

SurTec® 680 LC

Chromiting – Chromitierung®

Low in Cobalt

Thick Layer Passivation for Zinc and Zinc Alloys

Properties

- liquid concentrate, based on chromium(III)
- exceeds the requirements for yellow chromates according to DIN 50 021 SS
- produces coatings of a clear, green, slightly iridescent colour
- the passivation layer can also be dyed with organic colourings or with SurTec 680 Y
- the passivation layer can also be dyed with organic colourings
- long service life, even with feed-back of rinsing water
- contains only about 1 g/l Co in the bath
- layer fulfils all requirements of ELV, RoHS and WEEE when following the recommended process sequence (see application)
- world-wide patent: Europe 0 907 762; Japan 3597542; USA 6,287,704
- IMDS number: 900896

Application

SurTec 680 LC is applied in rack or barrel application. The process SurTec 680 LC includes the following products:

- SurTec 680 LC Chromiting Concentrate contains chromium(III), cobalt and the complexing agent in the correct relations
- SurTec 680 K Salt Corrective Salt which is added at rising zinc contents in the bath to complex the excessive zinc
- SurTec 680 C Cobalt Solution is a cobalt containing additive which is only added for maintenance, according to analysis

optional recommended:

- SurTec 680 S Stabiliser in the final rinse (2 %vol)

make-up values: SurTec 680 LC 12.5 %vol
 SurTec 680 K Salt if necessary
 SurTec 680 C only for correcting the Co content

analytical values: SurTec 680 LC 12.5 %vol
 cobalt 1 g/l (> 1 g/l)
 (for make-up concentrations of 12.5 %vol SurTec 680 LC)

make-up: steps for the make-up:

 1. Fill in the calculated amount of SurTec 680 LC.
 2. Dilute with tap water to the final volume (hot tap water is possible).
 3. Check the pH value and adjust if necessary.

temperature: 60 °C (55-80 °C)

pH-value: 1.8 (1.8-2.0)
 adjust with nitric acid or NaHCO₃ (or Na₂CO₃)

application time: 60 s (30-90 s)

tank material: steel with heat resistant and acid resistant plastic coating

heating: necessary, out of acid resistant material (e.g. Teflon, glass)

agitation: rack or (low) air agitation

hints: As last step before Chromiting we recommend an acid activation in 0.5 %vol nitric acid (conc.), especially for parts plated in alkaline electrolytes. For zinc/nickel plated parts, an acid dip in hydrochloric acid is necessary (pH 1).

Because of the high make-up concentration of SurTec 680 LC, a feed-back of rinse-water is highly recommended. We'll be pleased to calculate the conditions for your line.
(please consult: <http://Chromiting.SurTec.com/>)

In case of recycling the feed-back rinsing water, the formed zinc sludge has to be removed out of the Chromiting bath (by sedimentation tank or filtration).

For rack applications it is recommended to install spray nozzles above the Chromiting bath, to rinse the parts while lifting out of the Chromiting solution to prevent drying of bath solution on top of the warm parts.

High iron contents in the Chromiting bath will firstly lead to a colour change of the Chromiting layer, and later the corrosion resistance could be lower than normal. So for baths with a high input of iron we recommend the installation of an ion exchange system. The specific ion exchange resin SurTec 680 IAT (see the separate product information sheet) is able to exchange selective the iron out of the Chromiting bath, without disturbing the passivation process.

recommended process sequence:

1. zinc or zinc alloy process
2. cascade rinsing
3. activation (nitric acid or hydrochloric acid) pH 1.0 for 10 s
4. rinse
5. Chromiting **SurTec 680 LC**
6. cascade rinsing
7. final rinse with 2 %vol SurTec 680 S Stabiliser
8. optional sealing SurTec 555 or SurTec 555 S
9. hot air drying (70-85°C)

The rinsing methods have to be adapted to the plating line.

Technical Specification

(at 20 °C)	Appearance	Density (g/ml)	pH-value
SurTec 680 LC	liquid, dark grey to violet	1.425 (1.38-1.47)	< 1
SurTec 680 K Salt	salt, white	0.900 (0.70-1.10) kg/l	-
SurTec 680 C	liquid, dark red, clear	1.235 (1.21-1.26)	4.8-7
SurTec 680 S	liquid, colourless, clear	1.120 (1.09-1.15)	6.5

Note: In the Chromiting concentrate SurTec 680, there is a light settling possible what will not impair its function.

Maintenance and Analysis

Check the pH-value regularly. Analyse and adjust the concentration of SurTec 680 LC Chromiting Concentrate regularly.

Strong dosages of SurTec 680 K Salt may lead to reduced cobalt concentrations. To raise the cobalt content, add SurTec 680 Cobalt Solution (10 ml/l SurTec 680 C correspond to 1 g/l cobalt). SurTec 680 LC Chromiting Concentrate can also be used for raising the cobalt content (125 ml/l SurTec 680 LC correspond to 1 g/l cobalt).

In case of using SurTec 680 S Stabiliser in the final rinse, the replenishment of the stabiliser should be done in the same ratio according to SurTec 680 LC Chromiting Concentrate in the Chromiting bath, or according to analysis (see further on).

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.

SurTec 680 LC – Analysis by Titration

reagents: sodium hydroxide (10 %)
 H₂O₂ (> 30 %)
 hydrochloric acid (1:1)
 potassium iodide
 0.1 N sodium thiosulfate solution (= 0.1 mol/l)
 starch solution (1 %)

procedure: Repeat determination:

1. Pipette 2 ml bath sample into a 250 ml beaker.
2. Add 20 ml NaOH solution (10 %), let it react for a short time.
3. Dilute with deionised water to approx. 100 ml.
4. Add 5 ml H₂O₂ to the cold solution, cover it with a watch glass and let it react for 5 min without stirring.
5. Add another 5 ml H₂O₂.
6. Now stir the solution and heat it up, boil it for exactly 20 min (the maximum evaporation loss should be 50 ml).
7. After cooling to room temperature, wash down the drops from the watch glass and from the beaker's walls, using small amounts of deionised water.
8. Dilute with deionised water to approx. 100 ml.
9. Acidify with 40 ml hydrochloric acid (1:1).
10. Add approx. 2 g potassium iodide (colour changes to dark red/brown).
11. Titrate with 0.1 mol/l sodium thiosulfate solution to a weak yellow colour of the solution.
12. Add a few drops of starch solution (colour changes to blue/violet).
13. Continue titrating until the colour disappears.

calculation: consumption in ml · 1.103 = %vol SurTec 680 LC

SurTec 680 LC – Analysis by Photometry

equipment:	spectrophotometer or filter photometer with 560 nm filter unit (± 50 nm) 100 ml measuring flask 10 ml pipette 1 cm cuvette
reagents:	hydrochloric acid (1:1) p. a.
procedure:	Prepare a 12 %vol standard solution (make up freshly at least every 3 month, see "possible errors"): Pipette 10 ml half conc. hydrochloric acid into a 1000 ml measuring flask. Add 12 ml SurTec 680 LC Chromiting Concentrate, fill up with deionised water and mix well. Before each sample measurement, fill the 12 %vol standard solution into a 1 cm cuvette, clean it with a soft cloth and measure it in the photometer at 560 nm against water. Note the extinction ES . Sample measurement: <ol style="list-style-type: none">1. Pipette 10 ml of the filtrated bath sample into a 100 ml measuring flask.2. Add about 1 ml half conc. hydrochloric acid.3. Fill up with deionised water and mix well.4. Fill this solution into a 1 cm cuvette.5. Measure the cuvette in the photometer at 560 nm against air.6. Note the extinction EP.
calculation:	$EP / ES \cdot 12 = \%vol \text{ SurTec 680 LC}$
possible errors:	<ul style="list-style-type: none">▪ Bath turbidity simulates a higher concentration, therefore the sample should be filtrated.▪ High amounts of iron impurities lead to wrong results.▪ Use the 12 %vol standard solution not longer than max. 3 month.

SurTec 680 LC – Analysis by AAS

equipment:	atomic absorption spectrometer (AAS) wave length: 357.9 nm
reagents:	acetylene/synth. air Cr-standards: 5, 10, 20 ppm hydrochloric acid (conc.) p. a.
procedure:	Make a dilution 1:1000: <ol style="list-style-type: none">1. Pipette 10 ml hydrochloric acid into a 1000 ml measuring flask.2. Add 1 ml bath sample and mix shortly.3. Wait 5 min before filling up.4. Fill up with deionised water and mix well.5. Calibrate the AAS with the standards and directly after this measure the prepared dilutions.
calculation:	$\text{measured value in ppm} \cdot 1.25 = \%vol \text{ SurTec 680 LC}$

- possible errors:
- The pipette has to be clean and should be rinsed with bath solution before it will be used for the bath sample.
 - If the reaction time of hydrochloric acid with the bath sample is too short, chrome has no good configuration for AAS measurement. The result will be too low.
 - Warm up the AAS lamp for 10-15 min (see AAS instructions).
 - Calibration has to be done before each measurement.
 - Older AAS lamps can leave the linear measurement range.

Cobalt – Analysis by AAS

- instruments: atomic absorption spectrometer (AAS)
 wave length: 240.7 nm
 slit: 0.2 nm
- reagents: hydrochloric acid (1:1)
 cobalt laboratory standards
- procedure: Prepare a dilution 1:200:
1. Pipette 1 ml bath sample into a 200 ml measuring flask.
 2. Add 5 ml hydrochloric acid (1:1).
 3. Fill up to 100 ml with deionised water and mix well.
 4. Measure against cobalt laboratory standards by AAS.
- calculation: measured value in ppm · 0.2 = g/l cobalt
- correction: rise by 1 g/l cobalt = addition of 10 ml/l SurTec 680 C
 or: addition of 125 ml/l SurTec 680 LC

SurTec 680 S (in the Final Rinse) – Analysis by Titration

- reagents: 0.1 N iodine solution
 hydrochloric acid (1:1)
 starch solution (1 % in deionised water)
- procedure:
1. Pipette 50 ml of the final rinsing bath into a 300 ml Erlenmeyer flask.
 2. Dilute with 50 ml deionised water.
 3. Add 20 ml hydrochloric acid (1:1).
 4. Add 1 drop of the starch solution.
 5. Titrate with 0.1 N iodine solution from colourless to blue.
- calculation: consumption in ml · 0.272 = %vol SurTec 680 S

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](#).

For each litre of dragged out solution, 125 ml of SurTec 680 LC concentrate has to be added; best is a dosage of SurTec 680 LC according to the throughput.

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

SurTec 680 LC	210 kg
SurTec 680 K Salt	60 kg
SurTec 680 C	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:

<u>product</u>	<u>hazard designation</u>	<u>water hazard class</u>
SurTec 680 LC	T - Toxic N - Dangerous for the environment	WHC 2
SurTec 680 K Salt	Xn - Harmful	WHC 1
SurTec 680 C	T - Toxic N - Dangerous for the environment	WHC 2
SurTec 680 S	-	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>

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Trouble shooting

problem	possible cause	remedy
slight white clouds on/in the Chromiting layer	a) if the clouds are already visible on the plated zinc (after activation)	check the quality of the parts, the pre-treatment and the zinc plating process
	b) insufficient rinsing and drying conditions	check the pH of the activation (< 1!); shorten the rinsing times (in total < 2 min); check the pH of the last rinse (best: 5-6) or use SurTec 680 S in the last rinse; optimize the drying process: first cold drying (air blow), then dry at 60-80 °C for 10-15 min
	c) pH of the Chromiting bath is too high	correct the pH with nitric acid to pH 1.8
	d) loss of complexing agent SurTec 680 K Salt (high zinc contents lead to precipitation of the complexing agent)	add SurTec 680 K Salt in steps of 1g/l (for 1 g/l zinc add 2 g/l SurTec 680 K Salt)
yellowish Chromiting layer	the content of iron in the bath is too high	find out the source of the iron contamination and prevent it; high amounts of iron can be precipitated and filtered by rising the pH to 3.5 (using sodium bicarbonate); Further dissolution of iron can be reduced by adding SurTec 660 A (only if SurTec 680 IAT is not used). For continuous input of iron we recommend the installation of an ion exchange system (SurTec 680 IAT).
pale colour of the Chromiting layer, bad corrosion protection	working parameters of the Chromiting are not correct	check concentration, pH-value, temperature, application time, agitation - and correct evtl. these parameters
discolouration of the Chromiting layers after 1-4 weeks	a) inadequate storage conditions	high humidity, high temperatures and salts on the part's surface impair the Chromiting layers
	b) too thin zinc layer	possible migration of base metal cations can lead to discolouration => Increase the plating time
	c) metal impurities in the zinc bath or the Chromiting bath	keep the electrolyte free from metal impurities; for the Chromiting bath: use the ion exchange SurTec 680 IAT for eliminating metal impurities
	d) in case of using a sealer: be aware that it is not too alkaline and the resulting layer not too thick	dilute the sealing bath; adjust the pH as low as possible