PC-375
Cyanide Bright Zinc Process

Properties
- Liquid brightener
- Produces brilliant deposits at low, medium, and high current densities
- For both, barrel and rack operations
- Excellent throwing and covering power
- Plated parts can easily be chromated
- Due to the variable metal and cyanide content of the solution, it may be used over a wide range of operating conditions
- Its brilliant deposits and its economic use make it the outstanding cyanide zinc brightener system

Application

Make-up concentrations:

Zinc oxide	44 g/l
Sodium cyanide	95 g/l
Sodium hydroxide	75 g/l
Brightener PC-375R	4 ml/l
Purifier	3 ml/l

Desired values:

Zinc Metal	35 g/l (30-40 g/l)
Sodium cyanide	95 g/l (75-110 g/l)
Sodium hydroxide	75 g/l (60-80 g/l)
Sodium carbonate	max. 70 g/l
Ratio NaCN:Zn	3.0 (2.5-3.5)

Make-up: Dissolve sodium hydroxide and sodium cyanide in 1/3 of the required amount of water; considerable heat will be evolved. Add zinc oxide and stirr until dissolved. Cool to room temperature. Add the purifier, fill the tank with water to its final volume and filtrate continuously overnight. Add the required amount of PC-375R and stirr the electrolyte.

Temperature: 25 °C (20-45 °C)
(at lower temperatures current densities should be lower, at higher temperatures brightness and throwing power is reduced)

Cathodic current density:

Barrel	0.2-2.0 A/dm2
Rack	0.2-4.0 A/dm2

Current efficiency: 60-80 %

Deposition rate: 10-14 µm per Ah/dm2

Anodes: pure zinc 99.99 % according to DIN 1706 or steel anodes to control the zinc concentration

Agitation: cathode agitation (rack or barrel movement) recommended, no air agitation (to avoid cyanide mist and carbonate increase)
Tank material: plastic or steel with plastic coating
Filtration: recommended
Heating: not necessary
Cooling: necessary for lines with high load on small volumes and/or recommended to freeze out sodium carbonate
Exhaustor: required for worker's protection

Maintenance: Analyse zinc, sodium cyanide, sodium hydroxide and sodium carbonate regulary. Zinc is controlled by changing the anodic current density or by using steel anodes. Add sodium cyanide and sodium hydroxide according analysis. Add 0.2 l purifier per 10 kg added NaOH. Freeze out excess sodium carbonate. Adjust PC-375R with the aid of Hull cell tests.

Consumption: PC-375R is consumed by drag-out as well as electrochemically, by anodic oxidation and cathodic build-in
The following values can give a range for the consumption (per 10,000 Ah):
PC-375R 1-3 l

Effects of the Electrolyte Components

Zinc
Increase of zinc increases the burning limit, but reduces the throwing power. A lack of zinc produces burnings.

Sodium cyanide
Excess cyanide reduces brightness, thus more PC-375R is needed. Lack of cyanide produces a more brittle zinc layer. The high cyanide electrolyte type is less sensitive against impurities.

Sodium hydroxide
Excess hydroxide speeds up zinc dissolution too much. Lack of hydroxide reduces the burning limit, and leads to passive anodes.

Sodium carbonate
Excess carbonate reduces brightness, thus more PC-375R is needed. Further, it is responsible for passive anodes leading to a bad current distribution in the electrolyte and a too low zinc dissolution rate.

Contaminating metals
like Cu, Pb, Cd, Sn, Ni (...) deteriorate brightness and appearance of the zinc layer and should be removed with the purifier. Chromium(VI) reduces current efficiency and coverage in the low current density area. It affects the chromatability and appearance and must be reduced to Cr(III) with sodium dithionite.

Additive PC-375R
Excess of PC-375R causes a spotted dull zinc deposition in the low to medium current density area, current efficiency is reduced and in extreme cases, blistering may occur. Lack of additive results into lack of brightness and throwing power.

Analysis Cyanide Zinc

Sample Preparation
Take the sample at a homogeneously mixed position and let it cool down to room temperature. If dull, allow to settle and decant or filtrate.

Zinc

Reagents: 0.1 N EDTA, buffering solution (100 g/l NaOH + 240 ml/l 98 % acetic acid), indicator 1 % xylenol orange blended with KNO_3

Process: Pipette 5 ml into a 250 ml Erlenmeyer flask, add 100 ml demineralized water, 20 ml buffering solution and a spatula tip of indicator and titrate with 0.1 N EDTA from red to yellow.

Calculation: consumption in ml · 1.3074 = g/l zinc

Sodium cyanide

Reagents: 0.1 N silver nitrate solution, 10% NaOH solution, 2 % potassium iodide solution

Process: Pipette 5 ml into a 250 ml Erlenmeyer flask, add 100 ml demineralized water, 10 ml 10 % NaOH solution, 6 drops potassium iodide solution and titrate with 0.1 N silver nitrate solution until lasting turbidity.

Calculation: consumption in ml · 1.98 = g/l sodium cyanide

Sodium hydroxide

Reagents: 1 N sulfuric acid, indicator sat. alcoholic solution of tropaeolin 0

Process: Pipette 5 ml into a 250 ml Erlenmeyer flask, add 100 ml demineralized water, 5 drops indicator and titrate with 1 N sulfuric acid from orange to light yellow.

Calculation: consumption in ml · 7.98 = g/l sodium hydroxide

Sodium carbonate

Reagents: 5 % barium nitrate solution, 1 N hydrochloric acid, 1 N sodium hydroxide solution, indicator 0.04 % methyl orange solution

Process: Pipette 10 ml into a 250 ml Erlenmeyer flask, add 50 ml demin. water and boil the solution. Add 75 ml barium nitrate solution. After settle down of the precipitate, filtrate with a fine grained filter paper and wash with hot demin. water. Put the filter into a 250 ml Erlenmeyer flask, add 100 ml demin. water, 30 ml 1 N hydrochloric acid and boil the solution shortly. After cooling down, add 3 drops indicator and titrate excess hydrochloric acid with 1 N sodium hydroxide from red to orange-yellow.

Calculation: (30 – consumption in ml) · 5.3 = g/l sodium carbonate

Guarantee

Our guarantee extends to the continuous quality of our products as they leave our factory and not to their usage in the field. Our technical service will be pleased to answer any question you may have concerning operation and use of our products:
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