

# RIAG Cu 390

## Bright cyanide copper barrel process

The **RIAG Cu 390** bright copper process produces semi 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		
<b>RIAG Cu 390 Make up</b>	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 390 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.

## 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 <sup>2</sup>
Anodic current density	Max. 1.0 A /dm <sup>2</sup>
Current interruption/ polarity change	8 sec. cathodic, 2 sec. without current or 10 – 40 sec. cathodic, 0.5 – 5 sec. anodic The <b>RIAG Cu 390</b> 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 <b>RIAG Cu 390 Brightener</b> according to ampère hours
pH-adjustment	Use acetic acid 10 % to lower pH.
Consumption	Additives are consumed by drag-out as well as electrochemically. Consumption therefor may vary  <b>RIAG Cu 390 Brightener:</b> 1.0 – 2.5 L/10 kWh  The wetting agent is part of the <b>RIAG Cu 390 Brightener</b> . So only <b>RIAG Cu 390 Brightener</b> has to be added under normal conditions.  <b>RIAG Cu 390 Make up</b> consumption depends only on drag-out loss.

## Effects of the electrolyte components

### RIAG Cu 390 Make up

Is mainly used for electrolyte make up. A lack of **RIAG Cu 390 Make up** causes dark red or even amorphous deposits in the low current density areas.

Addition of 0.5 – 2 mL/L **RIAG Cu 390 Make up** is sufficient to get bright deposits.  
Excess of **RIAG Cu 390 Make up** causes dull deposits in low current density areas. This can only be corrected by either dummy plating or lowering the temperature by 5 °C.

### RIAG Cu 390 Brightener

Is used for replenishment. A lack of **RIAG Cu 390 Brightener** causes loss of brightness in all current density areas. An addition of 0.1 to 0.5 mL/L 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 390 Brightener**.  
This can only be corrected by dummy plating or lowering the temperature by 5 °C.

### Active carbon treatment

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

## Environmental Considerations

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

## Liability

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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: 10 mL pipette 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.

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: 1 mL pipette 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
1.5 mL	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