

riag Cr 321

High efficiency bright chromium electrolyte

The bright chromium process **riag Cr 321** 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.

Make up quantities

	Standard make up	low concentrated make up
Chromic acid (CrO ₃)	300 g/L	190 g/L
Sulphuric acid, chem. pure (D = 1.84 g/mL)	0.65 mL/L	0.44 mL/L
riag Cr 321 Additive	30 mL/L	20 mL/L

Equipment: See instruction sheet R 20

Make up instructions: See instruction sheet R 21

The necessary quantity of chromic acid (Chromium trioxide) 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 quantity **riag Cr 321 Additive** 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:	Standard Make up:	Be (15 °C) = 25 ° (20 °C) = 1.21 g/cm ³
	Low concentrated make up	Be (15 °C) = 17 ° (20 °C) = 1.135 g/cm ³
Temperature:	35 – 50 °C	
Current density:	10 – 25 A/dm ² (Anode and Cathode)	
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.	
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
Low conc. make up	170 – 210 g/L CrO ₃
Sulphuric acid	0.4 – 0.6 % (in relation to the content of chromic acid)

The widest range of operation is achieved at a concentration of 320 – 340 g/L CrO₃.

Reinforcement

The electrolyte is reinforced by adding chromic acid and **riag Cr 321 Additive**.

For increasing the density by 1 ° Be, an addition of 1.5 kg chromic acid per 100 L solution is required. At addition of chromic acid, 10 % of the quantity of **riag Cr 321 Additive** have likewise to be added (1 kg CrO₃ needs 0.1 L **riag Cr 321 Additive**). Sulphuric acid is only added after made analysis, whereat it should also be taken care that the H₂SO₄ content between 0.4 – 0.6 % of the CrO₃ content is maintained

(0.4 % H₂SO₄ at lower the CrO₃ values, at higher ones 300 g/L the CrO₃ 0.6 % H₂SO₄).

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.

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

For your kind attention

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

Safety arrangements

We recommend wearing safety glasses, gloves and protective clothing during working with chromic acid. For further information please consult the 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. riag furthermore reserves the right to make changes in relation to products, methods and the instruction manual without prior notice.

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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 CrO₃

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
Dull, milky deposits	Temperature too high	Adjust temperature to 40 °C
	Content of riag Cr 321 too high	Dilute or add chromic acid
	Impurity of phosphate	Send sample to riag
	Plating time too long	Reduce plating time
Blue to greyish milky deposits	Impurity of nitrates	Dummy plating with high current density

Error	Cause	Remedy
Bad covering power	<p>Temperature too high</p> <p>Sulphuric acid content too high</p> <p>Cr₂O₃-content too high</p> <p>Ratio anode: cathode not correct</p> <p>Current density too low</p> <p>Contamination by bivalent and trivalent metals too high</p> <p>Incorrect pre-treatment</p>	<p>Adjust temperature to 40 °C</p> <p>Adjust sulphuric acid content</p> <p>Dummy plating</p> <p>Adjust ratio of anode surface to cathode surface to 2.5 : 1</p> <p>Control current density</p> <p>Locate the cause of error</p> <p>Control pre-treatment and improve Check mild-etching (cast metal) Special covering with higher current density</p>
Formation of nodules	<p>Insufficient pre-treatment of the base material</p> <p>Electrolyte agitation respectively air injection</p> <p>Incorrect etching</p> <p>Sulphuric acid content too low</p>	<p>Control mechanical pre-treatment</p> <p>Try to avoid electrolyte agitation</p> <p>Check etching solutions, analyse and correct Control etch conditions e.g. vary current density and etching times</p> <p>Adjust sulphuric acid content to nominal values</p>

Error	Cause	Remedy
Burnings	<p>Temperature too low</p> <p>Current density too high</p> <p>Incorrect shielding</p> <p>Chromic acid content too low</p> <p>Chloride contaminations</p>	<p>Adjust temperature to 40 °C</p> <p>Control current density</p> <p>Control shielding and improve if necessary</p> <p>Analyse and correct</p> <p>Analysis, locate the source of the chloride contamination Apply chlorine- and chloride-free water for topping up Add a silver anode</p>
Desired coating thickness is not obtained	<p>Current density too low</p> <p>Treatment time too short</p> <p>Depositions on tracks and shielding</p> <p>Residual ripple of rectifier e.g. too high</p> <p>Incorrect composition of electrolyte, e.g. CrO₃-content too high or too low or sulphuric acid content too high</p>	<p>Control calculation for current density Check ammeter and apparatus for thickness measuring</p> <p>Check treatment time</p> <p>Control racks</p> <p>Control rectifier</p> <p>Analytical control and correction</p>