

HR 2015

Cyanide free alkaline bright zinc process based on sodium hydroxide

PROPERTIES

- Excellent metal distribution (only about 25 % of variance on a 1 A, 30 min Hull cell panel)
- A high brilliant zinc deposit
- Easy to chromate
- Very ductile, without blistering
- Perfectly suited for rack as well as 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

BATH MAKE UP

	Range	Optimum
Zinc oxide	10 - 16 g/l	12,5 g/l
Sodium hydroxide	110 - 150 g/l	120 g/l
Sodium carbonate	10 - 80 g/l	50 g/l
HR 2015 Carrier	5 - 15 ml/l	10 ml/l
HR 2015 Brightener	0.5 - 2 ml/l	1 ml/l
HR 2015 Conditioner	5 - 15 ml/l	10 ml/l
HR 2015 Purifier	0 - 4 ml/l	If necessary

Fill the tank to 1/3 with DI water, add and dissolve the sodium hydroxide in small portions while stirring the solution (attention: the solution becomes hot). Add the zinc oxide and stir until the solution is clear.

Dissolve the sodium carbonate and fill the tank with DI water to its final volume. Add the **HR 2015 Carrier** and the **HR 2015 Conditioner**. Dummy plate the solution at low current density for 6 - 8 hours. Finally add the **HR 2015 Brightener**.

ANALYTICAL VALUE AND MAINTENANCE

	Range	Optimum
Zinc	8 – 13 g/l	10 g/l
Sodium hydroxide	110 – 150 g/l	120 g/l
Sodium carbonate		< 80 g/L

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

ENVIRONMENTAL CONSIDERATIONS

All concentrates, rinse waters and waste solution must be treated and discharged according to local effluent control regulations. Chemicals shall not be stored below 10°C.

CONSUMPTION

	Due to drag out* (ml per kg NaOH)	Electrolytic (L per 10 kWh)
HR 2015 Carrier	83	0.5 – 1.5
HR 2015 Brightener	17	0.5 – 1.5
HR 2015 Conditioner	83	0

*valid only for the given make-up values

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

OPERATING PARAMETERS

Temperature	20 – 40°C
Cathodic current density	0.5 – 6 A/dm ²
Current efficiency	50 – 80 %
Deposition rate	0.2 µm/min
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

FUNCTION OF THE COMPONENTS

HR 2015 Carrier

The **HR 2015 Carrier** effectuates the excellent metal distribution.

HR 2015 Brightener

The **HR 2015 Brightener** is responsible for the brightness of the layer.

HR 2015 Conditioner

The **HR 2015 Conditioner** avoids negative optical influences of the layer due to water hardness or impurities of raw materials.

HR 2015 Purifier

The **HR 2015 Purifier** eliminates metal impurities as lead, cadmium or copper. Avoid overdosing of the HR 2015 Purifier. Test the addition of the purifier in the Hull cell before adding to the electrolyte.

ANODES

We recommend using inert anodes in combination with an external zinc generator. Despite this recommendation, **HR 2015** can of course be operated with soluble zinc anodes. However, we strongly warn 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 38) have to be 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. Anodic current density up to 20 A/dm².

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 semi bright nickel (NITEC SF). Fill the baskets with zinc clippings (approx. 100 mm ↑, 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 catalytically baskets and for determination of the size of the zinc generator, please consult SCA.

OPERATION WITH SOLUBLE 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/dm², the anodic current efficiency lies at 100 %. Above 3 A/dm² the anode gets covered with a semi conductive zinc oxide parting layer, the anode becomes black, the cell favour of 95 – 98 % O₂ 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.

LIABILITY

This instruction manual was compiled with reference to the state of the art and all current standards, and is based on the long-term knowledge and experience of SCA. However, SCA cannot monitor compliance with this instruction manual and the methods described herein at the customer/end-user's premises. Work carried out with SCA products must be adapted accordingly to meet local conditions. In particular, SCA cannot accept liability for damage, loss or cost incurred due to a failure to adhere to this instruction manual, improper application of the methods, unauthorized technical modifications, insufficient maintenance or the absence of maintenance in respect of the requisite technical hardware or equipment, or in the event of use by unqualified personnel. SCA is not liable for damage or loss caused by SCA or its employees except where intention or gross negligence can be proved. SCA furthermore reserves the right to make changes in relation to products, methods and the instruction manual without prior notice.

TROUBLE SHOOTING

Before consulting the following list, it should be verified that temperature, current density and analytical values stay within the above limit values. Hull cell tests should be done with a 250 mL. Hull cell at 1 A, 15 min on thorough fully pre-treated steel panels. The plated Hull cell panel should be rinsed in 0.5 vol % nitric acid for 15 s, rinsed again with tap water and dried with hot air.

Error	Cause	Remedy
Bright uniform layer within the whole current density range	Electrolyte is ok	None
Bad throwing power	Concentration of HR 2015 Carrier is too low	Add HR 2015 Carrier in steps of 2 – 5 ml/l, confirm each step by the wat of hull cell tests before addition to the bath
Low but uniform brightness within the whole current density range	Concentration of HR 2015 Brightener too low	Add HR 2015 Brightener in steps of 0.25ml/l, confirm each step by the wat of hull cell tests before addition to the bath
Dull irregular regions in the zinc deposit	a. Bad pretreatment	Improve the pretreatment (note: pretreatment of hull cell panels is very important for good test deposits)
	b. Water hardness too high	For water conditioning, add HR 2015 Conditioner to the electrolyte in steps of 3 – 5 ml/l, confirm each step by the wat of hull cell tests before addition to the bath
Dentrites, distributed in all current density region	Over dosage of HR 2015 Brightener	Work out
Bad current efficiency, no deposits in low current density area	a. Over dosage of HR 2015 Carrier	Work out
	b. Impurities of chromium (VI)	Add reduction agent sodium dithionite according to hull cell tests
Discoloured chromating layers	a. Chromating bath wrongly adjusted	Check chromating bath and activation
	b. Metal impurities in zinc electrolyte	Close the source of the impurities; dummy plate at low current densities
Dull grey low current density area	Lead impurities (about 1 ppm and higher)	a. Treatment of the electrolyte with 1 g/l zinc dust
		b. Add HR 2015 Purifier

CONVERSION OF STRANGE ELECTROLYTE TO HR 2015

For a complete conversion test, at least 3 L original electrolyte are necessary.
First indication.

1. Plate a Hull cell panel in a freshly prepared **HR 2015** electrolyte according to the instructions of the chapter "Trouble shooting".
2. Plate an "original" panel in the strange electrolyte without any additions. If the original panel is already bright, you can only try the over dosage effect, if it is less bright than panel 1, you can already get an indication on the receptivity of the old system for **HR 2015**
3. Add 5 ml/l **HR 2015 Carrier** and 0.5 ml/l **HR 2015 Brightener** 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.

MIDDLE TERM COMPATIBILITY

1. Fill 1.8 L original bath into a 2 L beaker, hang in a small hull cell soluble zinc anode an a pre-eated Jiggle cell panel (or, if not available. a 15 cm long and about 4 cm wide steel sheet) as a cathode, put it into a magnetic stirrer and stir slowly, connect anode and cathode to the rectifier and plate with 1 A for 8 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 "Trouble Shooting"
3. Add 5 mL **HR 2015 Carrier** and 0 5 mL **HR 2015 Brightener** to the Hull cell and repeat the test
4. repeat (3) until a good result is achieved

LONG TERM COMPATIBILITY

1. Prepare 1 L of a fresh HR 2015 electrolyte with the desired concentrations of zinc and NaOH or KOH and add 10 mL/L HR 2015 Carrier, 1 mL/L HR 2015 Brightener, 10 mL/L HR 2015 Conditioner and 1 mL/L HR 2015 Purifier.
2. If the first indication test (see above) had shown a lack of brightness in the original bath then add 0.5 mL/L HR 2015 Brightener to the untreated strange electrolyte
3. Prepare 5 dilutions with a total volume of 250 mL each of the strange electrolyte (if necessary + HR 2015 Brightener) with the HR 2015 electrolyte mentioned above.
 - a. 225 ml original bath + 25 ml HR 2015 electrolyte
 - b. 175 ml original bath + 75 ml HR 2015 electrolyte
 - c. 125 ml original bath + 125 ml HR 2015 electrolyte
 - d. 75 ml original bath + 175 ml HR 2015 electrolyte
 - e. 25 ml original bath + 225 ml HR 2015 electrolyte

Plate a Hull cell panel in each electrolyte mixture

There should not be any negative effect in any dilution. If e.g. the panel plated in bath c) had an unexpected 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.

ANALYSIS

Sample preparation

Take the sample at a homogeneously mixed position and let it cool down to room temperature. If turbid, allow to settle and decant or filter.

Zinc

Reagents	0.1 mol/l Na ₂ EDTA Buffer solution (100 g/l NaOH and 240 ml/l 98% acetic acid in DI water indicator: xylenol orange, (mixture of 1% in KNO ₃)
Procedure	Pipette 5 ml Sample into a 250 ml Erlenmeyer flask, add about 100 ml DI water, 20 ml Buffer solution and A spatula tip Of indicator. Titrate with 0.1 mol/l EDTA from red to yellow
Calculation	Zinc (g/l) = Consumption in ml x 1.3078

Sodium hydroxide

Reagents	0.5 mol/l sulphuric acid Indicator: 0.1% solution of tropaeolin 0
Procedure	Pipette 5 ml Sample into a 250 ml Erlenmeyer flask, add about 100 ml DI water, 5 drops Of indicator and titrate with 0.5 mol/l sulphuric acid from orange-brown to yellow
Calculation	KOH (g/l) = Consumption in ml x 8.00

Sodium carbonate

Reagents	Barium nitrat solution 5% Hydrochloric acid 1 mol/l Sodium hydroxide 1 mol/l Indicator: 0.04% methyl orange solution
Procedure	Pipette 10 ml Sample into a 250 ml Erlenmeyer flask, add 50 ml DI water and boil solution. Add 75 ml Barium chloride solution and stir for another 30 s. filter by suction and rinse with hot deion. water until the rinse water is neutral Put the filter in a 250 beaker and add

100 ml DI water, pipette
20.0 ml Hydrochloric acid 1 mol/l, and heat the
solution shortly.
After cooling down, add
3 drops Methyl orange solution
Titrate with sodium hydroxide 1 mol/l until the colour
turns from red to orange - yellow
Sodium carbonate (g/l) = (20 – consumption in ml) x
5.3

Calculation