

riag Cr 332

Hard chromium electrolyte with high current efficiency

The hard chromium process **riag Cr 332** deposits hard chromium layers which excels in the following benefits:

Properties

- High plating speed (up to 1 $\mu\text{m}/\text{min}$)
- Excellent protection against corrosion
- Highly bright coatings
- Fluoride free, therefore only slight attack on iron
- Hardness of approximately 1000 HV (0,1)
- Micro-cracked deposits
- High cathodic current efficiency (up to 27 %)
- Good throwing power

Make up values

	Target value	Optimum
Chromium trioxide (CrO_3)	250 – 320 g/L	300 g/L
riag Cr 332 Additive	45 – 55 mL/L	50 mL/L
Sulphuric acid 96 % chemical pure (H_2SO_4)	1.4 – 2.0 mL/L	1.5 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 quantity **riag Cr 332 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.

Equipment / Working conditions

Tank material:	SM-steel with rubber or special plastic lining
Heating:	Immersion heaters (porcelain or PTFE)
Anodes:	We recommend the application of platinized titanium anodes. By using them, make sure, that the platinum surface is covered with a lead dioxide film (brown-black layer). The lead dioxide film is obtained using one or more lead alloy anodes together with the platinized titanium anodes. Only under this condition Cr^{3+} is oxidized to Cr^{6+} (important, because otherwise the value of chromium-(III) increases too much). The ratio of the anode and cathode surface should be 2.5 : 1.
Temperature:	55 – 65 °C
Voltage:	6 – 12 volt (max. 15 volt)
Current density:	50 A/dm ² (20 – 60 A/dm ²)
Anodic current density:	20 – 30 A/dm ²
Rectifiers:	12 volt units, respectively 15 volt units for higher outputs. The residual ripple must be below 5 %.
Exhaust:	An exhaust is absolutely necessary.
Deposition rate:	At 55 A/dm ² the chromium deposition rate is around 1 µm/min.

Electrolyte control and maintenance

Regular analysis of the chromic and sulphuric acid are necessary.

Electrolyte values:	Target value	Optimum
Chromium trioxide (chromic acid)	250 – 320 g/L	300 g/L
Sulphuric acid (referred to the concentration of chromic acid)	1.0 – 1.2 %	1.1 %
Chromium-(III)-oxide	2 – 6 g/L	3 g/L

Reinforcement: Per 10 kg chromic acid add 1 L **riag Cr 332 Additive**. Missing sulphuric acid has to be added with chemical pure sulphuric acid.

Barium carbonate: To reduce (precipitate) 1 g of sulphuric acid 2.2 g barium carbonate are necessary.

Mode of operation of riag Cr 332 Additive

An insufficiency of **riag Cr 332 Additive** results in milky dull deposits. Both the plating speed and the hardness of the chromium deposits will be lessened. The number of micro cracks lowers also and lessened the good layer quality.

An excess heads towards burnings in the areas with high current density. A too high concentration of **riag Cr 332 Additive** can be dropped only by diluting the electrolyte.

To guarantee a failure-free operation we recommend sending an electrolyte sample frequently to the riag laboratory in order to analyse it.

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. 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