SurTec® 816
White Bronze Process

Properties

- deposits bright white bronze layers, also directly on iron
- replaces the functional and decorative properties of nickel coatings but causes no allergic skin reactions
- suitable for rack and barrel application

Application

The process SurTec 816 includes the following products:

- SurTec 816 A Make-Up Salt
- SurTec 816 I Base Brightener
- SurTec 816 II Top Brightener
- SurTec 816 III Wetting Agent

make-up values:

copper cyanide	13	g/l
potassium cyanide	80	g/l
potassium hydroxide	20	g/l
SurTec 816 A Make-Up Salt	140	g/l
SurTec 816 I Base Brightener	0.5	ml/l
SurTec 816 II Top Brightener	1	ml/l
SurTec 816 III Wetting Agent	6	ml/l

analytical values:	copper	9	g/l	(8-10 g/l)
	tin	37	g/l	(35-39 g/l)
	free potassium cyanide	61	g/l	(55-65 g/l)
	KOH	41	g/l	(35-45 g/l)
	(KOH also coming from SurTec 816 A)			
	potassium carbonate	up to 60 g/l		

make-up: Steps for make-up:

1. Dissolve potassium hydroxide and SurTec 816 A Make-Up Salt in 2/3 of deionised water.
2. To the warm solution, add potassium cyanide and copper cyanide.
3. When all salts are dissolved, filtrate the bath and fill up to the final volume with deionised water.
4. Add the additives and heat up the bath to operating temperature.

temperature:	60°C	(55-65°C)
cathodic current density:	1-1.5 A/dm^2	*barrel application*
	2-6 A/dm^2	*rack application*

deposition rate:	0.3 µm/min at 1 A/dm^2
ratio anode/cathode:	1:1 to 2:1
anodes:	graphite anodes
agitation:	*rack agitation:* with 4-12 m/min *barrel rotation:* with 2-6 rpm
tank material:	steel with PP coating, heat and alkali resistant
filtration:	continuous filtration, 1-5 times the bath volume per hour
heating:	with thermostat regulated Teflon heater
exhaust:	required for worker´s protection

Technical Specification

(at 20°C)	Appearance	Density (g/ml)	pH-value (conc.)
SurTec 816 A	powder, white	0.892 (0.88-0.90) kg/l	> 14 (at 100 g/l)
SurTec 816 I	liquid, colourless	1.013 (1.00-1.02)	3.5 (2-5)
SurTec 816 II	liquid, yellowish-orange	1.079 (1.07-1.09)	5.5 (5-6)
SurTec 816 III	liquid, colourless	1.000 (0.94-1.06)	7.5 (6-9)

Maintenance and Analysis

Check the pH-value regularly. Analyse and adjust the electrolyte composition regularly and kept within ±10 % of the desired values.

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.

Potassium Hydroxide – Analysis by Titration

reagents:
1 N sulfuric acid
indicator sat. alcoholic solution of Tropaeolin O

procedure:
1. Pipette 5 ml bath sample into a 250 ml Erlenmeyer flask.
2. Dilute with 100 ml deionised water.
3. Add 5 drops of indicator.
4. Titrate with 1 N sulfuric acid from orange to beginning light yellow. (Best results with pH control: endpoint at pH 11.1-11.0)

calculation: consumption in ml · 11.19 = g/l potassium hydroxide

Copper and Tin – Analysis by AAS

equipment: Atomic Absorption Spectrometer (AAS)

procedure:
1. Prepare a dilution of 1.2000 of the filtered bath sample.
2. Determinate the content of copper and tin in the AAS.

correction:
tin: 4.1 g of SurTec 816 A Make-Up Salt corresponds to 1 g Sn
copper: 1.4 g copper cyanide corresponds to 1 g Cu

Copper and Tin – Analysis by Titration

MUST be done in the exhaustion hood! Hydrocyanic acid will be formed!

reagents:

1 N sodium chloride solution (58.4 g/l)
hydrochloric acid (conc.)
hydrogen peroxide solution (30 %)
thiourea solution (10 %)
xylenol orange (1 % in KNO_3)
0.05 M EDTA solution (Titriplex III)
urotropin buffer solution (400 g/l urotropin, 100 ml/l HCl conc.)
0.05 N lead nitrate solution (16.56 g/l)

procedure:

1. Pipette 10 ml bath sample into a 250 ml beaker.
2. Add 10 ml NaCl solution.
3. Add 10 ml HCl conc. (no additional water!). A white precipitate will be formed which dissolves in heat.
4. In order to expel the HCN, heat until shortly boiling and chill to room temperature (a light precipitate will reoccur).
5. Add 5 ml hydrogen peroxide solution (sample becomes light green) and heat again to boiling, boil 5 min.
6. After cooling down to room temperature again, fill the complete sample into a 100 ml volumetric flask (including the precipitate) and fill up to the mark (the precipitate will dissolve, light blue solution).

Analysis a)

7. Pipette 10 ml of this solution into a 250 ml beaker and add thiourea solution drop by drop until discolouring (first yellowish, than colourless, without precipitate).
8. Add further 2 ml thiourea solution.
9. Add **exactly** 10 ml 0.05 N EDTA.
10. Add a spatula tip of indicator.
11. Adjust the pH-value at approx. pH 5.5 with the urotropin buffer.
12. Fill up with water to **exactly** 100 ml.
13. Titrate with 0.05 N lead nitrate solution from lemon yellow to red-violet (sharp endpoint, a dull zone at the drop-in area will redissolve through stirring. Do not overtitrate! This would influence analysis (b).

    Consumption of lead nitrate solution = consumption **A** (ml)

Analysis b)

14. To the same sample (a) add 10 ml hydrogen peroxide solution. The colour changes to blue, with lots of indicator to violet-blue.
15. Add **exactly** further 100 ml water and stir **exactly** 3 minutes.
16. Titrate with 0.05 N EDTA until the solution is grey-green. (Slow endpoint, slight dullness; volume and waiting time have to be exact, only then the titration will be correct.)

    Consumption of EDTA = consumption **B** (ml)

calculation:

tin: (10 - consumption **A** in ml) · 5.935 = g/l Sn
copper: consumption **B** in ml · 3.177 = g/l Cu

Potassium Cyanide – Analysis by Titration

First analyse tin and copper (best by AAS) and adjust to 9 g/l copper (Cu) and 37 g/l tin (Sn). Only then, after correction of the metal contents, prepare a new bath sample and titrate potassium cyanide, as the analytical result is influenced by the copper content.

reagents:
0.1 N silver nitrate solution
consumption (10 %)
potassium iodide solution (2 %)

procedure:
1. Pipette 5 ml bath sample into a 250 ml Erlenmeyer flask.
2. Dilute with 50 ml deionised water.
3. Add 10 ml 10 % sodium hydroxide solution.
4. Add 5 ml potassium iodide solution.
5. Titrate with 0.1 N silver nitrate solution until lasting turbidity.

calculation:
consumption in ml · 2.63 = g/l free potassium cyanide

If the copper content is other than 9 g/l, you can recalculate the total cyanide. Please adjust always the metal content first.

total KCN: free KCN (g/l) + Cu (g/l) · 2.049 = total KCN (g/l)

Potassium Carbonate – Analysis by Titration

reagents:
barium nitrate solution (5 %)
1 N hydrochloric acid
1 N sodium hydroxide solution
indicator: methyl orange solution (0.04 %)

procedure:
1. Pipette 10 ml bath sample into a 250 ml Erlenmeyer flask.
2. Dilute with 50 ml deionised water.
3. Boil the solution shortly.
4. Add 75 ml barium nitrate solution.
5. After settle down of the precipitate, filtrate with a fine-grained filter paper and wash with hot deionised water.
6. Put the filter into a 250 ml Erlenmeyer flask.
7. Dilute with 100 ml deionised water.
8. Add exactly 30 ml 1 N hydrochloric acid.
9. Boil the solution shortly.
10. After cooling down, add 3 drops of indicator.
11. Titrate excessive hydrochloric acid with 1 N sodium hydroxide solution from red to orange-yellow.

calculation:
(30 - consumption in ml) · 6.91 = g/l potassium carbonate

Hull Cell Test

Fill 250 ml of the hot (60°C) electrolyte into a standard Hull Cell. Plate a well pre-treated steel Hull cell panel 10 min at 1 A, 60°C with mechanical agitation. Rinse the panel afterwards and dry with hot air.

Consumption and Stock Keeping

The consumption depends heavily on the drag-out and on specific line conditions. 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 816 I	approx. 0.5 l
SurTec 816 II	approx. 0.5 l
SurTec 816 III	approx. 0.5 l

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

SurTec 816 A	Make-up Salt	75 kg
SurTec 816 I	Base Brightener	30 kg
SurTec 816 II	Top Brightener	30 kg
SurTec 816 III	Wetting Agent	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:

product	*hazard designation*	*water hazard class*
SurTec 816 A	C - Corrosive	WHC 1
SurTec 816 I	T - Toxic	WHC 1
SurTec 816 II	-	WHC 1
SurTec 816 III	-	WHC 0

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

Before anything else, analyse and adjust the alkalinity.

problem	possible cause	remedy
dull deposits	a) lack of copper	analyse and adjust
	b) bath composition is not correct	b 1) analyse and adjust the correct analytical values
		b 2) first add SurTec 816 I and then SurTec 816 II (after test in the Hull cell: first add half of the optimal amount, finally evtl. more)
	c) dragged-in tensides (out of the pretreatment)	improve the rinsing procedure
yellow areas in the high current density (hcd)	lack of cyanide	add potassium cyanide (after control by analysis)
black stripes or areas	a) agitation is insufficient	improve agitation (stirrer, barrel rotation)
	b) lack of SurTec 816 III	add SurTec 816 III (after test in the Hull cell)