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

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riag Cu 397

Bright cyanide copper rack process

The **riag Cu 397** bright copper process produces light, bright deposits on all materials. The **riag Cu 397** process has to operated as rack variant. The deposits are active and can be further plated without any problems. The process can be used either with potassium or sodium salts.

Properties

- Good brightness
- Very good thickness distribution
- High ductility
- Very good brightness throwing power
- Very active deposits

Make up

	Potassium electrolyte		Sodium electrolyte	
	Range	Optimum	Range	Optimum
Sodium cyanide			95 – 105 g/L	100 g/L
Potassium cyanide	125 – 165 g/L	155 g/L		
Copper cyanide	65 – 85 g/L	80 g/L	55 – 75 g/L	70 g/L
Sodium carbonate			20 – 30 g/L	20 g/L
Potassium carbonate	20 – 30 g/L	20 g/L		
Sodium hydroxide			1 – 10 g/L	4 g/L
Potassium hydroxide	1 – 10 g/L	4 g/L		
riag Cu 397 Carrier		2 mL/L		2 mL/L
riag Cu 397 Brightener		1 mL/L		1 mL/L
riag Cu 397 Tenside		2 mL/L		2 mL/L

If the process is used to plate zinc- and aluminium-alloys, hydroxide must not be added.

Operating values

	Potassium electrolyte		Sodium electrolyte	
	Range	Optimum	Range	Optimum
free cyanide	35 – 40 g/L	35 g/L	25 – 30 g/L	25 g/L
M factor	1.5 – 1.7	1.6	1.9 – 2.1	2.0
Copper	45 – 60 g/L	56 g/L	40 – 55 g/L	50 g/L
Sodium carbonate			20 – 70 g/L	20 g/L
Potassium carbonate	20 – 150 g/L	20 g/L		
Sodium hydroxide				4 g/L
Potassium hydroxide		4 g/L		

Make up

In a separate container ¾ of the end volume is filled with deionised water and heated to at least 40 °C. Now the salts have to be added. After the salts have fully dissolved water is added to reach the final volume. Because of possible contaminations of the salts an intensive filtration of the electrolyte is recommended. For the same reason, dummy plating for at least 5 hours is recommended. At the end the according amounts of **riag Cu 397 Additives** are added.
If the process is used to plate zinc- and aluminium-alloys, hydroxide must not be added.

Working conditions

Temperature	50 °C (45 – 55 °C)
pH-value	10.4 (10.0 – 10.8), only important for plating zinc- and aluminium-alloys
Cathodic current density	0.5 – 2.0 A /dm^2 (0,4 µm/min. at 1 A/dm^2)
Anodic current density	max. 1.0 A /dm^2
Current interruption/ polarity change	8 sec. cathodic, 2 sec. without current or 10 – 40 sec. cathodic, 0.5 – 5 sec. anodic The **riag Cu 397** bright copper process may also be operated without this procedure i.e. with permanent cathodic current
Anodes	Copper anodes free of phosphorus, with a purity of at least 99.96 % (OFHC). We recommend polypropylene anode bags. The bags have to be treated first with hydrochloric acid 10 % and washed with water before usage.
Agitation	Agitation of the electrolyte by filter pump, movement of goods required
Container	Plastic containers or coated steel containers
Filtration	A permanent filtration is recommended. The electrolyte should be turned over 2 – 3 times / hour.
Heating	Ceramic glass heaters with temperature control

Cooling	Not necessary
Exhaust	Essential
Maintenance	Analysis and correction of free cyanide, copper, carbonate and hydroxide.
pH-adjustment	Use acetic acid 10 % to lower pH, however, usually not necessary
Consumption	Additives are consumed by drag-out as well as electrochemically, i.e. by anodic and cathodic processes. Consumption therefore may vary

riag Cu 397 Brightener	1.5 – 2.5 L/10 kAh
riag Cu 397 Carrier	1.5 – 2.5 L/10 kAh

The two additives must not be pre-mixed!

Consumption of **riag Cu 397 Tenside** depends on drag-out loss, but normally addition is not necessary.

Environmental considerations

All concentrates, rinse water and wastewater must be treated and discharged according to local effluent control regulations.

Safety instructions

Please refer to the safety data sheet and the general instructions for handling chemicals. Chemicals must not be stored below 10 °C.

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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Analytical procedures

Sample preparation:	Take a sample from the well mixed electrolyte. Cool down to room temperature.

Free cyanide

Reagents:	Silver nitrate solution 0.1 mol/L Potassium iodide solution 10 % Ammonia solution 25 %	
Procedure:		pipette
	10 mL	electrolyte in a 300 mL Erlenmeyer flask, add
	40 mL	deion. water, add
	3 drops	Ammonia solution, add
	10 mL	Potassium iodide solution

Titrate with Silver nitrate solution until a stable yellowish opalescence occurs.

Attention: Always carry out titration under the same conditions. Increased temperature or higher dilution will give higher analytical results.

Calculation:

free Sodium cyanide (g/L) = mL Silver nitrate x 0.98

free Potassium cyanide (g/L) = mL Silver nitrate x 1.30

Copper

Reagents:	Ammonium peroxodisulfate solid Ammonia solution 25 % PAN-indicator (0.1 % in Ethanol) EDTA solution 0.1 mol/L	
Procedure:		pipette
	1 mL	electrolyte in a 300 mL Erlenmeyer, add
	approx. 1 g	ammonium peroxodisulfate, add
	10 mL	deion. water, add
	5 mL	ammonia solution (sample turns blue), add
	100 mL	deion. Water, add
	10 drops	PAN-indicator

Titrate with EDTA until the colour turns from blue to green.

Calculation:

Copper (g/L) = mL EDTA x 6.354

Copper cyanide (g/L) = mL EDTA x 8.96

Potassium copper cyanide (g/L) = mL EDTA x 21.98

Sodium copper cyanide (g/L) = mL EDTA x 18.75

Carbonate

Reagents:	Barium chloride 10 % Methyl orange 0.1 % in water Hydrochloric acid 1 mol/L Sodium hydroxide 1 mol/L	
Procedure:		pipette
	10 mL	electrolyte in a 250 mL beaker, add
	100 mL	deion. water and heat until boiling, add
	50 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 mL beaker and add
	150 mL	hot deion. water, add
	30.0 mL	Hydrochloric acid 1 mol/L, stir, add
	5 drops	Methyl orange solution

Titrate with sodium hydroxide 1 mol/L until the colour turns from pink to yellow.

Calculation:	Sodium carbonate (g/L)	= (30 - mL NaOH 1 mol/L) x 5.3
	Potassium carbonate (g/L)	= (30 - mL NaOH 1 mol/L) x 6.9

Hydroxide

Reagents:	Hydrochloric acid 1 mol/L Indigo carmine (sodium chloride 1:100)	
Procedure:		pipette
	25 mL	electrolyte in a 50 mL beaker
		do not dilute with water, add
	ca. 150 mg	indigo carmine

Titrate slowly with hydrochloric acid from mustard yellow to light green then turquoise, colour change at light blue, light blue has to last

Calculation:	Sodium hydroxide (g/L)	= mL Hydrochloric acid x 1.6
	Potassium hydroxide (g/L)	= mL Hydrochloric acid x 2.24