SurTec® 836
Electroless Nickel
Composite PTFE Process

Properties

- produces electroless nickel layers with 18-25 %vol Teflon (= 5-9 % by weight)
- phosphorous content of the layer: 9-11 %
- produces homogenous, self-lubricating abrasion resistant Ni/P/PTFE layers
- stable bath with long service life

Application

The process SurTec 836 includes the following products:

- SurTec 836 I Make-up Reductor contains the reduction additives and the stabilisers for the new bath make-up
- SurTec 836 II Nickel Concentrate for the new bath make-up and correction of the nickel content
- SurTec 836 III Reductor contains the reduction additives in the correct ratio for maintenance (for each 1 part SurTec 836 II, also 1 part SurTec 836 III has to be added)
- SurTec 836 T Teflon Dispersion contains PTFE in a good stabilized dispersion for the new make-up and for maintenance

make-up values:	SurTec 836 I	18 %vol	
	SurTec 836 II	6 %vol	
	SurTec 836 III	only for maintenance	
	SurTec 836 T	8 g/l	
analytical values:	nickel	6 g/l	(5.5-6.4 g/l)
	reductor content	42 g/l	(40-44 g/l)
	SurTec 836 T	5.5-10 g/l	

make-up: Steps for make-up:

1. Fill 50 % of the deionised water into the tank.
2. Add the calculated amount of SurTec 836 I and stir well.
3. Add the calculated amount of SurTec 836 II and stir well.
4. Heat up the bath to 50°C.
5. Shake well the additive SurTec 836 T in its bottle (foam formation!), then weigh out the desired amount of SurTec 836 T and add it to the bath under strong agitation.
6. Stir well for 10 minutes.
7. Fill up to the final volume with deionised water.
8. Check the pH-value (at 50°C) and adjust with sulfuric acid (10 %) or ammonia solution (1:1), if necessary.
9. Heat up to working temperature and check the pH-value.

temperature:	88°C	(85-92°C)
pH-value:	4.7	(4.6-5.0)
	lower with 10 % sulfuric acid or rise with 25 % ammonia solution (1:1)	
	Measure the pH-value at room temperature (for longer service life of the pH meter) or with a freshly calibrated pH meter with temperature compensation, with grinded diaphragm.	
deposition rate:	5-8 μm/h	depending on temperature, pH-value and bath age
work load:	1.5-2.5 dm^2/l	
agitation:	strong electrolyte circulation (e.g. flooding) **prior** to the coating, but **during** coating only continuous slow agitation in order to avoid over-stabilization and to keep the Teflon in dispersion	
tank material:	stainless steel (type 316) with anodic protection, or PP tanks	
filtration:	Do not filtrate the electrolyte to keep constant the PTFE content	
	A good bath control is necessary. If metal swarfs swim on the bath surface, immediately filter the bath through a filter bag into a clean tank and clean the old tank with nitric acid to remove the deposited nickel.	
heating:	Tanks with outside wall heating are recommended. Indirect heating with steam tubes is also possible (for quick cooling, the tubes can be flooded with cold water). By use of immersion heaters, they have to be flooded strongly to avoid an overheating of the solution near the heater (this can lead to spontaneous bath destruction).	
cooling:	required, out of acid-resistant material	
exhaust:	required for worker's protection	
hints:	The bath should not be allowed to remain idle at operating temperatures for longer time without use. In case of longer rest periods, cool down the bath.	
	The deposition rate is linear addicted to the temperature and the pH-value. With higher temperature and pH, a higher deposition rate can be reached. The deposition rate should be in the range of 5-8 μm/h to build in the desired content of phosphor and Teflon.	
	The temperature should not exceed 90°C and the pH-value should not exceed pH 5.0 to avoid the destruction of the bath.	
	Impurities as metal splinter lead to a foreign nickel process. So the content of nickel and reduction additive will drop down and the bath will be decomposed (visible at strong foam formation with black nickel parts on the foam). This will need immediate action: transfer the bath through a coarse filter bag into a clean tank and analyse it. Clean the old tank with nitric acid to remove the deposited nickel.	
	The analytical values of nickel and sodium hypophosphite should not differ more than 10 % from the desired value. This means that all additives should be added in small amounts over the day.	
	For optimum adherence of the Ni-P-PTFE layer, temper it 1 h at 260°C (the used oven has to be exhausted).	

recommended process sequence (for iron parts):

1. hot degreasing
   emulsifying: e.g. SurTec 188 + SurTec 415
   demulsifying: e.g. SurTec 188 + SurTec 089
2. hydrochloric acid pickling, e.g. with SurTec 424
3. anodic electrolytical cleaning, e.g. SurTec 171
4. neutralisation, e.g. SurTec 481
5. **Electroless Nickel SurTec 836 with Teflon Dispersion**
6. hot air drying
7. if necessary, heat treatment at 260°C for 1 hour

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

Maintenance and Analysis

Check the pH-value regularly (best is a bath sample at room temperature). At growing service life of the bath, pH-value and temperature have to be adjusted to higher values to get a constant deposition rate.

Analyse the nickel content regularly and adjust by dosing SurTec 836 II. For each part SurTec 836 II, add also one part SurTec 836 III and 0.13 parts SurTec 836 T (shake well before use). After addition of SurTec 836 T stir well the bath for 10 minutes.

Keep the content of nickel and reductor and the pH-value in the range of maximum 10 % of the desired values to produce constantly good layers.

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 with a fluted filter.

Nickel – Analysis by Titration

reagents: 0.1 mol/l EDTA solution (Titriplex III)
ammonia solution (conc.)
indicator: murexide

procedure:
1. Pipette 10 ml bath sample into a 250 ml Erlenmeyer flask.
2. Dilute to approx. 100 ml with 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 · 0.587 = g/l nickel

correction: rise by 0.1 g/l nickel = addition of 10 ml/l SurTec 836 II

With addition of 10 ml/l SurTec 836 II add also 10 ml/l SurTec 836 III and 1.3 g/l SurTec 836 T.

After addition of SurTec 836 T stir well the bath for 10 minutes.

SurTec 836 III Reductor – Analysis by Titration

reagents:	hydrochloric acid (conc., 37 %, p.a.) 0.1 N potassium chromate solution (= 1/30 mol/l) *or:* 0.1 N potassium dichromate solution (= 1/60 mol/l) copper(II)sulfate · 5 H_2O solution (5 %) ferroin indicator solution
procedure:	1. Pipette 2 ml bath sample into a 250 ml Erlenmeyer flask. 2. Add 25 ml copper(II)sulfate solution. 3. Add 25 ml conc. hydrochloric acid. 4. Let react for 3-4 min. 5. Add 3-5 drops ferroin indicator solution (not more!). 6. Titrate with 0.1 N potassium *(di)*chromate solution from olive brown/orange to light green. The colour change must be constant for 60 s.
calculation:	consumption in ml · 2.65 = g/l SurTec 836 III Reductor
correction:	rise by 1 g/l = addition of 2 ml/l SurTec 836 III
hint:	SurTec 836 III is normally dosed according to SurTec 836 II Nickel Concentrate, in the ratio 1:1. Only in special cases, small amounts of SurTec 836 III can be added separately.

SurTec 836 T Teflon Dispersion – Analysis by Analytical Balance

reagents:	sodium bichromate solution 200 g/l (= sodium dichromate solution 200 g/l) membrane filter (cellulose acetate) with pores of 0.3 μm or smaller
procedure:	1. Pipette 50 ml well stirred bath sample into a 100 ml beaker. 2. Add 5 ml sodium bichromate solution. 3. Stir well the solution and let react for 10 minutes. 4. Weigh out a fresh membrane filter with an analytical balance with an accuracy of 0.0001 g (note the empty weight). 5. Pour the solution through the membrane filter, rinse the beaker with deionised water several times and pour the water through the filter. Rinse the filter with deionised water thoroughly. 6. Dry the membrane filter at 100°C for about 1.5 h, than cool down in the exsiccator. 7. Weigh out the membrane filter with the analytical balance.
calculation:	weight difference in g · 33.3 = g/l SurTec 836 T Teflon Dispersion in the bath sample
hint:	Shake well the Teflon Dispersion before adding to the bath in order to assure a uniform distribution of the PTFE particles.

Technical Specification

(at 20°C)	Appearance	Density (g/ml)	pH-value (conc.)
SurTec 836 I	liquid, colourless, clear	1.180 (1.16-1.20)	6.0 (5.0-7.0)
SurTec 836 II	liquid, green, clear	1.250 (1.23-1.27)	approx. 3.5
SurTec 836 III	liquid, colourless, clear	1.270 (1.25-1.29)	6.0 (5.0-7.0)
SurTec 836 T	pasty, white	0.900 (0.75-1.05)	approx. 3

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.

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

SurTec 836 I	180 kg
SurTec 836 II	100 kg
SurTec 836 III	100 kg
SurTec 836 T	13 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:

product	*hazard designation*	*water hazard class*
SurTec 836 I	Xi - Irritant	WHC 2
SurTec 836 II	T - Toxic N - Dangerous for the environment	WHC 2
SurTec 836 III	Xi - Irritant	WHC 2
SurTec 836 T	-	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

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