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riag Cu 396

Bright cyanide copper barrel process

The **riag Cu 396** bright copper process produces light, bright deposits on all materials. 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			85 – 135 g/L	110 g/L
Potassium cyanide	110 – 170 g/L	140 g/L		
Copper cyanide	60 – 100 g/L	80 g/L	60 – 100 g/L	80 g/L
Sodium carbonate			20 – 30 g/L	25 g/L
Potassium carbonate	20 – 30 g/L	25 g/L		
Sodium hydroxide			1 – 10 g/L	5 g/L
Potassium hydroxide	1 – 10 g/L	5 g/L		
riag Cu 396 Make up	3 – 5 mL/L	4 mL/L	3 – 5 mL/L	4 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	25 – 30 g/L	27 g/L	20 – 25 g/L	22 g/L
Copper	42 – 70 g/L	55 g/L	42 – 70 g/L	55 g/L
Sodium carbonate			20 – 70 g/L	25 g/L
Potassium carbonate	20 – 150 g/L	25 g/L		

Make up

In a separate container $\frac{3}{4}$ 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. At the end the according amount of **riag Cu 396 Make up** is added. 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.

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

Working conditions

Temperature	52 °C (45 – 65 °C)
pH	10.4 (10.0 – 10.8), only important for plating zinc- and aluminium-alloys
Cathodic current density	0.5 – 3.0 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 396 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, barrel rotation.
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 needed
Exhaust	Essential

Maintenance	Analysis and correction of free cyanide, copper, carbonate and hydroxide. Addition of riag Cu 396 Brightener (2.7 x) according to ampere hours
pH-adjustment	Use acetic acid 10 % to lower pH.
Consumption	Additives are consumed by drag-out as well as electrochemically. Consumption therefore may vary riag Cu 396 Brightener (2.7 x): 0.2 – 10 L/10 kWh Consumption varies in particular due to the following influencing parameters: Sodium electrolyte (significantly higher consumption) pH value 10 – 10.5 (significantly higher consumption) Minimum consumption results from: Potassium electrolyte at pH value 12 – 14 The wetting agent is part of the riag Cu 396 Brightener (2.7 x) , so that only the addition of brightener is necessary for ongoing operation. riag Cu 396 Make up consumption depends only on drag-out loss.

Effects of the electrolyte components

riag Cu 396 Make up

Is mainly used for electrolyte make up.

riag Cu 396 Brightener (2.7 x)

Is used for replenishment. A lack of **riag Cu 396 Brightener (2.7 x)** causes loss of brightness in all current density areas. An addition of 0.2 to 0.8 mL/L **riag Cu 396 Brightener (2.7 x)** is sufficient to reobtain bright deposits in all current density areas. Excess leads to dull deposits at low current density areas that cannot be fixed by addition of **riag Cu 396 Brightener (2.7 x)**.

Remedy: By dummy plating or lowering the temperature by min. 5 °C.

Active carbon treatment

A continuous filtration with active carbon is **not** recommended.

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

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riag Oberflächentechnik AG
Murgstrasse 19a
CH-9545 Wängi
T +41 (0)52 369 70 70
F +41 (0)52 369 70 79
riag.ch
info@riag.ch

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:

10 mL	pipette
100 mL	electrolyte in a 250 mL beaker, add
50 mL	deion. water and heat until boiling, add
	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:

25 mL	pipette
	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