOLUTION</u>		
<u>Chromic acid g/L</u>	<u>S.G.</u>	<u>Degrees Bé</u>
250	1.175	21.60
260	1.182	22.30
270	1.190	23.15
280	1.196	23.80
290	1.202	24.20
310	1.215	25.66

(Measured at 16°C)

Anodes

It may be necessary to remove insulating scale from some anodes. This can be done by scrubbing while wet. If the solution is left idle for an extended period (over shut-down etc) the anodes should be removed and left suspended in air. When plating begins again they should be electrolysed to re-form the brown film.

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Table 2

BARIUM CARBONATE ADDITIONS TO REDUCE SULPHATE LEVEL

<u>g/L sulphate to be removed</u>	<u>gm. barium carbonate required</u>			
	<u>250L</u>	<u>500L</u>	<u>750L</u>	<u>1000L</u>
0.1	50	100	150	200
0.2	100	200	300	400
0.3	150	300	450	600
0.4	200	400	600	800
0.5	250	500	750	1000

ANALYSIS METHODS

1. Hexavalent Chromium

Reagents

50% v/v sulphuric acid

0.1N ferrous ammonium sulphate

0.1N potassium permanganate (standard volumetric solution)

Method

1. Pipette 40ml of 0.1N ferrous ammonium sulphate into a 250ml conical flask.
2. Add 50ml DI water and 10ml 50% sulphuric acid.
3. Titrate with 0.1N potassium permanganate to pink end point.
4. Record titre = A mls.
5. Pipette a 10ml aliquot of the plating solution into a 500ml volumetric flask and make up to the mark with DI water.
6. Mix thoroughly.
7. Pipette 10ml of this dilution into a 250ml conical flask.
8. Add 50ml DI water and 10ml 50% sulphuric acid.
9. Pipette 40ml 0.1N ferrous ammonium sulphate into the flask.
10. Titrate with 0.1N potassium permanganate to a pink end point.
11. Record titre = B mls.

Calculation

$(A - B) 16.64 = \text{g/L chromic acid}$

Replenishment

For every 1g/L required add 1g/L chromic acid and 0.033ml/L HE Chrome Catalyst.

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2. Sulphuric acid (sulphate)

Reagents

Conc. hydrochloric acid
Hydrogen peroxide solution
30% barium chloride solution
5% v/v hydrochloric acid

Method

1. Filter a sample of the working solution.
2. Pipette a 10ml aliquot of the filtered solution into a 500ml beaker.
3. Add 20ml DI water and 20ml conc. hydrochloric acid.
4. Add hydrogen peroxide dropwise until no further effervescence is seen and the solution is a blue-green colour.
5. Heat to boiling and add 2ml of 30% barium chloride solution.
6. Continue boiling for 2 mins.
7. Add 200mls boiling DI water and continue boiling for 2 hours.
8. Allow to stand overnight.
9. Filter into a Whatman 542 filter paper.
10. Bobby out the beaker and rinse into filter with hot DI water.
11. Rinse beaker into filter paper with hot 5% hydrochloric acid.
12. Rinse filter with hot DI water until paper is clean.
13. Weigh a dried crucible and record weight as 'A' gms.
14. Transfer paper to the crucible and burn off in furnace for 1 hour at 800°C.
15. Ensure no carbon residues remain in the crucible.
16. Transfer crucible to a dessicator and allow to cool.
17. Weigh the crucible and record weight as 'B' gms.

Calculation

$(B-A) \times 42.02 = \text{g/L sulphuric acid (sulphate)}$.

Replenishment

For every 1g/L low add 0.54ml/L sulphuric acid.

DISPOSAL

Dispose of in accordance with local authority requirements.

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PRODUCT FAMILIES

The following products are referred to in this data sheet.

Product Name

Product Number

HE Chrome Catalyst (25L)	417004
HE Chrome Catalyst (5L)	417003
PMD Spray Suppressant	411001

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