

# SurTec® 704 Matt

## Matt Zinc Process

### (Electrolyte based on Sodium)

#### Properties

- very good metal distribution  
(only about 25 % of variance on a 1 A, 30 min Hull cell panel)
- produces a homogenous matt zinc deposit, easy to passivate
- very ductile, without blistering
- especially suited for rack applications, but also for barrel or continuous applications
- easy plating even on parts with difficult shapes
- high burning limit, suited for high current densities
- simple waste water treatment
- excellently adapted for an external zinc generator
- IMDS-number: 213570

#### Application

The process SurTec 704 M (Electrolyte based on Sodium) includes the following products:

- SurTec 704 Matt Carrier is responsible for the very good metal distribution
- SurTec 700 L LCD Booster is used to get a homogeneously surface appearance, especially to improve low current density areas
- SurTec 704 R Conditioner avoids optical influences on the layer caused by water hardness or impurities inside sodium hydroxide
- SurTec 700 EN Sodium Zincate Electrolyte, 3x Concentrate is the electrolyte concentrate that provides zinc and sodium hydroxide for the bath make-up (as an alternative to the make-up out of the salts)

make-up values:	zinc oxide	12.5 g/l	
	sodium hydroxide	120 g/l	
	<i>or using the electrolyte concentrate:</i>		
	SurTec 700 EN	33 %vol	
	sodium carbonate	50 g/l	
	SurTec 704 M	10 ml/l	(5-15 ml/l)
	SurTec 700 L	0.3 ml/l	(0-0.5 ml/l)
	SurTec 704 R	if necessary	(0-15 ml/l)
analytical values:	zinc	10 g/l	(8-15 g/l)
	sodium hydroxide	120 g/l	(110-150 g/l)
	sodium carbonate	max. 80 g/l	

make-up:	Steps for make-up:
	<ol style="list-style-type: none"> <li>1. Fill 1/3 of the deionised water into the tank.</li> <li>2. Add and dissolve sodium hydroxide in small portions while stirring the solution (attention: the solution becomes hot!).</li> <li>3. Add zinc oxide and stir until the solution is clear. <b>Alternatively</b> fill the bath with 33 %vol SurTec 700 EN Sodium Zincate Electrolyte, 3x Concentrate (30 g/l Zn).</li> <li>4. Dissolve sodium carbonate and fill the tank with deionised water to its final volume.</li> <li>5. Add SurTec 704 Matt Carrier, SurTec 700 L LCD Booster and SurTec 704 R Conditioner.</li> </ol>
temperature:	20-40 °C (higher temperatures: layers are more matt)
cathodic current density:	0.5-6 A/dm <sup>2</sup> recommendation for rack: ≥ 2 A/dm <sup>2</sup> (max. current density depends on zinc content and agitation)
current efficiency:	55-80 %
deposition rate:	0.2 µm/min at 1 A/dm <sup>2</sup> <i>barrel</i> 0.35 µm/min at 2 A/dm <sup>2</sup> <i>rack</i>
tank material:	plastic or steel with plastic coating
agitation:	cathode movement with 3-5 m/min
filtration:	continuous filtration is necessary
cooling:	necessary at high current load, depending on the electrolyte volume
exhaust:	strongly recommended, especially when using inert anodes

## Anodes

SurTec recommends the use of inert anodes in combination with an external zinc generator. Despite this recommendation, SurTec 704 Matt can of course be operated with soluble zinc anodes. However, SurTec strongly warns against mixed operation of inert and soluble anodes.

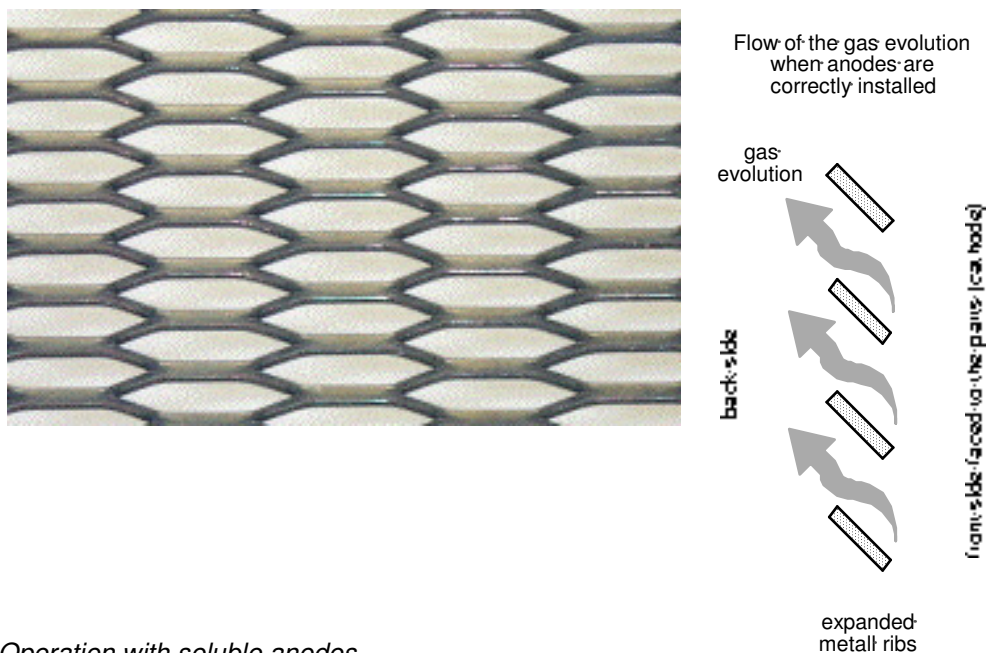
### *Operation with inert anodes and external zinc generator*

Anodes: made of expanded metal (30 mm x 8 mm piccolo mesh, rib width 6 mm, material thickness 2 mm), of mild steel (e.g. ST 37) plated with 15 µm semi bright nickel. The expanded metal should be installed with the ribs horizontally oriented for driving the gas evolution to the back side.

Before plating the expanded metal with semi bright nickel, it should be vertically stiffened with flat irons leading to the anode hooks. For optimal current distribution, the anodes should be placed at both sides of the cathode along the full width of the plating tank, with an anodic current density up to 20 A/dm<sup>2</sup>.

Zinc generator: with baskets (optimal: 62.5 mm x 62.5 mm x 1000 mm of 1.5 mm perforated mild sheet DD 11 GK according to DIN 10111/10051; perforation Rv 3-5 DIN 24041). plated with the SurTec Catalyst. Fill the baskets with zinc clippings (approx. 10 mm Ø, lead content < 0.002 %). Control the zinc concentration in the electrolyte adjusting the exchange rate between plating cell and zinc generator. For an online calculation of the necessary number of catalytic baskets and for determination of the size of the zinc generator, please consult:

<http://Berechnung.SurTec.com/Zinkgenerator.html>



### Operation with soluble anodes

Anodes: soluble zinc anode pieces, clippings, drops or balls in titanium baskets as usual in the trade, or zinc anode panels at titanium hooks (the lead content of the zinc anodes must be generally < 0.002 %). Up to a current density of about 3 A/dm<sup>2</sup>, the anodic current efficiency lies at 100 %. Above 3 A/dm<sup>2</sup> the anode gets covered with a semi conductive zinc oxide parting layer, the anode becomes black, the cell voltage increases abruptly by 3-4 V, and the anodic current efficiency drops down to 2-5 % in favour of 95-98 % O<sub>2</sub> evolution. However, it is not impossible, but it is hard to control the zinc content of the electrolyte by adjusting the anode surface. Anodes must be removed and placed back frequently. Consequently, the current in the plating cell is of course very unevenly distributed.

## Technical Specification

(at 20 °C)	Appearance	Density (g/ml)	pH-value (conc.)
SurTec 704 Matt	liquid, colourless-yellowish, clear	1.017 (1.01-1.03)	9 (8-10)
SurTec 700 L	liquid, yellowish, clear	1.052 (1.01-1.09)	13.4 (12-14)
SurTec 704 R	liquid, colourless, clear - slightly turbid	1.400 (1.38-1.44)	12.0
SurTec 700 EN	liquid, colourless, clear	1.332 (1.31-1.35)	> 11

## Maintenance and Analysis

Analyse the concentration of zinc and potassium hydroxide regularly.

Keep the zinc content constant by regulation of the anode surface or by an external zinc generator. Dose sodium hydroxide corresponding to the analysis.

### 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 (Zn) – Analysis by Titration

- reagents: 0.1 mol/l EDTA (Titriplex III, Merck)  
buffer solution (100 g/l NaOH and 240 ml/l 98 % acetic acid  
in deionised water)  
indicator: xylenol orange tetra sodium salt (1 % in KNO<sub>3</sub>)
- procedure: 1. Pipette 5 ml bath sample into a 250 ml Erlenmeyer flask.  
2. Dilute with approx. 100 ml deionised water.  
3. Add 30 ml buffer solution.  
4. Add a spatula tip of indicator.  
5. Titrate with 0.1 mol/l EDTA from red to yellow.
- calculation: consumption in ml · 1.3078 = g/l zinc

### Sodium Hydroxide (NaOH) – Analysis by Titration

- reagents: 1 N sulfuric acid  
indicator: Tropaeolin O (0.1 % solution)
- procedure: 1. Pipette 5 ml bath sample into a 250 ml Erlenmeyer flask.  
2. Dilute with approx. 100 ml deionised water.  
3. Add 5 drops of indicator.  
4. Titrate with 1 N sulfuric acid from orange-brown to yellow.
- calculation: consumption in ml · 8.00 = g/l sodium hydroxide

### Sodium Carbonate (Na<sub>2</sub>CO<sub>3</sub>) – 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. Add 50 ml deionised water.  
3. Boil the solution.  
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. Add 100 ml deionised water.  
8. Add 20 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 from red to orange-yellow.
- calculation: (20 - consumption in ml) · 5.3 = g/l sodium carbonate

## Ingredients

- polymeric amines
- organic nitrogen compounds

## Consumption and Stock Keeping

The total consumption consists of the drag out and the electrolytic consumption. For the dosage both have to be considered.

	due to drag out* [per kg NaOH]	electrolytic [per 10 kWh]
SurTec 704 Matt Carrier	83 ml	0.5-1.5 l
SurTec 700 L LCD Booster	83 ml	0-0.4 l
SurTec 704 R Conditioner	83 ml	

\*valid only for the given make-up values

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

SurTec 704 Matt Carrier	100 kg
SurTec 700 L LCD Booster	30 kg
SurTec 704 R Conditioner	90 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 704 Matt	-	WHC 3
SurTec 700 L	C - Corrosive	WHC 1
SurTec 704 R	Xi - Irritant	WHC 1
SurTec 700 EN	C - Corrosive N - Dangerous for the environment	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>

## Trouble Shooting

Before consulting the following list, it should be verified that temperature, current density and analytical values stay within the above limit values.

Then prepare for better evaluation Hull cell tests with a 250 ml Hull cell at 1 A · 15 min on thoroughly pre-treated (pickled and anodal cleaned) steel panels. Rinse the plated Hull cell panel in 0.5 %vol nitric acid for 15 s, rinse again with tap water and dry with hot air.

problem	possible cause	remedy
matt uniform layer within the whole current density range	electrolyte is o.k.	none
bad throwing power	concentration of SurTec 704 Matt Carrier is too low	add SurTec 704 Matt in steps of 2-5 ml/l; confirm each step by Hull cell tests before addition to the bath
dull irregular areas in the zinc deposit	a) bad pre-treatment	improve the pre-treatment (note: pre-treatment of Hull cell panels is also very important for good test deposits)
	b) water hardness is too high	for water conditioning, add SurTec 704 R to the electrolyte in steps of 5 ml/l; confirm each step by Hull cell tests before addition to the bath
	c) lack of SurTec 700 L LCD Booster	add SurTec 700 L in steps of 0.1 ml/l
bad current efficiency, no deposits in low current density area	a) overdosage of SurTec 704 Matt Carrier or SurTec 700 L LCD Booster	work out
	b) impurities of chromium (VI)	add reduction agent sodium dithionite according to Hull cell tests
discoloured passivation layers	a) passivation bath is wrongly adjusted	check passivation bath and activation
	b) metal impurities in the zinc electrolyte	close the source of the impurities; dummy plate at low current densities
dull grey deposits in the low current density area	impurities of heavy metals (e.g. lead)	a) add SurTec 700 L LCD Booster in steps of 0.1 ml/l, leave 15 min for reaction; confirm each step by Hull cell tests before addition to the bath (attention: it may become bright)
		b) treat the electrolyte with 1 g/l zinc dust