

SurTec® 821

Bright Acid Tin Process

Properties

- produces bright, compact and high levelled tin deposits
- for plating of parts used in electrical industry, printing industry and semiconductor technology as well as for special applications
- equal and bright deposits over a wide range of current density, thus suited for rack and barrel plating
- easy to handle: works in wide ranges of temperature and metal concentration
- good solderability
- fast deposition: 2.5 µm within 2 minutes at normal current density
- resistant against spots and finger prints

Application

The process SurTec 821 includes the following products:

- SurTec 821 A Make-Up Wetter for the new make-up
- SurTec 821 B Make-Up Solution for the new make-up
- SurTec 821 C Maintenance Additive for the maintenance of the bath

make-up values:

tin sulfate (SnSO ₄)	30 g/l
sulfuric acid (96 %)	100 ml/l
SurTec 821 A	10 ml/l
SurTec 821 B	10 ml/l
SurTec 821 C	3 ml/l

analytical values:	tin(II)	16.5 g/l	(10 - 23 g/l)
	sulfuric acid	190 g/l	(180-200 g/l)

make-up:

Steps for make-up:

1. Fill the tank with deionised water of about 2/3 of the desired bath volume.
2. Add the calculated amount of sulfuric acid slowly, stirring steadily (caution: solution becomes hot!).
3. Let the electrolyte cool down to 25°C.
4. Add and dissolve tin sulfate.
5. Add SurTec 821 A Make-Up Wetter, pre-diluted 1:1 with deionised water, and stir well.
6. Add SurTec 821 B Make-Up Solution, pre-diluted 1:1 with deionised water, and stir well.
7. Fill up nearly to the final volume with deionised water.
8. Add SurTec 821 C Maintenance Additive, also pre-diluted 1:1 with deionised water.
9. Fill up to the final volume and stir well.
10. Start the continuous filtration.

temperature:	21°C	(13-29°C)	
	best brightness will be achieved below 22°C		
cathodic			
current density:	1.5 A/dm ²	(0.1-3 A/dm ²)	<i>rack</i>
	1.5 A/dm ²	(0.5-3 A/dm ²)	<i>barrel</i>
anodic			
current density:	1 A/dm ²	(0.1-3 A/dm ²)	
ratio			
anode / cathode:	1:1	to 2:1	
current efficiency:	about 90 %		
deposition rate:	1.25 µm/min at 1.5 A/dm ²		
anodes:	electrolytic tin (99.9 % tin at least), anode bags are not necessary (if desired: out of PP, PVC)		
agitation:	rack agitation (approx. 1-8 m/min)		
tank material:	out of acid resistant material (PVC, PE, PP...)		
filtration:	continuously with PP or PVC cartridge		
cooling:	if necessary, best out of PTFE coated material		
exhaust:	required for worker's protection		
hints:	Best brightness in the low current density is reached at low temperature (15-22°C) and with low tin content (8-10 g/l).		
	The rectifier must have sufficient capacity (approx. up to 6 V) and a ripple of max. 5 %.		
	Brass parts should be shortly plated with (acid) copper or with nickel, in order to prevent the dissolution of zinc.		
	Additions of formaldehyde and chloride contaminations have to be prevented.		

Technical Specification

(at 20°C)	Appearance	Density (g/ml)	pH-value (conc.)
SurTec 821 A	liquid, colourless	1.016 (1.00-1.03)	7.5 (4.5-9.0)
SurTec 821 B	liquid, colourless	1.007 (1.00-1.01)	2.3 (1.9-2.7)
SurTec 821 C	liquid, colourless to amber coloured	1.017 (1.00-1.04)	5.4 (5.0-6.0)

Maintenance and Analysis

Analyse and correct the content of tin(II) and sulfuric acid frequently. Keep the tin content constant by working with the correct ratio of anode to cathode.

SurTec 821 A Make-Up Wetter and SurTec 821 B Make-Up Solution are only required for a new bath make-up, all further additions are done only with SurTec 821 C Maintenance Additive. In order to reach a most equal deposition, add SurTec 821 C in 3 portions over a day (or with continuous addition systems).

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.

Tin(II) – Analysis by Titration

reagents: 0.1 N iodine solution
hydrochloric acid (1:1)
0.1 N sodium thiosulfate solution
marmoreal grit
(all reagents in p.a. quality)

procedure: Repeat determination:

1. Fill 100 ml deionised water into a 250 ml beaker.
2. Acidify with 30 ml half conc. hydrochloric acid.
3. Add a spatula tip of marmoreal grit and wait, until the gas emission has decreased.
4. Add **exactly** 30 ml iodine solution.
5. Add 10 ml bath sample (tin(II) oxidizes in iodine solution immediately to tin(IV) and precipitates).
6. Cover the beaker with a watch glass and wait until the gas emission has stopped.
7. Wash the watch glass and the beaker with deionised water.
8. Titrate back the unused iodine with 0.1 N sodium thiosulfate solution.

calculation: $(30 - \text{consumption in ml}) \cdot 0.5935 = \text{g/l tin(II)} = \mathbf{A}$ (in g/l)

remarks: The emission of CO₂ takes the dissolved oxygen out of the water; the water surface becomes an oxygen free area. By addition of the bath sample into the iodine solution the undesired oxidation of tin(II) by oxygen is minimized.

Too much marmoreal grit provokes a too strong neutralization of the acid, which is responsible for the redox reaction. Too heavy gas emission will lead to substance loss by fume.

At tin concentrations > 15 g/l, take only half of the volume of the bath sample for analysis and duplicate the result.

Free Sulfuric Acid (H₂SO₄) – Analysis by Titration

reagents: 1 N sodium hydroxide solution
indicator: thymolphthalein (0.1 % in alcoholic solution)

procedure:

1. Pipette 10 ml bath sample into a 250 ml Erlenmeyer flask.
2. Dilute to approx. 100 ml with deionised water.
3. Add 3 drops of indicator solution.
4. Titrate with 1 N sodium hydroxide solution until the sample turns to blue.

calculation: consumption 1 N NaOH = **B** (ml)
tin(II) concentration = **A** (g/l)
 $(\mathbf{B} \cdot 4.9) - (\mathbf{A} \cdot 0.826) = \text{g/l free sulfuric acid (H}_2\text{SO}_4)$

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 value per 10,000 Ah can be taken as estimated average consumption:

SurTec 821 C	3 l
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In order to prevent delays in the production process, per 1,000 l bath the following amounts should be kept in stock:

SurTec 821 A	25 kg
SurTec 821 B	25 kg
SurTec 821 C	200 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 821 A	Xi - Irritant	WHC 2
SurTec 821 B	C - Corrosive	WHC 1
SurTec 821 C	Xi - Irritant	WHC 2

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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Trouble Shooting

problem	possible cause	remedy
burnings, rough or matt depositions	a) too low content of tin sulfate or of sulfuric acid	analyse and adjust the values
	b) too low content of SurTec 821 A and B	test addition of this additives in the Hull cell
deposition is matt or with stripes in the hcd	a) too low content of SurTec 821 A and B	test addition of this additives in the Hull cell
	b) too low content of tin sulfate and/or of sulfuric acid	analyse the values; if dilution of the bath is necessary, check all additives in the Hull cell
	c) current density is too high	lower the current density
black or brown stripes in the hcd and bad throwing power in the lcd	a) content of brightener is too high	work out selectively at 2-3 A/dm ² ; dilute the bath if necessary
	b) too low content of SurTec 821 A and B	test addition of this additives in the Hull cell
	c) metal contamination (Ni, Fe, Cu, Zn)	stop the input of the impurities and work out at middle to high current densities
pitting	a) content of brightener is too high	work out selectively at 2-3 A/dm ² ; dilute the bath if necessary
	b) the acid of the pretreatment is too strong or too weak or the rinsing is ineffective	check the pretreatment and the rinsing
	c) irregular agitation	check the agitation
	d) metal contamination (Ni, Fe, Cu, Zn)	stop the input of the impurities and work out at middle to high current densities
	e) wrong ratio of tin sulfate to sulfuric acid	analyse and adjust the values
	f) bath temperature is too low	increase the temperature slowly
	g) particles are build-in	check the filtration
	h) holes in the basic material	check the source
matt deposition in the lcd	a) too low content of SurTec 821 A and B	test addition of this additives in the Hull cell
	b) too low content of SurTec 821 C	test addition of this additives in the Hull cell
	c) contamination with heavy metals	work out selectively at 0.5-1 A/dm ²
	d) too low content of tin sulfate and/or sulfuric acid	analyse and adjust the values
	e) contamination with chloride	stop the coming in of chloride; work out selectively; if also heavy metals are inside the bath, first add 0.6 ml/l hydrogen peroxide, then work out
	f) current density is too low	increase the current density
	g) anode surface is too small	enlarge the anode surface
	h) too high temperature	cool down the electrolyte
	i) insufficient pretreatment	check the pretreatment

problem	possible cause	remedy
bad throwing power	a) too low content of sulfuric acid or too high content of tin sulfate	analyse and adjust the values
	b) too low content of SurTec 821 A and B	test addition of this additives in the Hull cell
	c) current density is too low	increase the current density
	d) the distance of anode and cathode is too high	correct the distance
	e) irregular agitation	check the agitation
spots in the deposit	insufficient rinsing after tin plating	check the rinsing quality
bad solderability	a) content of brightener is too high	work out selectively at 2-3 A/dm ² ; dilute the bath if necessary
	b) contamination with chloride and/or metals	stop the coming in of chloride; work out selectively; if also heavy metals are inside the bath, first add 0.6 ml/l hydrogen peroxide, then work out
	c) rinsing before and after the tin bath are insufficient	check the rinsing
	d) faults in the tin deposition are coming from the basic material	evtl. copper plating prior to the tin process
	e) too low layer thickness	control the layer thickness: 2.5-5 µm is minimum
	f) temperature of the soldering is too low	check the soldering temperature
polarisation of the anodes	a) insoluble metals in the bath in high concentration	check the filtration
	b) tin sulfate or sulfuric acid of insufficient quality	check the quality
	c) anode bags are plugged	clean the anode bags
	d) anode surface is too small	enlarge the anode surface