

SurTec® 723

Cyanide Bright Zinc Process

Properties

- liquid brightener
- produces brilliant deposits at low, medium, and high current densities
- for both, barrel and rack operations
- excellent throwing and covering power
- plated parts can easily be chromated
- due to the variable metal and cyanide content of the solution, it may be used 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 its economic use make it the outstanding cyanide zinc brightener system

Application

make-up values:

zinc oxide	44 g/l	
sodium cyanide	105 g/l	
sodium hydroxide	50 g/l	
SurTec 723 Brightener	4 ml/l	(3-5 ml/l)
SurTec 720 Purifier	0-1 ml/l	

analytical values:

zinc	35 g/l	(30-40 g/l)
sodium cyanide	105 g/l	(75-110 g/l)
sodium hydroxide	50 g/l	(40-60 g/l)
sodium carbonate	max. 70 g/l	
ratio NaCN : Zn	3.0	(2.5-3.5)

make-up: Steps for make-up:

1. Dissolve sodium hydroxide and sodium cyanide in 1/3 of the required amount of water
2. Considerable heat will be evolved.
3. Add zinc oxide and stir until dissolved.
4. Cool to room temperature.
5. According to the amount of contaminants, add SurTec 720 Purifier (pre-diluted 1:10).
6. Fill the tank with water to its final volume.
7. Filtrate continuously overnight.
8. Add the required amount of SurTec 723 and stir the electrolyte.

temperature: 25 °C (20-45 °C)

(at lower temperatures current densities should be lower, at higher temperatures brightness and throwing power is reduced)

cathodic

current density: *barrel:* 0.2-2.0 A/dm² *rack:* 0.2-4.0 A/dm²

current efficiency:	60-80 %
deposition rate:	10-14 μm per Ah/dm ²
anodes:	pure zinc 99.99 % according to DIN 1706 or steel anodes to control the zinc concentration
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 723	liquid, yellow-orange red	1.010 (0.99-1.03)	10.6
SurTec 720	liquid, light red-brown	1.072 (1.03-1.12)	10.3

Maintenance and Analysis

Analyse zinc, sodium cyanide, sodium hydroxide and sodium carbonate regularly. Zinc is controlled by changing the anodic current density or by using steel anodes. Add sodium cyanide and sodium hydroxide according analysis. Add 0.2 l SurTec 720 Purifier per 10 kg added NaOH. Freeze out excess sodium carbonate. Adjust SurTec 723 with the aid of Hull cell tests.

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

Excess **sodium cyanide** reduces brightness, thus more SurTec 723 is needed. Lack of cyanide produces a more brittle zinc layer. The high cyanide electrolyte type is less sensitive against impurities.

Excess **sodium hydroxide** speeds up zinc dissolution too much. Lack of hydroxide reduces the burning limit, and leads to passive anodes.

Excess **sodium carbonate** reduces brightness, thus more SurTec 723 is needed. Further, it is responsible for passive anodes leading to a bad current distribution in the electrolyte and a too 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 the purifier SurTec 720. Chromium(VI) reduces current efficiency and coverage in the low current density area. It affects the chromatability and appearance and must be reduced to Cr(III) with sodium dithionite.

Excess of **SurTec 723** causes a spotted dull zinc deposition in the low to medium current density area, current efficiency is reduced and in extreme cases, blistering may occur. A lack of additive results into a lack of brightness and 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 (Titriplex III)
buffering solution (100 g/l NaOH + 240 ml/l 98 % acetic acid)
indicator: xylenol orange (1 % blended with KNO₃)

procedure: 1. Pipette 5 ml bath sample into a 250 ml Erlenmeyer flask.
2. Dilute approx. 100 ml deionised water.
3. Add 20 ml buffering solution.
4. Add a spatula tip of indicator.
5. Titrate with 0.1 mol/l 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
NaOH solution (10 %)
potassium iodide solution (2 %)

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

calculation: consumption in ml · 1.98 = g/l sodium cyanide

Sodium 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 approx. 100 ml deionised water.
3. Add 5 drops of indicator.
4. Titrate with 1 N sulfuric acid from orange to light yellow.

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

Sodium Carbonate – Analysis by Titration

- reagents: 5 % barium nitrate solution
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. Add 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 30 ml 1 N hydrochloric acid and boil the solution shortly.
 8. After cooling down, add 3 drops indicator.
 9. Titrate excess hydrochloric acid with 1 N sodium hydroxide from red to orange-yellow.
- calculation: $(30 - \text{consumption in ml}) \cdot 5.3 = \text{g/l sodium carbonate}$

Hull Cell Test

- material: rectifier with 10-30 V and 0-3 A
cables
250 ml Hull cell
zinc anode
steel Hull cell panels
- procedure:
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 plastic film mechanically, or remove the zinc coating of the Hull cell panel in 1:1 hydrochloric acid, rinse, electroclean the panel, rinse well and put 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 the panel out, 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: The correct SurTec 723 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 mcd and lcd area and the panel must be coated completely. Correct according 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 overdosage. 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 was now possible.

Conversion of a cyanide Electrolyte to SurTec 723

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

First Indication Test:

1. Plate a SurTec 723 panel in a fresh laboratory electrolyte according 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 723.
3. Add 0.5 ml/l SurTec 723 to the 250 ml Hull cell 2 and plate again.

If there was 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 l original bath into a 2 l beaker, hang in a small Hull cell anode and a pretreated 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 723 to the Hull cell and repeat the test.
4. Repeat (3) until a good result was obtained.

Long Term Compatibility:

1. Prepare 1 l of a fresh SurTec 723 electrolyte with the desired values (see front page) with 4 ml/l SurTec 723.
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 723 additive for every 25 ml of the actual 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.

