

# SurTec® 857

## High Performance Bright Nickel Process

### Properties

- very reliable and proved process of outstanding quality
- produces brilliant, ductile, and - if necessary - highly levelled nickel coatings
- properties can be adjusted by adding Brightener and/or Leveller
- coatings are very active and easy to chromium plate
- no formation of interfering degradation products in the bath
- the brightener system keeps its good ductility properties even after years
- IMDS-number: 749088

### Application

The process SurTec 857 includes the following products:

- SurTec 857 I Nickel Carrier is the basis of the additive system
- SurTec 857 II Nickel Brightener brings brightness and levelling to the deposit
- SurTec 857 III Nickel Leveller is used if better levelling is required
- SurTec 850 W Nickel Wetter is a foam producing agent for rack agitated baths
- SurTec 850 L Nickel Wetter is used for air agitated baths and for barrel application
- SurTec 850 LCD Nickel Purifier corrects impurities of zinc and copper

make-up values:

|   |                  |               |
|---|------------------|---------------|
| nickel sulfate · 6 H <sub>2</sub> O           | 240 g/l          |               |
| nickel chloride · 6 H <sub>2</sub> O          | 70 g/l           |               |
| boric acid                                    | 45 g/l           |               |
| SurTec 857 I Nickel Carrier                   | 15 ml/l          |               |
| SurTec 857 II Nickel Brightener               | 1 ml/l           | (0.5-1 ml/l)  |
| SurTec 857 III Nickel Leveller                | 1 ml/l           | (0.5-2 ml/l)  |
| Nickel Wetter:                                |                  |               |
| <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 <sup>2+</sup> )                    | 70 g/l           | (60-75 g/l)   |
| chloride (Cl <sup>-</sup> )                   | 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 (at least 60°C) deionised (DI-) water of about 1/3 of the final volume, stirring well.
2. Add 5 g/l active carbon and stir again for about 2 hours.
3. Let the active carbon settle down and filter the electrolyte into the clean active tank.
4. Fill up to the final volume with deionised water.
5. Dummy plate for about 4 hours at 0.4 A/dm<sup>2</sup>.
6. Check the ductility on a test panel by plating a test panel at 4 A/dm<sup>2</sup> for 15 minutes.
7. If the test panel is ductile enough, add the additives. If not, continue dummy plating.

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<sup>2</sup> (1-6 A/dm<sup>2</sup>)  
 anodic  
 current density: 1.5 A/dm<sup>2</sup> (0.5-2.5 A/dm<sup>2</sup>)  
 current efficiency: 98 %  
 deposition rate: 0.8 µm/min at 4 A/dm<sup>2</sup>  
 ratio  
 anode : cathode: 2:1  
 anodes: pure nickel anodes according DIN 1702 with anode bag  
 or diaphragm frame of precleaned PP  
 agitation: mechanical movement with 3-6 m/min  
 or barrel rotation with 6-12 rpm  
 or air agitation (oil free!)  
 tank material: polypropylene (PP) or steel tank coated with heat resistant plastic  
 filtration: continuously; 1-5 times the total bath volume per hour  
 heating: thermostatic heating out of porcelain, glass or Teflon  
 exhaust: recommended for worker's protection  
 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 857**
7. No rinsing with DI-water if chromium plating follows!
8. Decorative Chromium Process  
     *trivalent:* SurTec 876  
     *hexavalent:* 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 857 I   | liquid, colourless-pale yellow | 1.080 (1.07-1.09) | approx. 4.2      |
| SurTec 857 II  | liquid, yellowish              | 1.012 (1.00-1.03) | approx. 4.5      |
| SurTec 857 III | liquid, colourless-yellowish   | 1.039 (1.03-1.05) | approx. 3.5      |
| SurTec 850 W   | liquid, colourless             | 1.003 (0.97-1.03) | approx. 4.2      |
| SurTec 850 L   | liquid, yellowish              | 1.003 (0.99-1.02) | approx. 4.2      |
| SurTec 850 LCD | liquid, colourless-yellowish   | 1.008 (1.00-1.01) | 4.5 (3.5-5.5)    |

## Maintenance and Analysis

Compensate evaporation losses with deionised or distilled water.

Check the pH-value regularly. Analyse and adjust the concentration of nickel, chloride and boric acid regularly.

### 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 filter the solution by using a fluted filter.

### Nickel – Analysis by Titration

|              |  |
|--------------|--|
| reagents:    | 0.1 mol/l EDTA solution (Titrplex III)<br>ammonia solution (conc.)<br>indicator: murexide  |
| procedure:   | 1. Pipette 1 ml bath sample into a 250 ml Erlenmeyer flask.<br>2. Dilute with approx. 100 ml deionised water.<br>3. Add 12 ml ammonia solution.<br>4. Add a spatula tip of indicator.<br>5. Titrate with 0.1 M 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 H <sub>2</sub> O<br>or: 4.1 g/l nickel chloride · 6 H <sub>2</sub> O  |

### Chloride – Analysis by Titration

|              |  |
|--------------|--|
| reagents:    | 0.1 N silver nitrate solution<br>indicator: potassium chromate solution (5 %)<br>or: 5 g K <sub>2</sub> Cr <sub>2</sub> O <sub>7</sub> + 95 g NaHCO <sub>3</sub>   |
| procedure:   | 1. Pipette 1 ml bath sample into a 250 ml Erlenmeyer flask.<br>2. Dilute with approx. 100 ml deionised water.<br>3. Add some indicator (pH-value has to be between 6.5 and 10.5).<br>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 %)<br>or: 3.4 g/l nickel chloride · 6 H <sub>2</sub> O  |

### Boric Acid – Analysis by Titration

|              |   |
|--------------|---|
| reagents:    | 0.1 N NaOH solution<br>EDTA sodium salt<br>mannitol<br>NaOH solution (15 %)   |
| procedure:   | 1. Pipette 2 ml bath sample into a 250 ml Erlenmeyer flask.<br>2. Dilute with approx. 50 ml deionised water.<br>3. Add 2-4 g EDTA salt.<br>4. Adjust the pH-value to pH 7.9 with 15 % NaOH solution.<br>5. Add so much mannitol to the <b>clear</b> solution, until the pH is not changing more than 0.1 points (approx. 10 g).<br>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 857 I      | 0.5-1 l                              |
| SurTec 857 II     | 1.5-3 l                              |
| SurTec 857 III    | up to 3 l                            |
| SurTec 850 W or L | approx. 0.5 l                        |
| SurTec 850 LCD    | according to impurities and drag-out |

Once the average consumption of each additive is known, they can be premixed for easier dosage.

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

|                          |       |
|--------------------------|-------|
| SurTec 857 I Carrier     | 25 kg |
| SurTec 857 II Brightener | 50 kg |
| SurTec 857 III Leveller  | 50 kg |
| SurTec 850 W or L Wetter | 25 kg |
| SurTec 850 LCD Purifier  | 25 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 857 I   | -                         | WHC 0                     |
| SurTec 857 II  | Xn - Harmful              | WHC 2                     |
| SurTec 857 III | -                         | WHC 1                     |
| 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) SurTec 857 I Carrier is too low                         | add SurTec 857 I, check in the Hull cell test   |
|                              | 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 the pretreatment;<br>improve the rinsing procedure  |
|                              | b) bath temperature is too high                            | lower the temperature   |
|                              | c) metal content is too high                               | reduce the anode surface;<br>work out excessive nickel  |
|                              | d) SurTec 857 I Carrier is too low                         | add SurTec 857 I, check in the Hull cell test   |
|                              | e) current density is too low                              | rise the current density  |
|                              | f) content of SurTec 857 II Brightener is too low          | add SurTec 857 II Brightener<br>(special additions of max. 0.2 ml/l;<br>an overdosage leads to embrittlement) |
|                              | g) improper agitation                                      | adjust speed and/or type of agitation   |
|                              | h) organic impurity  | active carbon treatment   |
| insufficient throwing power  | a) metal content is too high                               | reduce the anode surface;<br>work out excessive nickel  |
|                              | b) too much additives                                      | work out at pH 3.8  |
|                              | c) organic impurity  | 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 impurity   | treat with peroxide at high pH  |
|                              | e) calcium impurity  | 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 Wetter is too low                            | add Wetter  |
|                              | e) content of boric acid is too high                       | filtrate the bath solution at 25°C  |
|                              | f) calcium impurity  | add potassium fluoride to precipitate calcium   |
| insufficient layer thickness | a) metal content is too low                                | add nickel sulfate; check the chloride content:<br>a lack of chloride reduces the anode solubility            |
|                              | b) current density is too low                              | rise the current density  |
|                              | c) defective contacts                                      | check contacts and clean them   |
|                              | d) anode surface is too small                              | increase the anode surface  |
|                              | e) too much SurTec 857 II Brightener                       | work out at pH 3.8  |
|                              | f) plating time is too short                               | extend the plating time   |
| bad levelling of the layer   | a) pH-value is too low                                     | adjust the pH-value to pH 4.2-4.6   |
|                              | b) loss of SurTec 857 I Carrier or SurTec 857 III Leveller | add SurTec 857 I or SurTec 857 III,<br>check in the Hull cell test  |

| <b>problem</b>         | <b>possible cause</b>                | <b>remedy</b>                                      |
|------------------------|--------------------------------------|--|
| double nickel          | a) too much SurTec 857 II 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 nickel layer | a) iron impurity                     | treat with peroxide at high pH                     |
|                        | b) iron inside spare rinse           | refill spare rinse freshly regularly               |
| rough depositions      | a) contamination with anode sludge   | check the anode bags, filtrate the bath solution   |
|                        | b) iron impurity                     | treat with peroxide at high pH                     |
|                        | c) pretreatment is insufficient      | improve the pretreatment                           |
| brittle nickel layer   | a) too much SurTec 857 II Brightener | work out at pH3.8                                  |
|                        | b) organic impurity                  | treat with active carbon                           |
| dark in the lcd        | a) zinc impurity                     | plate selectively in the lcd or add SurTec 850 LCD |
|                        | b) copper impurity                   | plate selectively in the lcd or add SurTec 850 LCD |