# ZINCOBRITE AZ *ULTRA*

**ACID CHLORIDE ZINC PLATING PROCESS**

# INTRODUCTION

ZINCOBRITE AZ *ULTRA* is a unique acid chloride zinc additive package system exhibiting extended brightness and uniform thickness at both high and low current densities and at traditionally low as well as at high temperatures The hyper-concentrated additives are designed for ammonium or potassium makeups and is an ideal rack and barrel acid zinc plating process.

# BENEFITS

- Fast acting brightener system
- Mirror bright, leveled deposits
- Superior thickness distribution/throw
- Enhanced LCD brightness and passivate color
- Able to use reduced thickness targets
- Aqueous additives – no oiling
- High cloud point – can operate at elevated temperatures
- Easy to control
- Economical to use
- Excellent acceptance of passivates

# SOLUTION MAKE-UP*

| | |
|---|---|
| **Zinc Chloride** | 40 – 60 g/L (5.3 – 8.0 oz/gal) |
| **Ammonium Chloride** | 150 – 200 g/L (20.0 – 26.7 oz/gal) |
| **Or Potassium Chloride**<br>**Plus Boric Acid** | 200 g/L (26.7 oz/gal)<br>20 g/L (2.7 oz/gal) |
| **Zincobrite AZ Ultra Carrier (Starter)** | 4.5% v/v |
| **Zincobrite AZ Ultra Brightener** | 1.0 ml/L (3.8 ml/gal) |

*Mixed chloride (low ammonia) make-up is available upon request

# OPERATING DATA

| | |
|---|---|
| **Zinc** | 20 – 30 g/L (2.7 – 4 oz/gal) |
| **Chloride** | 105 – 203 g/L (14.0 – 27.1 oz/gal) |
| **pH** | 4.8 – 5.8 (ammonia) / 5.0-5.5 (potassium) |
| **Temperature** | 68 – 122°F |
| **Cathode Current Density** | 20 – 40 ASF (Rack) / 5 – 15 ASF (Barrel) |

# EQUIPMENT

| | |
|---|---|
| **Tanks** | Hard rubber-lined steel, polypropylene or PVC. |
| **Heaters** | PTFE immersion with thermostatic control. |
| **Cooling** | Titanium, PTFE or polypropylene heat exchangers or cooling coils should be used if required. |
| **Filtration** | Continuous recommended, all plastic construction pump. Should give 2-3 bath turnovers per hour. |
| **Agitation** | Slight solution movement to provide mild agitation for rack plating. |
| **Anodes** | High purity zinc (99.95%) with titanium hooks or in titanium baskets, with anode bags. 2:1 surface area ratio to cathode area |

# INSTALLATION

It is essential that the tanks to be used for ZINCOBRITE AZ ULTRA are thoroughly cleaned and leached before any product is introduced. For new tanks or linings extended warm leaching is required. Automated Chemical Solutions Lab can evaluate existing bath compatibility with PMD additives and provide recommendations for startup.

DO NOT PRE-MIX ADDITIVES

1. Clean the process tank with water and leach with 10% v/v hydrochloric acid, pumping through all the filters, pumps and pipework. Allow to stand overnight then thoroughly clean with water.

   If there is any questions regarding the cleaning procedure, please contact Automated Chemical Solutions for technical support.

2. Add tap water to one-half tank volume and heat to 120°F.

3. Add the appropriate amount of zinc chloride:

   a) 150 – 200 g/L ammonium chloride and stir to dissolve **OR**

   b) 200 g/L potassium chloride plus 20 g/L boric acid and stir to dissolve.

4. Allow to cool to 68 – 86°F then add 4.5% v/v **Zincobrite AZ ULTRA Carrier**.

5. Filter the solution thoroughly and adjust the pH:

   a) pH 4.0 – 5.8 (ammonium) **OR**

   b) pH 5.0 – 5.5 (potassium/boric)

6. Add 1 ml/L **Zincobrite AZ ULTRA Brightener**, top up to volume and mix thoroughly.

7. The solution is now ready to use.

# MAINTENANCE AND CONTROL

The zinc and chloride concentration should be analyzed regularly using the methods detailed in *Analysis Methods* and adjusted accordingly.

**ZINCOBRITE AZ ULTRA Brightener:**
As a guide, add 75 – 200 ml/1000 amp-hours (1 gal per 19 – 50,000 AH)
The consumption of Brightener will vary with drag-out and electrolysis.

**ZINCOBRITE AZ ULTRA Carrier**:
The Carrier is usually consumed by drag-out only and additions can be linked to the chloride analysis and additions (basically, adding back Carrier at the Make Up percentage)

For example:

If nominal chloride conc. = 130 g/l
And nominal **Carrier** conc. = 45 ml/l (4.5% vv)

And chloride conc. by analysis is 102 g/l
Then the chloride addition should be 28 g/l (130 – 102 or 21.5% of nominal)
And **Carrier** addition should be 9.7 ml/l (21.5% of nominal)

*Or alternatively* for **Carrier**: add 75 – 200 ml/1000 amp-hours (1 gal per 1 gallon Brightener)

pH:
Keep within range with 50% v/v hydrochloric acid to lower and either 10% w/v solution of potassium hydroxide or ammonia to raise. **During normal operation the pH will tend to rise**.

Zinc Concentration:
This can vary between 20 and 30 g/l depending on requirements.
***For higher current densities use higher zinc concentrations.**

Deposition Rate:
At 28 ASF the current efficiency is 95% and the deposition rate is 0.03 mils/minute.

Zinc Metal / Total Chloride:
Reduced zinc/moderately elevated chlorides improves throw. Alternatively, high current densities require both high zinc and high chlorides and typically if running lower zinc, start with reduced chlorides.

Qualitative Iron Test and Treatment Procedure:
**Method:**
1. Place 30-40 ml sample of bath in 100 ml beaker (if not clear – filter).
2. Add 1 ml of 4 to 5% hydrogen peroxide (dilute concentrated peroxide with water).
3. Look for precipitate in beaker.
4. If slight-to-heavy precipitate treat bath as follows (per 1,000 gallons):
   - Make a dilute gallon of peroxide (water plus 0.5 L 35% hydrogen peroxide).
   - Mix well in the plating bath.
   - Repeat Steps 1 – 4 until most of the iron is precipitated out determined in beaker test.
   - Filter out precipitated iron from plating bath.

# ANALYSIS METHODS

**Zinc**

**Reagents**

1. 0.1M EDTA
2. Eriochrome Black T indicator
3. Ammonium chloride buffer solution (40 g/L ammonium chloride, 200 ml/L ammonium hydroxide, Deionized water to 1 liter)

**Method**

1. Pipette 2 mls of the plating solution into a 250 ml Erlenmeyer flask.
2. Add 50 mls buffer solution and 50 mls DI water.
3. Add a trace of Eriochrome Black T indicator.
4. Titrate with 0.1M EDTA to a blue end-point.

**Calculation**

Zinc (g/L) = mls of 0.1M EDTA X 3.27

**Replenishment**

For every 1 g/L low add 2.1 g/L zinc chloride

**Chloride**

**Reagents**

1. 0.1N silver nitrate
2. Sodium chromate indicator – 20 g/L sodium chromate (aqueous)

**Method**

1. Pipette 10 mls of the plating solution into a 250 ml volumetric flask and make up to the mark with DI water.
2. Pipette 10 mls of the diluted sample into a 250 ml Erlenmeyer flask.
3. Add approximately 100 mls DI water.
4. Add approximately 2 mls of indicator solution.
5. Titrate with 0.1N silver nitrate. During titration a white precipitate of silver chloride will be seen immediately. The end point is when the solution/precipitate becomes reddish brown.

**Calculation**

Chloride (g/L) = mls of 0.1N silver nitrate X 8.875

**Replenishment**

For every 1 g/L low add 1.5 g/L ammonium chloride or 2.1 g/L potassium chloride

# ANALYSIS METHODS (Cont.)

**Boric Acid (Potassium only)**

**Reagents**

1. Mannitol
2. Bromocresol purple indicator
3. 0.1M sodium hydroxide solution

**Method**

1. Pipette 5 mls of the plating solution into a 250 ml Erlenmeyer flask.
2. Add mannitol to make a slurry then add a few drops of bromocresol purple indicator.
3. Titrate with 0.1N sodium hydroxide to a purple end point.
4. Record titrant = t ml.

**Calculation**

Boric acid (g/L) = mls of 0.1N sodium hydroxide X 1.24

**Replenishment**

For every 1 g/L low add 1 g/L boric acid

**Hull Cell Tests**

OPERATING CONDITIONS:

| | | |
|---|---|---|
| Hull Cell | - | 267 ml |
| Temperature | - | 90˚F |
| Current | - | 2 amps |
| Time | - | 10 minutes |
| Anode | - | Zinc |
| Cathode | - | Polished Brass Panel |
| Brightener Adds | - | 0.2 ml increments |

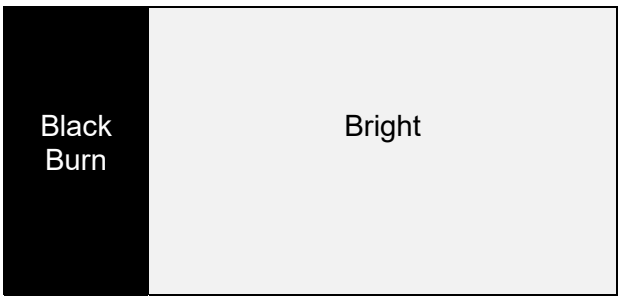
***Zincobrite AZ ULTRA***

Normal Panel

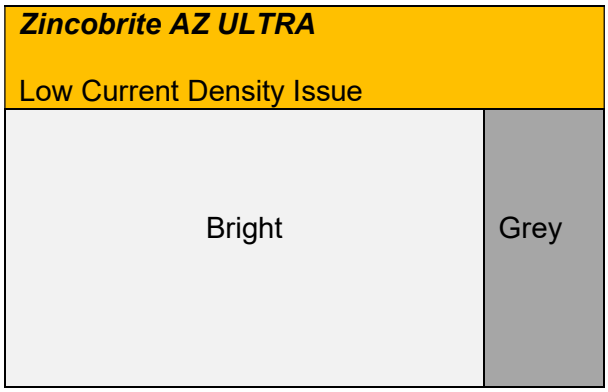
***Zincobrite AZ ULTRA***

High Current Density Issue

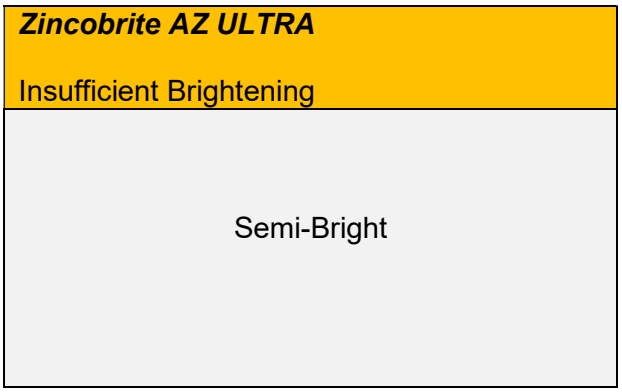

Normal



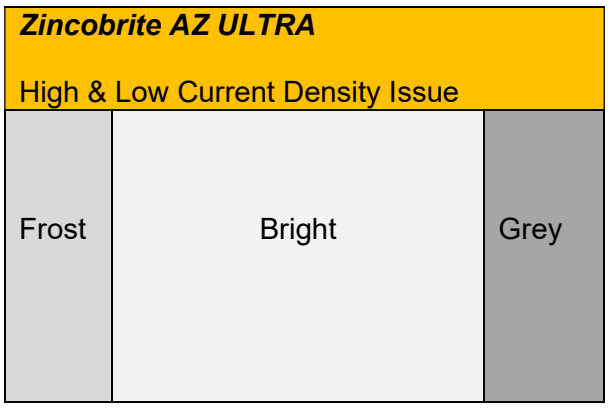

Low temperature, low zinc concentration, Excessive current density, organic contamination, high current



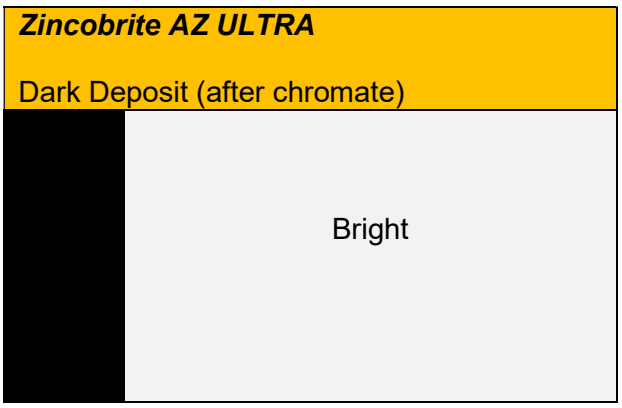

Low brightener, low chlorides, high pH, high zinc concentration




Low Brightener, low current density




Low Brightener & Low Carrier




Iron (II) Contamination, pH too high

# TROUBLE SHOOTING GUIDE

Contamination with foreign materials should be avoided. Copper, lead, cadmium, arsenic and antimony can cause problems with loss of brightness, dark deposits or poor color. They can usually be removed by

plating out or by zinc dust treatment. Iron contamination should not exceed 80-100 ppm. Iron can be removed by additions of hydrogen peroxide (1-2 ml/l) – see above test/treatment procedure

| Problem | Reason | Remedy |
|---|---|---|
| Insufficient brightening and leveling. Low current density (blue) coloration | Low Brightener<br><br>Low current density | Add 0.3-2.0 ml/L Brightener<br><br>Increase current density |
| Poor coverage at low current density | Low chloride concentration<br><br>Low Carrier | Correct per analysis<br><br>Add 2-4 ml/L Carrier |
| High current density burning | Low temperature<br><br>Low zinc concentration<br><br>Excessive current density<br><br>Organic contamination | Heat solution<br><br>Add zinc chloride per analysis<br><br>Reduce<br><br>Carbon treat |
| Roughness, pitting | pH too high<br><br>Suspended solids | Reduce pH<br><br>Filter |
| Dark deposit | pH too high<br><br>Iron (II) contamination | Reduce pH<br><br>Add 1 ml/L hydrogen peroxide for every g/L iron (II) and filter |
| Deposit will not passivate easily | Low Carrier<br><br>Excessive concentration of additive decomposition products | Add 2-4 ml/L Carrier<br><br>Carbon treat |
| Barrel hole “burning” | Low temperature<br><br>Low chloride concentration<br><br>Iron (II) contamination<br><br>Decomposition products | Heat solution<br><br>Correct per analysis<br><br>Add hydrogen peroxide (see above)<br><br>Carbon treat |
| Spots developing during passivation | Low Carrier<br><br>Poor rinsing after zinc | Add 2-4 ml/L Carrier<br><br>Improve rinsing |
| Zinc metal growth | pH too low<br><br>Anode area too high | Operate at the higher pH range<br><br>Reduce anode area until Zn in spec<br><br>Dilute bath |

# STORAGE

Store in original containers above 40°F

# Safety

Avoid contact with eyes, skin and clothing. Wear chemical handler's gloves, goggles and protective clothing when handling. Read and understand Material Safety Data Sheet before using this product.

# PRODUCT GROUPS

The following products are referred to in this data sheet.

| PRODUCT NAME | PRODUCT NUMBER |
|---|---|
| Zincobrite AZ ULTRA Carrier | 584019 |
| Zincobrite AZ ULTRA Brightener | 584020 |

# NOTICE

The information and recommendations of PMD (UK), Ltd. and Automated Chemical Solutions, Inc., and its representatives, regarding this product are, to the best of our knowledge, true and accurate. We make no guarantee of results because the conditions of actual use are beyond our control. We assume no liability for damages or penalties resulting from the use of this product or following our recommendations. Our recommendations and suggestions for use of this product are not intended to grant license to operate under or infringe any patent.