COLUMBIA® CHEMICAL
Simplifying Surface Finishing®

COL-COPPER CNCU

TECHNICAL DATA
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COL-COPPER CNCU

HIGH SPEED BRIGHT COPPER CYANIDE PROCESS

COL-COPPER CNCU	is a high-speed cyanide copper plating process designed for plating bright, fine grained and uniform deposits over a wide range of current densities.
COL-COPPER CNCU	is particularly suited for plating over Zinc die-castings, has excellent buffability properties, and can be used in both barrel and rack operations.
COL-COPPER CNCU	may be used with direct current, interrupted current, or periodic reverse.

OPERATING PARAMETERS

POTASSIUM FORMULATION	RANGE	OPTIMUM
Copper as Metal (Cu)	4 - 6 opg (30 - 45 g/l)	5 opg (37.5 g/l)
Copper Cyanide (CuCN)	6.0 - 8.0 opg (45 - 60 g/l)	7.0 opg (52 g/l)
Total Potassium Cyanide	11 - 15 opg (83 - 113 g/l)	13 opg (98 g/l)
Free Potassium Cyanide	2.0 - 3.0 opg (15 - 23 g/l)	2.5 opg (19.0 g/l)
Potassium Hydroxide	1.5 - 3.5 opg (11 - 26 g/l)	2.5opg (17 g/l)

SODIUM FORMULATION	RANGE	OPTIMUM
Copper as Metal (Cu)	4 - 6 opg (30 - 45 g/l)	5 opg (37.5 g/l)
Copper Cyanide (CuCN)	6.0 - 8.0 opg (45 - 60 g/l)	7.0 opg (52 g/l)
Total Sodium Cyanide	8 - 12 opg (60 - 90 g/l)	10 opg (75 g/l)
Free Sodium Cyanide	2.0 - 3.0 opg (15 - 23 g/l)	2.5 opg (19.0 g/l)
Sodium Hydroxide	1.0 - 3.0 opg (11 - 26 g/l)	2.5opg (17 g/l)

SOLUTION MAKEUP

1. Fill tank to 60% of working volume.
2. Slowly, and with mechanical agitation, add either potassium or sodium cyanide to bath, depending on formula desired. Agitate until fully dissolved.
3. Slowly, and with mechanical agitation, add copper cyanide to bath until fully dissolved. Bath should have a clear appearance.
4. Slowly, and with mechanical agitation, add either potassium or sodium hydroxide to bath. Bath will heat up as addition is made.
5. Add addition agents as stated below.
6. Bring tank to working volume, allow to mix until thoroughly homogeneous.

EQUIPMENT

TANKS	Steel
AGITATION	Mechanical Agitation only
ANODES	OFHC Copper
FILTRATION	Continuous with DE and carbon
ANODE BAGS	Nylon

MAINTENANCE ADDITIONS

ADDITION AGENTS

COL-COPPER CNCU BRIGHTENER	0.05 - 0.5% by volume
COL-COPPER CNCU GRAIN REFINER	3.0 - 5.0 % by volume

FUNCTION OF ADDITION AGENTS

COL-COPPER CNCU BRIGHTENER may be employed to produce uniform brightness and leveling of the copper deposits. For most plating needs, an addition rate of 0.1% should be sufficient. Excessive amounts of COL-COPPER CNCU BRIGHTENER will cause a dull band in the low current density area. If this should accidentally occur, the color may be restored by temporarily increasing the free cyanide level by 1.9 - 3.8 g/l (0.25 -0.50 opg).

As a guide, COL-COPPER CNCU BRIGHTENER is consumed at the approximate rate of 1 gallon / 20,000 amp. hours. Continuous filtration through a light carbon pack may be employed without brightener loss.

COL-COPPER CNCU GRAIN REFINER is used to impart improved tolerance of the bath to organic contamination, grain refinement of the deposit, as well to promote uniform corrosion of the anodes.

COL-COPPER CNCU PURIFIER is used to overcome organic impurities that can affect the LCD and cause LCD dullness. Typical additions will be in 0.1% increments up to 0.3% (1 gallon per 1,000 gallons of bath).

COL-COPPER CNCU DISPERSANT is a wetter that may be used to improve the baths tolerance to organic contamination. It is not recommended that the wetter be added on an ampere hour basis, but used on an as needed basis. Typical additions will be ½ to 1-pint increments /1,000 gal of plating bath.

FUNCTION OF SOLUTION COMPONENTS

<u>SOLUTION MAINTANCE</u>

The continuous production of quality deposits at high plating speeds is dependent on control of the salts and brighteners within the recommended ranges. These parameters should be analyzed and adjusted periodically.

<u>FILTRATION</u>

Good solution filtration is essential in order to ensure high quality, smooth copper deposits. Continuous filtration through filter aid and activated carbon at an hourly rate equal to the capacity of the tank, will generally keep the solution free of suspended metallic particles, dirt and organic contamination. The filter should first be pre-coated with the filter aid, followed by an activated carbon slurry of 1-3 lbs./100 gallons (1-3 kg/1000L) of plating solution. Smaller additions of carbon on a weekly basis are recommended, if the capacity of the filter permits. The filter should be inspected and repacked periodically.

<u>ANODES AND ANODE CURRENT DENSITY</u>

A high purity grade copper anode free of oxide inclusions is preferred. Electrolytic sheet copper is not recommended. The anode area should be balanced so that the amperage requirements will be obtained within the recommended voltage limits. The upper limit of the anode current density will vary with the type of agitation employed and if the anodes are bagged or un-bagged. It is suggested that the anode current density be maintained between 1/0 - 1.5 A/dm2 (10 - 15 ASF). The anodes should be replenished as frequently as necessary in order to maintain sufficient anode area.

<u>COPPER CONTENT</u>

The copper concentration greatly influences the operating limits of the process and should be held within the specified range for optimum performance. A low metal concentration will cause burning of the deposit in the high current density areas. This is corrected by a reduction of amperage, but results in a proportional loss of plating speed.

<u>“FREE” CYANIDE CONTENT</u>

The optimum “free” cyanide concentration will be found in the range of 2-3 oz/gal (15-22.5 g/L). Once this value has been established, it should be maintained by analysis and expressed in terms of either the sodium or potassium salt.

<u>ALKALI CONTENT</u>

Caustic potash is recommended for makeup and maintenance of the hydroxide content (in straight potassium or mixed baths) since it is an economical source of potassium ions. A low hydroxide concentration may result in inferior anode corrosion and poor conductivity. Concentrations in excess of the recommended range may influence the hardness and brightness of the deposit.

<u>CARBONATES</u>

Carbonate is formed by absorption of carbon dioxide from the air, hydrolysis and the electrolytic decomposition of cyanide. The permissible carbonate concentration will vary depending on the operation, but normally a concentration of 20 oz/gal can be tolerated without difficulty. An excess reduces the bright current density range and increases the tendency to produce granular deposits. Carbonates may be removed by chemical precipitation with Calcium Hydroxide, Calcium Formate or (in straight Sodium baths) chilling the solution. Recommendations for carbonate removal should be obtained from your Columbia Chemical representative, if this becomes necessary.

ORGANICS

Grease and oils, which may be carried in on the work or accidentally introduced into the solution when lubricating the mechanical equipment, are very harmful to the plating solution. The effect of such contaminants is to require carbon treatment which is both time-consuming and expensive. Therefore, care should be taken to avoid the introduction of such contaminants into the plating solution. Normal organic contamination can be controlled by the use of COL-COPPER CNCU DISPERSANT as outlined in the previous section.

CHROMIUM

Chromium is a common contaminant in cyanide copper plating solutions. The source may be due to poorly maintained racks, incomplete stripping of contacts or poorly ventilated chromium baths that are in the proximity of the copper solution. Chromium contamination will cause dull streaks or step plate in the mid current density area or possibly an overall dullness depending on its concentration.

ANALYTICAL PROCEDURE

COPPER METAL

1. Pipette a 1 mL sample into a 250 mL wide mouth Erlenmeyer Flask.
2. Add 50 mLs D.I. water
3. Add 2-3 grams of Ammonium Persulfate
4. Swirl to mix. - let sit for 2 - 3 mins.
5. Add 5 mLs Ammonium Hydroxide (solution will turn blue)
6. Add 8 drops of P.A.N. Indicator
7. Titrate with 0.1 M EDTA until gold/yellow endpoint.
8. Calculation:
   mLs 0.1 M EDTA x 0.848 = oz/gal of Copper (Metal)
   mLs 0.1 M EDTA x 6.36 = g/L of Copper (Metal)

FREE CYANIDE

1. Pipette a 10 mL sample into a 250 mL Erlenmeyer Flask.
2. Add 40 mL of water, 10 mL of Concentrated Ammonium Hydroxide and 10 mL of 10% Potassium Iodide solution.
3. Titrate with 0.1 N Silver Nitrate until luminous yellow.
4. Calculation:
   mL 0.1 N AgNO3 x 0.131 = oz/gal of Free NaCN
   mL 0.1 N AgNO3 x 9.825 = g/L of Free NaCN
   mL 0.1 N AgNO3 x 0.174 = oz/gal of Free KCN
   mL 0.1 N AgNO3 x 1.305 = g/L of Free KCN

HYDROXIDES

1. Pipette a 10 mL sample into a 250 mL Erlenmeyer Flask.
2. Add 20 mL of water, 10 drops of Sulfo-Orange Indicator, and 1-gram solid Sodium Cyanide.
3. Titrate with a 1.0 N HCL Solution until the color changes from orange to yellow.
4. Calculation:

mL of 1.0 N HCL * 0.535 = oz/gal of NaOH
mL of 1.0 N HCL * 4.013 = g/L of NaOH
mL of 1.0 N HCL * 0.752 = oz/gal of KOH
mL of 1.0 N HCL * 5.64 = g/L of KOH

CARBONATES

1. Pipette a 10 mL sample into a 250 mL Beaker.
2. Add 50 mL of water.
3. Add 20 mL of 20% Barium Chloride Solution.
4. Filter through a P8 Whatman Filter Paper, saving filtrate in clean 250 mL beaker.
5. Check filtrate for complete precipitation by the addition of 5 mL of 20% Barium Chloride solution. If a white precipitate occurs, add an additional 15 mL of 10% Barium Chloride Solution and re-filter.
6. Rinse the original beaker several times and pour through filter paper.
7. Transfer the precipitate and filter paper to a 500 mL Erlenmeyer Flask.
8. Add 1mL of Methyl Orange Indicator and titrate 1.0 N HCl until the solution changes to a pink color.
9. Calculations:
   (mLs x 0.708) = oz/gal Sodium Carbonate (mLs x 5.31) = g/L Sodium Carbonate
   (mLs x 0.923) = oz/gal Potassium Carbonate (mLs x 0.923) = g/L Potassium Carbonate

HANDLING & STORAGE

Columbia Chemical recommends referring to the specific product Safety Data Sheets for safety, handling, and storage precautions.

NON-WARRANTY

The data contained in this bulletin is believed by Columbia Chemical Corp. to be accurate, true, and complete. Since, however, final methods of use of this product are in the hands of the customer and beyond our control, we cannot guarantee that the customer will obtain the results described in this bulletin, nor can we assume responsibility of the use of this product by the customer in any process which may infringe the patents of third parties.