

SurTec® 881 ACL Shield

Trivalent Decorative Chromium Process (Anti Salts Type)

Properties

- environmentally friendly, hexavalent chromium free plating process
- high corrosion protection for not only CASS but also anti-calcium chloride property
- trivalent chromium plating finish with very attractive white colour
- high plating efficiency (0.3-0.7 µm per 5 minutes)
- very easy and stable to plate with TCP anodes which are specially designed for trivalent chromium plating solutions

Application

The process SurTec 881 ACL Shield includes the following products:

- SurTec 881 ACL Conductivity Salts
- SurTec 881 ACL Chromium Solution
- SurTec 881 ACL Maintenance Additive
- SurTec 881 ACL Make Up Solution
- SurTec 880 Wetter W Wetting Agent

make-up values:

SurTec 881 ACL Conductivity Salts	280 g/l	(260-300 g/l)
SurTec 881 ACL Chromium Solution	150 ml/l	
SurTec 881 ACL Make Up Solution	20 ml/l	(16-24 ml/l)
SurTec 880 Wetter W	1 ml/l	

analytical values:

chromium (III)	10 g/l	(8-12 g/l)
SurTec 881 ACL Conductivity Salts	280 g/l	(260-300 g/l)
SurTec 881 ACL Make Up Solution	20 ml/l	(16-24 ml/l)

make-up:

Steps for make-up:

1. Fill approx. 50 % of the clean water into the tank.
2. Heat up to 50-60°C.
3. Add the desired amount of SurTec 881 ACL Conductivity Salts under vigorous agitation. (It is very important to resolve the salts completely before the next step!)
4. Add the required volume of SurTec 881 ACL Chromium Solution.
5. Fill up to the final volume with water.
6. Mix thoroughly and heat up to working temperature.
7. Gradually adjust the pH-value (very slowly!) to pH 3.5 by using 25 % sodium hydroxide solution under vigorous agitation.
8. Leave the solution at this temperature for at least 12 hours.

9. Add the required volume of SurTec 881 ACL Make Up Solution and SurTec 880 Wetter W under vigorous agitation.
10. Install the anode system.
11. Replenish evaporation losses with deionised water.
12. Adjust the pH-value to pH 3.5.
Electrolyse with freshly nickel-plated steel cathodes at min. 1 Ah/l, preferably at 3-4 Ah/l, before production. Control the pH during this initial working and correct it by using 25 % sodium hydroxide solution. The pH will stabilize after a few days. (Caution: Freshly nickel-plated steel cathodes should be exchanged every 30 minutes of electrolysis.)

temperature:	55°C	(50-60°C)
pH-value:	3.5	(3.3-3.7)
	adjust with sodium hydroxide solution (25 %) or with sulfuric acid (10 %)	
	A local high pH condition is harmful; therefore make all additions very slowly under vigorous agitation. Never allow the pH to rise above pH 4.0 to avoid a loss of efficiency.	
plating time:	5 min	(3-8 min)
current density:	7 A/dm ²	(5-10 A/dm ²)
cell voltage:	6-15 V	
anodes:	specially designed TCP anodes (T ri v alent C hromium P lating), otherwise the plating solution will be broken by electrolysing	
	Handle the anodes with care to prevent any chipping or cracking of the coating (anode current density < 7 A/dm ²).	
agitation:	mild air agitation (with twin-row PVC or ABS air agitation pipes) or gentle solution movement, is necessary	
	Rack movement is highly recommended, especially for large tanks containing more than 800 litre of plating solution.	
tank material:	tanks lined with PVC or PP	
	Clean new plastic-lined tanks and pipe work thoroughly by filling with diluted sulfuric acid solution before use.	
filtration:	recommended: regular filtration; carbon filtration is necessary, to remove organic contaminations	
heating:	required: titanium coils or titanium-clad or silica cased electric immersion heater (thermostatic control is essential)	
exhaust:	required for worker's protection: local exhaust ventilation is essential, good general ventilation is recommended	
hint:	After a prolonged shut-down period, heat SurTec 881 ACL Shield solution up to working temperature for 2-3 days prior to re-start to ensure that any precipitates will be re-dissolved. Analyse the composition of the solution and the pH-value and adjust, if necessary. Then electrolyze (at normal current density) for 30 min to 1 h using freshly nickel-plated cathodes before re-start the production.	

recommended process sequence:

1. Bright Nickel Process, e.g. SurTec 855
2. rinse
3. Decorative Chromium Process SurTec 881 ACL Shield
4. rinse
5. passivation

SurTec 881 ACL Shield does not passivate the plated chromium surface as hexavalent chromium solution does. Subsequent passivation such as SurTec PD05/08 or electrolytic hexavalent chrome may be considered in some cases.

6. rinse
7. hot water rinse
8. drying

Between each step, there has to be rinsed. The rinsing methods have to be adapted to the plating line.

After the Bright Nickel Process prior to the Decorative Chromium Process SurTec 881 ACL Shield an efficient rinsing is important.

Technical Specification

(at 20°C, conc.)	Appearance	Density (g/ml)	pH-value
SurTec 881 ACL Conductivity Salts	powder, white	1.20 (1.0-1.7) (kg/l)	4-7 (1%)
SurTec 881 ACL Chromium Solution	liquid, dark purple	1.283 (1.25-1.35)	< 2
SurTec 881 ACL Maintenance Additive	liquid, colourless	1.107 (1.05-1.18)	3-5
SurTec 881 ACL Make Up Solution	liquid, colourless	1.140 (1.10-1.19)	7-9
SurTec 880 Wetter W	liquid, colourless	1.007 (0.95-1.05)	3-5

Maintenance and Analysis

Check the pH-value regularly. Analyse the concentration of SurTec 881 ACL Conductivity Salts, SurTec 881 ACL Chromium Solution and SurTec 881 ACL Make Up Solution regularly and adjust it to the standard range.

For optimum performance of the process, an auto-dosing system of SurTec 881 ACL Chromium Solution and SurTec 881 ACL Maintenance Additive according to Ampere-hours is strongly recommended. Do not pre-mix the additives before adding to the plating solution.

During normal plating operation the surface tension of the solution will increase. When the surface tension rises above 40 mN/m, an addition of 0.5 to 1.0 ml/l SurTec 880 Wetter W is required.

Although SurTec 881 ACL Shield solution is tolerant to impurities, a good rinsing is essential after the Bright Nickel Process prior to the Decorative Chromium Process SurTec 881 ACL Shield, especially when tubular or difficult to drain components are being processed. Inefficient rinsing will result in nickel contaminations that may produce a loss of efficiency. This contamination can be removed by plating out or by temporary addition of purifier solution and subsequent filtration of the solution.

Sample Preparation

Take a sample at a homogeneously mixed position. Keep the samples warm for analysis (in order to avoid result disturbing precipitations).

Chromium(III) – Analysis by Titration

reagents: sodium hydroxide solution (NaOH solution, 10 %)
H₂O₂ (> 30 %)
hydrochloric acid (1:1) p.a.
potassium iodide
0.1 N sodium thiosulfate solution (= 0.1 mol/l)
starch solution (1 %)

procedure: Repeat determination:

1. Pipette 2 ml bath sample into a 250 ml beaker.
2. Add 20 ml NaOH solution and let react for a short time.
3. Dilute with deionised water up to approx. 100 ml.
4. Add 5 ml H₂O₂ to the cold solution, cover it with a watch glass and let it react for 5 min, without stirring.
5. Add another 5 ml H₂O₂.
6. Now stir the solution and heat it up, boil it for exactly 20 min.
(Avoid to concentrate the sample below 50 ml!)
7. After cooling down to room temperature, wash down the drops from the watch glass and the beaker walls, using small amounts of deionised water.
8. Dilute with deionised water to approx. 100 ml.
9. Acidify the sample with 40 ml hydrochloric acid.
10. Add approx. 2 g potassium iodide
(colour changes to dark red-brown).
11. Titrate quickly with 0.1 mol/l sodium thiosulfate solution up to a weak yellow colour of the solution.
12. Add some drops of starch solution
(colour changes to blue/violet).
13. Continue titrating until the colour disappears.

calculation: consumption in ml · 0.865 = g/l chromium(III)

correction: rise by 1 g/l Chromium = addition of 15 ml/l SurTec 881 ACL Chromium Solution

SurTec 881 ACL Conductivity Salts – Analysis by Titration

- reagents: 0.1 N NaOH solution
EDTA sodium salt
mannitol
NaOH solution (15 %)
- procedure:
1. Take the bath sample out of the warm and well-mixed bath solution and keep it warm for analysis (in order to avoid a precipitation of boric acid which pretends lower values).
 2. Pipette 10 ml of the warm (55°C) bath sample into a 100 ml volumetric flask.
 3. Fill up with deionised water and shake well.
 4. From this dilution pipette 5 ml in a 250 ml Erlenmeyer flask.
 5. Dilute with approx. 50 ml deionised water.
 6. Add 2-4 g EDTA sodium salt.
 7. Adjust the pH-value to pH 7.90 with 15 % NaOH solution.
 8. Add so much mannitol to the **clear** solution, until the pH is not changing more than 0.1 points (approx. 10 g).
 9. Titrate with 0.1 N NaOH solution to pH 7.90 again.
- calculation: consumption in ml · 38.45 = g/l SurTec 881 ACL Conductivity Salts

SurTec 881 ACL Make Up Solution – Analysis by Titration

- reagents: ethyl acetate p.a.
methanol p.a.
hydrochloric acid (conc.)
0.1 N NaOH solution
indicator: bromocresol purple
- procedure:
1. Pipette 50 ml bath sample into a 10 ml analytical flask.
 2. Fill up with deionised water.
 3. Pipette 50 ml from this dilution into a separating funnel.
 4. Acidify with 2 ml hydrochloric acid and shake for 15 s.
 5. Add 50 ml ethyl acetate and mix intensely for 2 minutes.
 6. After 15 minutes (time is to keep exactly) both phases are segregated and the lower phase can be discarded.
 7. Pour the upper organic phase into 250 ml beaker, without rinsing the separating funnel.
 8. Add 50 ml methanol.
 9. Add some indicator.
 10. Titrate with 0.1 N NaOH solution from yellow to blue-violet.
- calculation: consumption in ml · 3.168 = ml/l SurTec 881 ACL Make Up Solution

Hull Cell Test

Perform all tests in a standard 250 ml Hull cell. Nickel-plate a well-prepared brass panel with SurTec 855 or SurTec 857 and insert the panel into the Hull Cell, leave it there for 10-15 s without current. Then electroplate it with SurTec 881 ACL Shield at 4 A for 5 min at 55°C without agitation. Use the specially designed TCP anode also in the Hull cell.

Rinse the panel with water and dry it with hot or compressed air. An ideal panel has a distribution of 75-80 %.

Test all additions in the Hull cell first before adding to the bath.

Ingredients

SurTec 881 ACL Conductivity Salts

- boric acid

Consumption

The consumption depends heavily on the drag-out. To determine the exact amounts of drag-out, see [SurTec Technical Letter 11](#).

The following values per 10,000 Ah can be taken as estimated average consumption:

SurTec 881 ACL Chromium Solution	10-15 l
SurTec 881 ACL Maintenance Additive	10-15 l

However, small volumes of frequent replenishments (ex. 100-150 ml/100 Ah) are strongly recommended to ensure constant plating properties.

Product Safety and Ecology

The safety instructions and the instructions for environmental protection have to be followed in order to avoid hazards for people and environment. The Material Safety Data Sheets (according to European legislation) contain explicit details for this.

The following hazard designations and classifications into water hazard classes (WHC) have to be taken into account:

<u>product</u>	<u>hazard designation</u>	<u>water hazard class</u>
SurTec 881 ACL Conductivity Salts	T - Toxic	WHC 1
SurTec 881 ACL Chromium Solution	C - Corrosive	WHC 1
SurTec 881 ACL Maintenance Additive	Xn - Harmful	WHC 1
SurTec 881 ACL Make Up Solution	-	WHC 1
SurTec 880 Wetter W	-	WHC 1

Warranty

We are responsible for our products in the context of the valid legal regulations. The warranty exclusively accesses for the delivered state of a product. Warranties and claims for damages after the subsequent treatment of our products do not exist. For details please consider our [general terms and conditions](#).

Further Information and Contact

In our forum, you can discuss topics of the surface technology:

<http://forum.SurTec.com/>

If you have any questions concerning the process, please contact your local technical department: <http://SurTec.com/International.html>