

SurTec® 855

High Performance Bright Nickel Process

Properties

- produces most active layers which are excellent suitable for chromium plating
- the precipitated coatings are bright and ductile, and can be levelled well, if required
- the process is easy to handle
- no development of harmful or disturbing reduction products in the bath
- IMDS-number: 749088

Application

The process SurTec 855 includes the following products:

- SurTec 850 I Nickel Carrier is the basis of the additive system
- SurTec 855 II Brightener gives brightness and levelling to the deposit
- SurTec 855 III Leveller is used if better levelling is required
- SurTec 850 W Nickel Wetter is used especially for mechanical agitated baths
- SurTec 850 L Nickel Wetter is used especially for air agitated baths
- SurTec 850 LCD Nickel Purifier corrects impurities of zinc and copper

make-up values:

nickel sulfate · 6 H ₂ O	240 g/l	
nickel chloride · 6 H ₂ O	70 g/l	
boric acid	45 g/l	
SurTec 850 I Carrier	15 ml/l	
SurTec 855 II Brightener	1 ml/l	(0.5-1.0 ml/l)
SurTec 855 III Leveller	if required	(0.1-0.5 ml/l)
<i>for mechanical agitation:</i> SurTec 850 W	8 ml/l	(5-10 ml/l)
<i>for air agitation:</i> SurTec 850 L	2 ml/l	(2-3 ml/l)
SurTec 850 LCD Purifier	only if required	(max. 2 ml/l)

analytical values:	nickel (Ni ²⁺)	70 g/l	(60-75 g/l)
	chloride (Cl ⁻)	20 g/l	(15-25 g/l)
	boric acid	45 g/l	(40-45 g/l)

make-up: Steps for make-up:

1. In a separate tank dissolve boric acid and the two nickel salts in very hot deionised (DI-) water (at least 60°C), stirring well.
2. Add 5 g/l active carbon and stir for two hours.
3. Let the active carbon settle and filter the electrolyte into the clean active tank.
4. Fill up to the final volume with DI-water.
5. Dummy plate for four hours at 0.4 A/dm².
6. Check the ductility on a test panel. If the panel is not ductile enough, continue dummy plating.
7. If the test panel is ductile enough, add the additives and fill up completely to the final volume.
8. Start the filtration to avoid rough deposits.

temperature:	55 °C	(50-60 °C)
pH-value:	4.2	(3.8-4.6)
	adjust with sulfuric acid or increase by plating	
cathodic		
current density:	4 A/dm ²	(1-6 A/dm ²)
anodic		
current density:	1.5 A/dm ²	(0.5-2.5 A/dm ²)
current efficiency:	98 %	
plating speed:	0.8 µm/min at 4 A/dm ²	
ratio		
anode : cathode:	2:1	
anodes:	pure nickel anodes according to DIN 1702 with anode bags of PP	
agitation:	mechanical movement with 3-6 m/min or oil-free slight air agitation	
tank material:	made of PP or steel tank coated with heat resistant plastic	
filtration:	continuously at 1-5 x the bath volume per hour	
heating:	required; thermostatic heater made of resistant material (e.g. porcelain, glass, Teflon)	
exhaust:	recommended for worker's protection	
hint:	With high dissolving of copper or zinc, SurTec 850 LCD Purifier can be mixed with SurTec 855 II Brightener at a ratio of 1:1 and then be added automatically with 2 ml/l.	

recommended process sequence (for iron parts):

1. hot degreasing
 - emulsifying:* SurTec 188 + SurTec 415
 - demulsifying:* SurTec 188 + SurTec 089
2. hydrochloric acid pickling with SurTec 424
3. anodic electrolytic cleaning with SurTec 188
4. acid dip with SurTec 481
5. if required: Semi Bright Nickel Process SurTec 854
6. Bright Nickel Process SurTec 855
7. No rinsing with DI-water if chromium plating follows!
8. Decorative Chromium Process SurTec 871
9. drying

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

Technical Specification

(at 20 °C)	Appearance	Density (g/ml)	pH-value (conc.)
SurTec 850 I	liquid, colourless	1.152 (1.13-1.17)	4.1 (3-5)
SurTec 855 II	liquid, yellowish	1.063 (1.05-1.08)	3.7 (2-5)
SurTec 855 III	liquid, orange-yellowish	1.070 (1.06-1.08)	4.0 (3-5)
SurTec 850 W	liquid, colourless	1.003 (0.97-1.03)	4.2 (3-5)
SurTec 850 L	liquid, yellowish	1.003 (0.99-1.02)	4.2 (3-5)
SurTec 850 LCD	liquid, colourless-yellowish	1.008 (1.00-1.01)	4.5 (3-6)

Maintenance and Analysis

Compensate evaporation losses by deionised or distilled water.

The analytical values have to be restrained: Too low concentrations of nickel or boric acid lead to burnings, too high concentration of boric acid leads to pitting. Too low concentration of chloride decreases the anodic dissolution. Too low pH-value decreases the levelling power and the brightening, too high pH-value leads to burnings.

Sample Preparation

Take a sample at a homogeneously mixed position. Let it cool down to room temperature. If the sample is turbid, let the turbidity settle down and decant or filtrate by using a fluted filter.

Nickel – Analysis by Titration

- reagents: 0.1 mol/l EDTA (Titrplex III)
ammonia solution (conc.)
indicator: murexide
- procedure: 1. Pipette 1 ml bath sample into a 250 ml Erlenmeyer flask.
2. Dilute with approx. 100 ml deionised water.
3. Add 12 ml ammonia solution.
4. Add a spatula tip of indicator.
5. Titrate with 0.1 mol/l EDTA from yellow to violet.
- calculation: consumption in ml · 5.87 = g/l nickel
- correction: rise by 1 g/l = addition of 4.5 g/l nickel sulfate · 6 H₂O
or: 4.1 g/l nickel chloride · 6 H₂O

Chloride – Analysis by Titration

- reagents: 0.1 N silver nitrate solution
indicator: potassium chromate solution (5 %)
or: 5 g K₂Cr₂O₇ + 95 g NaHCO₃
- procedure: 1. Pipette 1 ml bath sample into a 250 ml Erlenmeyer flask.
2. Dilute with approx. 100 ml deionised water.
3. Add some indicator (pH-value has to be between 6.5 and 10.5).
4. Titrate with 0.1 N silver nitrate solution from yellow to brown.
- calculation: consumption in ml · 3.54 = g/l chloride
- correction: rise by 1 g/l = addition of 3.0 ml/l HCl (30 %)
or: 3.4 g/l nickel chloride · 6 H₂O

Boric Acid – Analysis by Titration

- reagents: 0.1 N NaOH solution
EDTA sodium salt
mannitol
NaOH solution (15 %)
- procedure: 1. Pipette 2 ml bath sample into a 250 ml Erlenmeyer flask.
2. Dilute with approx. 50 ml deionised water.
3. Add 2-4 g EDTA salt.
4. Adjust the pH-value to pH 7.9 with 15 % NaOH solution.
5. Add so much mannitol to the **clear** solution, until the pH is not changing more than 0.1 points (approx. 10 g).
6. Titrate with 0.1 N NaOH solution to pH 7.9 again.
- calculation: consumption in ml · 3.09 = g/l boric acid

Consumption and Stock Keeping

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 850 I	0.5-1.0 l
SurTec 855 II	3.5-4.0 l
SurTec 855 III	up to 0.5 l
SurTec 850 W resp. SurTec 850 L	approx. 0.5 l
SurTec 850 LCD	according to impurity

In order to prevent delays in the production process, per 1,000 l bath the following amounts should be kept in stock:

SurTec 850 I	60 kg
SurTec 855 II	60 kg
SurTec 855 III	30 kg
SurTec 850 W resp. SurTec 850 L	30 kg
SurTec 850 LCD	30 kg

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 850 I	-	WHC 1
SurTec 855 II	Xn - Harmful	WHC 2
SurTec 855 III	Xn - Harmful	WHC 2
SurTec 850 W	-	WHC 1
SurTec 850 L	Xn - Harmful	WHC 1
SurTec 850 LCD	-	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>

Trouble Shooting

problem	possible cause	remedy
burnings	a) current density is too high	lower the current density
	b) agitation is insufficient	improve the agitation
	c) Carrier content is too low	increase the Carrier content
	d) metal content is too low	add nickel sulfate
	e) content of boric acid is too low	add boric acid
cloudy or hazy depositions	a) pretreatment is insufficient	check pretreatment, improve rinsing procedure
	b) bath temperature is too high	lower the temperature
	c) metal content is too high	reduce the anode surface, work out excessive nickel
	d) Carrier content is too high	work out
	e) current density is too low	amplify the current density
	f) content of Brightener is too low	add Brightener
	g) improper agitation	adjust speed and/or type of agitation
insufficient throwing power	a) metal content is too high	reduce the anode surface, work out excessive nickel
	b) too much additives	work out at pH 3.8
	c) organic impurities	treat with active carbon
turbid bath solution	a) bath temperature is too high	lower the temperature
	b) filtration is insufficient	improve the filtration
	c) content of boric acid is too high	filtrate the bath solution at 25°C
	d) iron impurities	treat with peroxide at high pH
	e) calcium impurities	add potassium fluoride to precipitate calcium
pitting	a) agitation is insufficient	improve the agitation
	b) metal content is too low	add nickel sulfate
	c) current density is too high	lower the current density
	d) content of wetting agent is too low	add wetting agent
	e) calcium impurities	add potassium fluoride to precipitate calcium
insufficient layer thickness	a) metal content is too low	add nickel sulfate
	b) current density is too low	amplify the current density
	c) defective contacts	check the contacts and clean them
	d) anode surface is too small	enlarge the anode surface
	e) too much Brightener	work out at pH 3.8
	f) plating time is too short	extend the plating time
double nickel	a) too much Brightener	work out at pH 3.8
	b) pH-value is too high	adjust with sulfuric acid
	c) defective contacts	check the contacts and clean them
yellowish Ni layer	a) iron impurities	treat with peroxide at high pH
	b) iron inside spare rinse	Refill the spare rinse freshly regularly
hazy in the lcd	content of Brightener is too low	add Brightener
hazy in the hcd	a) content of Carrier is too low	add Carrier
	b) organic impurities	treat with active carbon

problem	possible cause	remedy
rough depositions	a) contamination with anode sludge	check anode bags, filtrate the bath solution
	b) iron impurities	treat with peroxide at high pH
	c) pretreatment is insufficient	improve the pretreatment
brittle Ni layer	a) content of Brightener is too high	work out at pH 3.8
	b) organic impurities	treat with active carbon
dark in the lcd	a) zinc impurities	plate selectively in the lcd or add SurTec 850 LCD
	b) copper impurities	plate selectively in the lcd or add SurTec 850 LCD