

SurTec® 728

Cyanide Bright Zinc Process

Properties

- liquid brightener
- produces brilliant deposits at low, medium and high current density
- for barrel and rack application
- excellent throwing and covering power
- plated parts can easily be chromated
- due to the variable metal and cyanide content of the solution, it is useable over a wide range of operating conditions
- contains no aldehydes - a fact which allows to use operating temperatures higher than normal (up to 45°C)
- its brilliant deposits and the economic use make it the outstanding cyanide zinc brightener system
- IMDS-number: 213570

Application

make-up values:	<i>low cyanide</i>	<i>medium cyanide</i>
zinc oxide	12.5 g/l	25 g/l
sodium cyanide	18 g/l	50 g/l
sodium hydroxide	85 g/l	70 g/l
SurTec 728 Brightener	3 ml/l	4 ml/l
SurTec 720 Purifier	0-1 ml/l	0-1 ml/l

analytical values:

zinc	10 g/l (7-15 g/l)	20 g/l (15-25 g/l)
sodium cyanide	18 g/l (11-30 g/l)	50 g/l (30-65 g/l)
sodium hydroxide	85 g/l (80-90 g/l)	70 g/l (60-80 g/l)
sodium carbonate	max. 90 g/l	max. 80 g/l
ratio NaCN : Zn	1.8 (1.5-2.2)	2.5 (2.0-3.0)

make-up:

Steps for make-up:

1. Fill 1/3 of the required amount of water into the tank.
2. Add and dissolve sodium hydroxide and sodium cyanide.
Caution: Solution becomes hot!
3. Add zinc oxide and stir until it is dissolved completely.
4. Cool down to room temperature.
5. According to the amount of contaminants (out of the salts) add SurTec 720 Purifier (pre-diluted 1:10).
6. Fill up the tank to its final volume with water and filtrate continuously overnight.
7. Add the required amount of SurTec 728 and stir the electrolyte.

temperature:	25°C (20-45°C)
	at lower temperatures the current densities should be lower; higher temperatures lead to reduced brightness and throwing power
cathodic current density:	0.2-2.0 A/dm ² (<i>barrel</i>) 0.2-4.0 A/dm ² (<i>rack</i>)
current efficiency:	60-80 %
deposition rate:	10-14 µm per Ah/dm ²
anodes:	pure zinc anodes 99,99 % according to DIN 1706 or steel anodes, for better control of the the zinc content
agitation:	cathode agitation (rack or barrel movement) recommended, no air agitation (to avoid cyanide mist and carbonate increase)
tank material:	plastic or steel with plastic coating
filtration:	recommended
heating:	not necessary
cooling:	necessary for lines with high load on small volumes and/or recommended to freeze out sodium carbonate
exhaust:	required for worker's protection

Technical Specification

(at 20°C)	Appearance	Density (g/ml)	pH-value (conc.)
SurTec 728	liquid, light yellowish-reddish	1.022 (1.01-1.04)	approx. 10.7
SurTec 720	liquid, light red-brown	1.072 (1.03-1.12)	approx. 10.3

Maintenance and Analysis

Analyse the concentration of zinc, sodium cyanide, sodium hydroxide and sodium carbonate regularly.

Control the zinc content by changing the anodic current density or by using steel anodes. Add sodium cyanide and sodium hydroxide according to the analysis. Add 0.1 l SurTec 720 Purifier for each added kg NaOH. Freeze out excessive sodium carbonate. Adjust SurTec 728 with the aid of Hull cell tests.

A rising **zinc** content increases the burning limit, but reduces the throwing power. A lack of zinc produces burnings.

Excessive **sodium cyanide** reduces the brightness, thus more SurTec 728 will be needed. A lack of cyanide produces a more brittle zinc layer. High cyanide bath types are less sensitive against impurities.

An excess of **sodium hydroxide** speeds up the zinc dissolution too much. A lack of hydroxide reduces the burning limit.

Excessive **sodium carbonate** reduces the brightness, thus more SurTec 728 will be needed. Further, it causes passive anodes leading to bad current distribution in the electrolyte and to low zinc dissolution rate.

Contaminating metals like Cu, Pb, Cd, Sn, Ni, ... deteriorate brightness and appearance of the zinc layer and should be removed with SurTec 720 Purifier. Chromium(VI) reduces current efficiency and coverage in the low current density(lcd) area. It affects chromatability and appearance and has to be reduced to Cr(III) by sodium dithionite.

An excess of **SurTec 728 Brightener** causes a spotted dull zinc deposition in the low (lcd) to medium current density (mcd) area, current efficiency will be reduced and in extreme cases, blistering may occur. A lack of SurTec 728 effects reduced brightness and bad throwing power.

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.

Zinc – Analysis by Titration

reagents: 0.1 mol/l EDTA (Titrplex III)
buffering solution (100 g/l NaOH + 240 ml/l 98 % acetic acid)
indicator: xylene orange (1 %, blended with KNO₃)

procedure: 1. Pipette 5 ml bath sample into a 250 ml Erlenmeyer flask.
2. Dilute with 100 ml deionised water.
3. Add 30 ml buffering solution.
4. Add a spatula tip of indicator.
5. Titrate with 0.1 M EDTA from red to yellow.

calculation: consumption in ml · 1.3074 = g/l zinc

Sodium Cyanide – Analysis by Titration

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

procedure: 1. Pipette 5 ml bath sample into a 250 ml Erlenmeyer flask.
2. Dilute with 100 ml deionised water.
3. Add 10 ml 10 % sodium hydroxide solution.
4. Add 6 drops potassium iodide solution.
5. Titrate with 0.1 N silver nitrate solution until lasting turbidity.

calculation: consumption in ml · 1.96 = g/l sodium cyanide

Sodium Hydroxide – Analysis by Titration

reagents: 1 N sulfuric acid or hydrochloric acid
indicator: Tropaeolin O (0.1 g in 100 ml deionised water)

procedure: 1. Pipette 5 ml bath sample into a 250 ml Erlenmeyer flask.
2. Dilute to approx. 100 ml with deionised water.
3. Add 5 drops of indicator.
4. Titrate with 1 N acid from orange to light yellow.

calculation: consumption in ml · 7.98 = g/l sodium hydroxide

Sodium 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:	<ol style="list-style-type: none">1. Pipette 10 ml bath sample into a 250 ml Erlenmeyer flask.2. Dilute with 50 ml deionised water and boil the solution.3. Add 75 ml barium nitrate solution.4. After settle down of the precipitate, filtrate with a fine-grained filter paper and wash with hot deionised water.5. Put the filter into a 250 ml Erlenmeyer flask.6. Add 100 ml deionised water.7. Add exactly 30 ml 1 N hydrochloric acid.8. Boil the solution shortly.9. After cooling down, add 3 drops indicator.10. Titrate excessive hydrochloric acid back with 1 N sodium hydroxide solution from red to orange-yellow.
calculation:	$(30 - \text{consumption in ml}) \cdot 5.3 = \text{g/l sodium carbonate}$

Hull Cell Test

equipment:	rectifier with 10-30 V and 0-3 A and cables 250 ml Hull cell zinc anode steel Hull cell panels
procedure:	<ol style="list-style-type: none">1. Put the anode into the Hull cell and connect with the cable to the (+) pole of the rectifier; fill the cell with the original zinc bath up to the Hull cell's mark.2. Remove the zinc coating of the Hull cell panel in 1:1 hydrochloric acid, rinse, electroclean the panel, rinse well and put it into the cell. Move slightly to and fro in order to wet the panel properly. Then connect with the cable to the (-) pole of the rectifier.3. Plate for 15 min with 1 A (full voltage, current adjusted to the desired value) without agitation. Take out the panel, rinse well and brighten in a 0.5 %vol nitric acid.4. If the analysis of the bath values indicated that some inorganic ingredient should be adjusted, plate a second panel with these corrections.
evaluation:	<p>A correct SurTec 728 panel should be completely bright and uniform; a slight haziness in the hcd area is normal, vertical hydrogen marks (stripes) also. There should be no dullness in the mcd and lcd area and the panel should be coated completely.</p> <p>Correct according to the information under "Effect of the Electrolyte Compounds". If the organic additives have no positive effect but the panel is still dull, it might be a strong overdose. In this case, dilute the original electrolyte 1:1 with a fresh electrolyte prepared in the laboratory and having no additives. Plate a Hull cell panel in this 50 % electrolyte and try again if the correction is possible now.</p>

Conversion of a Cyanide Electrolyte to SurTec 728

For a complete conversion test, at least 3 litres original electrolyte are necessary.

First Indication Test:

1. Plate a SurTec 728 panel in a fresh laboratory electrolyte according to the instructions of the chapter "Hull Cell Test".
2. Plate an original panel in the actual electrolyte without any additions. If the original panel was already bright, you can only try the overdosage effect, if it was less bright than panel 1, you can already get an indication on the receptivity of the old system for SurTec 728.
3. Add 0.5 ml/l SurTec 728 to the 250 ml Hull cell 2 and plate again.

If there is a positive effect (panel 3 is the same as or better than panel 2), a conversion is possible without an immediate problem.

Mid Term Compatibility:

1. Fill 1.8 litre of the actual bath into a 2 l beaker, hang in a small Hull cell anode and a pre-treated jiggle cell panel (or, if not available, a 15 cm long and about 4 cm wide steel sheet) as a cathode, put it on a magnetic stirrer and stir slowly, connect anode and cathode to the rectifier and plate with 1 A for 5 h.
2. Fill 250 ml of this treated electrolyte into a Hull cell and plate a Hull cell panel according the instructions of the chapter "Hull Cell Test".
3. Add 0.5 ml SurTec 728 to the Hull cell and repeat the test.
4. Repeat (3) until a good result is obtained.

Long Term Compatibility:

1. Prepare 1 litre of a fresh SurTec 728 electrolyte with the desired values (low or medium cyanide electrolyte, see front page) with 4 ml/l SurTec 728.
2. Prepare 5 dilutions with a total volume of 250 ml each of the actual (untreated) electrolyte with the fresh electrolyte:
 - a) 225 ml original bath + 25 ml fresh electrolyte
 - b) 175 ml original bath + 75 ml fresh electrolyte
 - c) 125 ml original bath + 125 ml fresh electrolyte
 - d) 75 ml original bath + 175 ml fresh electrolyte
 - e) 25 ml original bath + 225 ml fresh electrolyte

and plate a Hull cell panel in each electrolyte.

If the first indication test (see above) had shown a lack of brightness in the original bath, add 0.05 ml SurTec 728 additive for every 25 ml strange electrolyte.

There should not be any negative effect in any dilution. If e.g. the panel plated in bath c) had an unexpected appearance, e.g. uncorrectable spottiness, possible problems must be expected after about 5 weeks of conversion (barrel application) resp. 15-20 weeks (rack application).

If every dilution can be adjusted to a good panel, no problems are expected by the conversion itself.

Consumption and Stock Keeping

The consumption depends heavily on the drag-out as well as electrochemically, on anodic oxidation and cathodic build-in. 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 728 Brightener 1-3 l

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

SurTec 728 Brightener 90 kg

SurTec 720 Purifier 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:

<i><u>product</u></i>	<i><u>hazard designation</u></i>	<i><u>water hazard class</u></i>
SurTec 728	Xi - Irritant	WHC 2
SurTec 720	Xn - Harmful	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>