riag Oberflächentechnik AG · Postfach 169 · CH-9545 Wängi TG

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riag Cr 320

High efficiency bright chromium electrolyte

The bright chromium process **riag Cr 320** is a mixed-acid chromium electrolyte. It is applied for deposition of decorative bright chromium layers. The special characteristic of this electrolyte is excellent covering power which can be obtained by operation within a wide range of current density.

riag Cr 320 may be applied with 300 g/L as well as with 200 g/L chromic acid (Chromium trioxide).

High chromic acid concentrations have a positive effect to conductivity, tolerance to contaminations and there lower variations in the composition as is usual for chrome electrolytes.

Make up quantities

	Standard make up	low concentrated make up
Chromic acid (CrO_3)	300 g/L	200 g/L
Sulphuric acid, chem. pure (D = 1.84 g/mL)	0.65 mL/L	0.44 mL/L
riag Cr 320 Additive 1	25 mL/L	15 mL/L
riag Cr 320 Additive 2	30 mL/L	20 mL/L

The necessary quantity of chromic acid has to be dissolved in 70 % of the final electrolyte volume. For the make up and the current level balance deionised water is necessary. After the dissolution of the chromic acid the necessary quantities **riag Cr 320 Additive 1 and 2** and the sulphuric acid has to be added. Now add the deionised water until the final electrolyte volume is reached and mix well.

Afterward the electrolyte has to be worked through during 2 to 3 hours.

We recommend the application of **riag Cr 320 Tenside** for the reduction of atomised spray.

Operating Conditions

Density:	300 g/L make-up = 1.21 g/cm^3	(abt. 25 °Be)
	200 g/L make-up = 1.14 g/cm^3	(abt. 18 °Be)
Temperature:	35 – 50 °C, preferably 40 °C	
Current density:	10 – 25 A/dm² (anode and cathode) preferably 10 A/dm²	
Voltage:	The voltage is mainly depending upon the plant- and operating conditions. Average voltage: 6 – 12 V.	
Anode material:	use lead alloy anodes. PbSn with 6 % Sn	
Rectifiers:	Usually 8 Volt units, for higher outputs usually 12 Volt units. The rectifiers must provide a residual ripple of less than 5 % within the whole current range.	
Equipment:	See instruction sheet R 20	
Rate of deposition:	Rate of deposition (standard make up) at between 40 and 50 °C and cathodic current densities of:	
	10 A/dm^2 = approx. 0.08 µm/min.	
	15 A/dm^2 = approx. 0.14 µm/min.	
	20 A/dm^2 = approx. 0.22 µm/min.	
	25 A/dm^2 = approx. 0.29 µm/min.	

Maintenance

Standard make up	280 – 350 g/L CrO_3 The widest range of operation is achieved at a concentration of 320 – 340 g/L CrO_3.
Low conc. make up	180 – 220 g/L CrO_3
Sulphuric acid	0.4 – 0.6 % (in relation to the content of chromic acid) Sulphuric acid is only added after made analysis, whereat it should also be taken care that the H_2SO_4 content between 0.4 – 0.6 % of the CrO_3 content is maintained (0.4 % H_2SO_4 at lower the CrO_3 values, at higher ones 300 g/L the CrO_3) 0.6 % H_2SO_4)
Barium carbonate:	To reduce (precipitate) 1 g of sulphuric acid 2.2 g barium carbonate are necessary.

Under normal working conditions and if strictly adhering to our recommendations, corrections are required in exceptional cases only and will be prescribed by us after analysis of the solution.

For your kind attention

Send electrolyte samples only in packages approved for transport! Fill in the tag precisely!

Reinforcement

The electrolyte is reinforced by adding chromic acid and **riag Cr 320 Additive 1 and 2.**
For increasing the density by 1 °Be, an addition of 1.5 kg chromic acid per 100 L solution is required. When adding chromic acid, **riag Cr 320 Additive 1 and 2** are added in the same ratio as the make-up.

To 100 kg chromic acid are added:
10 L **riag Cr 320 Additive 1** and
10 L **riag Cr 320 Additive 2**

Attention: Addition of other chemicals may cause trouble and may adversely affect the performance of the electrolyte and the quality of the deposits.

Pertaining to these technical Data Sheet

R1 - Working precautions for operation and plating solutions
R20 - Technical equipment for chrome electrolyte
R21 - Make up and maintenance of chrome electrolytes
R22 - Anodes for chrome plating solutions

Safety arrangements

We recommend wearing safety glasses, gloves and protective clothing during working with chromic acid.
For further information please consult the material safety data sheets.

Waste water treatment / Environmental protection

The concentrates as well as their rinsing waters contain chromium (VI) and are extremely dangerous for waste water treatment plants. The waste water needs to be prepared according legal regulations before getting in the canalisation.

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 riag. However, riag cannot monitor compliance with this instruction manual and the methods described herein at the customer/end-user's premises. Work carried out with riag products must be adapted accordingly to meet local conditions. In particular, riag cannot accept liability for damage, loss or cost incurred due to a failure to adhere to this instruction manual, improper application of the methods, unauthorised 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. riag is not liable for damage or loss caused by riag or its employees except where intention or gross negligence can be proved.
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Analysis (Analytical Method)

Sample preparation: The sample must be taken from a well-mixed point and allowed to cool down to 25 °C.

Chromic acid (chromium trioxide)

Reagents:		Sulfuric acid 1 : 1 (approx. 60 %)
		Potassium iodide solution 10 %
		Starch solution 1 %
		Sodium thiosulfate solution 0.1 mol/L
Procedure:		pipette
	1 mL	electrolyte into a 50 mL measuring flask and fill up to the mark with deionised water, mix well
		pipette
	10 mL	of the diluted solution into a
	100 mL	beaker, add
	30 mL	deionised water, add
	10 mL	sulfuric acid 1 : 1, add
	10 mL	potassium iodide solution, the solution turns dark
		titrate with sodium thiosulfate solution 0.1 mol/L to light-yellow, add
	2 mL	starch solution (solution turns dark again) and titrate with sodium thiosulfate solution 0.1 mol/L to green

Calculation:

Chromium trioxide = consumption of sodium thiosulfate 0.1 mol/L in mL x 16.67 = g/L CrO_3

Error index – cause and remedy

Error	Cause	Remedy
Lessened / no chrome deposition	No or insufficient current at the articles	Control power source, circuit lines, anodes, fittings and contacts
	Incorrect pre-treatment	Check pre-treatment Control mild etching
	Sulphuric acid content too high	Correct after analysis
	Strong contamination by e.g. acetate, phosphate, nitrate	Control and statement by riag
Partly no chrome deposition	Anodes do not contact	Check anodes and jigs
	Development of gas pockets	Change position of articles on the jigs The developing hydrogen gas must have the possibility to escape
	Sulphuric acid content too high	Correct after analysis
	Current density too low	Adjust current density
	Insufficient pre-treatment	Control pre-treatment

Error	Cause	Remedy
Bad covering power	Temperature too high	Adjust temperature to 40 °C
	Sulphuric acid content too high	Adjust sulphuric acid content
	Cr_2O_3-content too high	Dummy plating
	Ratio anode: cathode not correct	Adjust ratio of anode surface to cathode surface to 2.5 : 1
	Current density too low	Control current density
	Contamination by bivalent and trivalent metals too high	Locate the cause of error
	Incorrect pre-treatment	Control pre-treatment and improve Check mild-etching (cast metal) Special covering with higher current density
Formation of nodules	Insufficient pre-treatment of the base material	Control mechanical pre-treatment
	Electrolyte agitation respectively air injection	Try to avoid electrolyte agitation
	Incorrect etching	Check etching solutions, analyse and correct Control etch conditions e.g. vary current density and etching times
	Sulphuric acid content too low	Adjust sulphuric acid content to nominal values

Error	Cause	Remedy
Burnings	Temperature too low	Adjust temperature to 40 °C
	Current density too high	Control current density
	Incorrect shielding	Control shielding and improve if necessary
	Chromic acid content too low	Analyse and correct
	Chloride contaminations	Analysis, locate the source of the chloride contamination Apply chlorine- and chloride-free water for topping up Add a silver anode
Desired coating thickness is not obtained	Current density too low	Control calculation for current density Check ammeter and apparatus for thickness measuring
	Treatment time too short	Check treatment time
	Depositions on tracks and shielding	Control racks
	Residual ripple of rectifier e.g. too high	Control rectifier
	Incorrect composition of electrolyte, e.g. CrO_3-content too high or too low or sulphuric acid content to high	Analytical control and correction

Error	Cause	Remedy
Dull, milky deposits	Temperature too high	Adjust temperature to 40 °C
	Content of **riag Cr 320 Additive 1** to high	Dilute or add chromic acid
	Impurity of phosphate	Send sample to riag
	Plating time to long	Reduce plating time
Blue to greyish milky deposits	Impurity of nitrates	Dummy plating with high current density