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TECHNICAL DATA

E-Brite™ Ultra Cu-Mg

Non-Cyanide, Non-Pyrophosphate Alkaline Copper Plating

E-Brite Ultra Cu-Mg plates copper directly on zincated magnesium casting (AZ91) resulting in excellent adhesion and corrosion protection. (Salt spray of 96 hours ASTM B-117).

E-Brite Ultra Cu-Mg is free of chelating agents.

It eliminates the necessity of striking in cyanide copper.

One bath serves as both a strike and a plate bath.

E-Brite Ultra Cu-Mg eliminates potential health and environmental liability and the high cost of waste treating the cyanide.

Accidental drag-in of **E-Brite Ultra Cu-Mg** into an acid copper solution poses no health hazards due to evolution of poisonous cyanide gas as with cyanide copper.

The solution does not have to be treated for carbonates as with cyanide solutions.

E-Brite Ultra Cu-Mg produces a fine grained, smooth, dense and ductile copper deposit which is non-porous with excellent bonding properties.

It has excellent throwing and covering power, especially in low current areas and is superior to cyanide copper in these properties.

It is used as a preplate strike for nickel, electroless nickel, acid copper, tin, solder and silver plate.

It does not contain strong chelators. It does not have a negative effect on typical waste treatment systems. **E-Brite Ultra Cu-Mg** plates while dissolving the copper anodes rather than plating out of the solution as is the case with other processes. Therefore, it offers lower operating costs.

The **E-Brite Ultra Cu-Mg** bath is stable and does not have to be periodically dumped and recharged as with other non-cyanide alkaline copper processes which are based on pyrophosphate.

E-Brite Ultra Cu-Mg is supplied as a liquid concentrate which is diluted using deionized water when making up the plating solution.

It is extremely easy to control with only one (1) liquid maintenance addition agent, **E-Brite Ultra Cu-Mg "E".**

See page 5 under **Metal Surface Preparation** on how to prepare magnesium.

PLATING SPECIFICATIONS

	RACK PLATING	
	Optimum	Range
Concentration **E-Brite Ultra Cu-Mg**	40% by volume	30-50% by volume
E-Brite Ultra Cu-Mg "E"	10% by volume	8 to 12% by volume
E-Brite Ultra Cu-Mg "pHA"	5% by volume	4 to 8% by volume
Copper Metal	1 oz/gal	0.8-1.2 oz/gal
pH	9.6	9.2 to 10.0
Temperature	120°F	100 to 140°F
Cathode-Current Density	15 ASF	10 to 25 ASF
Voltage	1 – 6 Volts	
Anode-Current Density	Minimum of 10 ASF in order to corrode the anodes and maintain the copper concentration in the bath.	
Agitation	Vigorous air mandatory. Use low pressure, large volume blowers only – not compressed air. In-tank filter systems do not produce sufficient solution agitation to be used with **E-Brite Ultra Cu-Mg** and must not be used for agitation or filtration. Air agitation aids in producing a brighter finish while helping to avoid burning in the high current density areas.	
Plate Thickness **Rectification:**	Minimum of 0.0002 inches for strike Rack: 9 volts. It is recommended that the parts go into the solution "live".	

EQUIPMENT AND OPERATION

Copper Anodes: Oxygen-free UNS C10100 or C10200 only. Use bar or balls. Oxygen-free UNS C10100 or C10200 copper anodes from Univertical, IMC-MetalsAmerica, or Outokumpu are acceptable. Do not use phosphorous-containing anodes.

Insoluble Anodes: With some installations it may prove to be helpful to use a mix of copper and graphite or stainless steel (304 or 316) anodes in order to plate down too high of a copper concentration or to maintain 10 ASF on the copper anodes in order to dissolve the copper into the solution. In most rack installations a mixture of graphite or stainless steel and copper anodes is advantageous. Use only high density, pure graphite extruded or molded anodes – grade JC-1.

Anode Baskets: Titanium only.

Anode/Cathode Ratio: 1.5:1 It is required that the anode area be such that the anode current density is sufficient to corrode the anodes.

Anode Bags: Normally not required. Bags must be thoroughly leached in hot water prior to use to avoid contaminating the bath with sizing compounds. Cotton, Dynel, or polypropylene bags may be used.

Carbon: Low sulfur 0.5% by weight or less. Elemental sulfur causes high current density burn. Activated powder such as Norit KB, KBB or G-60. Activated granular such as Norit "C" or Serfilco 206A. Note: If you use granular carbon you need more than powder because of its lower surface area per pound. Check with supplier.

Filtration: Continuous 5 micron, 2-3 turns per hour. New filter cartridges must be soaked in hot water then flushed with hot water prior to use. A sulfur-free activated powder carbon pack must be maintained on the bath – one pound per 100 gallons – change weekly. When plating heavy copper (one (1) mil or more) a 1 micron filter is recommended. In tank filter systems must not be used.

Racking: Positive, firm racking with good contact is recommended. Wiring parts can lead to difficulties as can hanging parts on hooks. This is especially true for plating magnesium diecastings

Heating: Teflon coated electric heaters are recommended. Scorching the solution must be avoided. D rated heaters should be used. Also 316 stainless steel, titanium or Teflon steam coils.

Tanks: Mild steel lined with rubber, koroseal or polypropylene or a drop in plastic liner. All plastic tanks may be used. Large polypropylene tanks must be reinforced. New plastic tanks and liners must be leached with a 2% Potassium or Sodium Hydroxide solution for 2 days followed by cold water rinsing.

Ventilation: Not required, but it is a good practice as with all heated plating solutions.

PH Control: An electronic pH meter must be used. If pH falls, add **E-Brite Ultra Cu-Mg "pHA"**. If pH goes over 10.0 or above a recommended level, add dilute (10%) sulfuric acid.

Rinsing: Whenever possible, 2 or 3 stage counter current flow rinses are recommended immediately prior to the **E-Brite Ultra Cu-Mg** bath. A soft water rinse prior to the bath will improve performance.

NOTE: When **E-Brite Ultra Cu-Mg** is used to replace cyanide copper in a plating line, it has been found that is very difficult to completely destroy residual cyanide. That is why a new drop-in plastic tank liner is recommended or a new tank be used. Anodes previously used with cyanide must be replaced. Anode bars, anode baskets, bus bars, racks must be free of residual cyanide. The equipment must be washed with 5% sodium hypochlorite or 3% hydrogen peroxide solutions. Do not neglect heating and filtration equipment. Rinse thoroughly with cold water and then rinse with diluted 1 to 2% sulfuric acid solutions**. When destroying cyanide, forced ventilation must be used at all times to prevent toxic cyanide fumes from accumulating. Personnel should be equipped with self contained breathing apparatus.**

New racks are recommended.

PLATING ADDITIVES

E-Brite Ultra Cu-Mg: Liquid concentrate used in make-up of new baths and replenishment. Contains the copper metal and the other balanced components of the bath.

E-Brite Ultra Cu-Mg "E": Liquid electrolyte replenisher. Periodic adds over time to complex copper disolved from anodes. Adds determined by Hull Cell tests or by **EPI.**

E-Brite Ultra Cu-Mg "pHA": Liquid pH adjuster and buffer to control pH. Additions determined by pH measurement with an electronic pH Meter. It is added to raise the pH upon bath make-up and when the pH decreases from acid drag in. If necessary, the pH may be lowered by adding dilute (10%) Sulfuric Acid. But this must not be done on a continuous basis. It is required that the source of the alkaline contamination be eliminated.

REPLENISHMENT OF PLATING SOLUTION

E-Brite Ultra Cu-Mg concentrate has a copper concentration of 2.4 oz/gallon. If the copper concentration in the bath decreases, additions of **E-Brite Ultra Cu-Mg** concentrate are required to replenish the copper and the other balanced components in the working solution. The strength of the working solution is monitored by determining the copper concentration. If additions are required frequently, the anode area must be adjusted to dissolve the copper anodes. A mixture of copper and stainless steel or graphite anodes may be required. When a new solution is prepared and plated the copper concentration should be determined every day and if it continually decreases or increases the anode area must be adjusted with copper and inert anodes to dissolve the copper.

E-Brite Ultra Cu-Mg "E" electrolyte is added on a regular basis (daily) to complex the copper dissolved from the anodes and to replace drag-out. Its consumption will depend upon drag-out, copper metal content and metallic contamination in the bath. The proper concentration of **E-Brite Ultra Cu-Mg "E"** must be maintained for maximum adhesion to the base metal. Periodic adds are required over time based on ampere hours, Hull Cell test or **EPI**'s lab recommendations. A metering pump controlled by amp-hours is recommended for adding **E-Brite Ultra Cu-Mg "E"**. If the copper metal concentration of the bath increases, 4% by volume **E-Brite Ultra Cu-Mg "E"** must be added to the bath for each 0.1 oz/gallon increase in copper concentration. A loss of adhesion will occur if sufficient **E-Brite Ultra Cu-Mg "E"** is not maintained.

E-Brite Ultra Cu-Mg "PHA" is a pH adjuster and buffer used when charging a new bath to adjust the pH to the range of 9.2-10.0. Additions are determined by pH measurement with a pH meter. It is normally used at 5 to 8% when charging a new bath, depending upon how much **E-Brite Ultra Cu-Mg** and **E-Brite Ultra Cu-Mg "E"** were used in making up the bath. A new bath will have a pH of 8.2 upon make up before adding the **E-Brite Ultra Cu-Mg "pHA"**. It is also added to a bath to maintain the pH if acid is dragged into the bath.

Note: In most strike installations, an **E-Brite Ultra Cu-Mg** bath is maintained with the single maintenance additive **E-Brite Ultra Cu-Mg "E"**.

METAL SURFACE PREPARATION

1. **E-Kleen 107** 30% by volume, 180 - 200° F, 10 minutes
2. Cold Water Rinse
3. **90% Phosphoric Acid** 90% by volume, 70°F, 1 minute
4. Cold Water Rinse
5. **E-Pik 236** 30% by volume, 180°F, 10 minute
6. Cold Water Rinse
7. **E-Pik 241-C** 40% by volume, 70° F, 2 minutes
8. Cold Water Rinse
9. **E-Prep 284** 100% by volume, 140 - 150° F, 5 minutes
10. Cold Water Rinse
11. **Ultra Cu-Mg** per Technical Data Sheet, 120 - 130° F, 45 minutes

ADHESION EVALUATION

Check adhesion by running a Hull Cell panel at 1 amp for 5 minutes for rack. Apply masking tape lengthwise, along the middle of the panel, and bend the panel back on itself through the middle of the masking tape. Then, bend back to flatten the panel. The tape is snapped off the LCD end. There should not be any loss of adhesion -- not even in the low current density area. If there is a loss of adhesion, add **E-Brite Ultra Cu-Mg "E"** to the Hull Cell in one (1) percent increments until loss of adhesion is eliminated. Then, add the same percentage to the bath. Or, plate a 1 amp, 5 minute Hull Cell panel, rinse with water and plate bright nickel over it at 2 amps for 10 minutes. Then bend the panel at the bottom corner of the LCD area. There should be no loss of adhesion in the LCD--first 1" of the panel. The same can be done with tin plating. If there is a loss of adhesion, add **E-Brite Ultra Cu-Mg "E"** in 1% increments as above. It may require as much as 5% **E-Brite Ultra Cu-Mg "E"**. Loss of adhesion will develop on a Hull Cell panel prior to occurring in a production bath enabling the Hull Cell panel test to predict loss of adhesion.

Adhesion of the copper plate and also nickel or tin plates over the copper on magnesium diecastings can be checked by heating the part to 300°F for 1/2 hour and then quenching in room temperature water. There should be no loss of adhesion or blistering.

Contamination: Lead (<50 ppm), cyanide (<50 ppm), dissolved iron, zinc, silver and organics are contaminants. The bath will plate with a black smut in the MCD and HCD areas with lead contamination, and with a red brick color with cyanide contamination. A smutty brick red plate will occur in HCD with high dissolved iron contamination (3-4,000 ppm).

Cyanide contamination is removed by treating with hydrogen peroxide (1 pint 35% peroxide per 100 gallons of bath). Dilute the peroxide with 50% water before adding to the bath with strong air agitation. This should not be done on a regular basis, the source of cyanide contamination must be found and eliminated.

Silver (30 ppm) and zinc (400+ ppm) contamination will cause a loss of adhesion when plating on die-cast magnesium surfaces.

Silver contamination comes from using poor quality copper anodes containing in excess of 0.0025% silver. Silver is removed with dummy plating.

Zinc contamination comes from poor rinsing before the **E-Brite Ultra Cu-Mg** tank when plating magnesium die-cast surfaces. Zinc contamination in baths used to plate diecast magnesium can be removed with low current density dummy plating.

Initial contamination of a solution with zinc can be overcome by adding **E-Brite Ultra Cu-Mg "E"** to the bath. Three (3) to 6% by volume of **E-Brite Ultra Cu-Mg "E"** per 400 to 1000 ppm contamination will take care of the problem. Contamination as high as 2000 ppm of zinc can also be taken care of with an **E-Brite Ultra Cu-Mg "E"** addition but preferably it should be dummy plated out at low current density.

Lead contamination comes from being dragged into the **E-Brite Ultra Cu-Mg** solution due to poor rinsing of dissolved lead from acid dipped leaded steels and leaded brass and from parts dropped into the solution.

Iron contamination comes from dissolved iron from an acid dip being dragged into the **E-Brite Ultra Cu-Mg** solution due to poor rinsing and from parts dropped into the solution.

Lead and iron contamination may be removed by high current density dummy plating onto corrugated steel plates covered with leached anode bags. As the metal contamination plates onto the cathode it will be sloughed off from the steel and be collected in the bags. The sloughed off material must be removed from the bags every hour or so to avoid re-dissolving the lead or iron. Rinse the powdered material off the cathodes and out of the bags to keep it out of the tank. The initial effect of iron contamination can be overcome by adding **E-Brite Ultra Cu-Mg "E"**. Iron is usually plated out continuously in the HCD area. But when excessive iron contamination causes a loss of adhesion - it must be dummy plated out.

Organic contamination from drag-in of wetting agents causes a discolored, dull, chalky, and brick red deposit which is removed by peroxide and batch carbon treatment. Do not use an organically inhibited acid prior to an **E-Brite Ultra Cu-Mg** bath. The inhibitor will be carried into the bath causing a loss of adhesion in the LCD area.

METALLIC COPPER ANALYSIS

1. Pipette a 5 ml sample of the plating solution into a 250 ml Erlenmeyer flask. Add 25 ml distilled or deionized water.
2. Add 2 to 3 grams Ammonium Persulfate – let stand for 10 to 15 minutes. (Swirl a few times while waiting.)
3. Add approximately 5 ml of concentrated Ammonium Hydroxide. Solution will be a clear, deep blue.
4. Add 50 ml distilled or deionized water.
5. Add 4 to 6 drops Pan Indicator. (Do not add more than 6 drops, as it will affect the end point.)
6. Solution should be purple or pale red in color.
   Titrate with 0.1M EDTA solution to a yellow-green end point.

   Calculation: **oz/gal of copper =** (ml of EDTA) x 0.170

WASTE TREATMENT

Copper from **E-Brite Ultra Cu-Mg** rinse water by itself or mixed with other metallic rinse waters is precipitated by conventional Sodium Hydroxide treatment with **EPI Coagulants** and **EPI Polymers.**

A spill of **E-Brite Ultra Cu-Mg** requires treatment with lime. Sometimes, using a small addition of lime to the hydroxide treatment will increase the effectiveness of the precipitation.

Trouble Shooting

PROBLEMS	POSSIBLE CAUSES	REMEDIES
Discolored plating, chalky, brick red to black and sometimes peels off.	Organic contamination dragged in from cleaners or due to poor cleaning and rinsing.	Change carbon filters or peroxide/carbon batch treatment. Improve cleaning and rinsing.
	Cyanide contamination - from previous copper cyanide process or from a cyanide zincate or plating processes in the vicinity.	Temporary treatment with peroxide. HCD dummying. Trace and eliminate the sources of cyanide - such as cracked racks.
Non-adherent plating, particularly in LCD areas or upon bending.	Low **E-Brite Ultra Cu-Mg "E"** **Too long in E-Pik 241**	Add **E-Brite Ultra Cu-Mg "E",** 1 to 2% by volume at a time - check Hull Cell plating results, then add to bath. Cut the immersion time.
	Poor cleaning and surface preparation. Exhausted zincate **E-Prep 284**	Ensure proper soak, electroclean and acid or acid salt along with good, counter-flow rinsing. Change or adjust zincate.
Copper plating adhesion okay but copper and nickel plated parts, upon bend testing fail.	Low **E-Brite Ultra Cu-Mg "E"**	Add **E-Brite Ultra Cu-Mg "E"**, 1 to 2% by volume at a time and check Hull Cell plating results. Carry out adhesion tests.
	Low pH	Add **E-Brite Ultra Cu-Mg "PHA"** to raise pH to 9.8.
	Copper metal too high	Lower the copper metal by plating out of bath using graphite or stainless steel anodes or a combination of copper and graphite and/or stainless steel anodes.
Dark, spongy deposits in HCD areas accompanied by poor adhesion in LCD areas.	Iron contamination	Use a good 2-3 stage counter flow rinse after acid pickling and before plating to minimize acid and iron contamination to the plating bath.
		HCD dummy plate to remove iron
		Remove fallen parts – fish out plating bath tank bottom with a magnet.

Black non-adherent plating in HCD areas.	Lead contamination from leaded brass or leaded steel parts being plated Note: E-Brite Ultra Cu-Mg should not be used to barrel plate over pure lead. Example: bullets	HCD dummy plate to remove lead on a periodic basis. Improve counter current flow rinsing to avoid drag in of dissolved lead. Check for parts dropped into tanks.
Burned deposits in HCD areas	Too much current	Lower Current
	No or insufficient air agitation.	Ensure good vigorous air agitation.
	Too low temperature	Raise temperature to 120 to 140°F.
	Too low copper metal (below 0.5 oz/gal)	Raise copper metal to at least 0.8 oz/gal for zinc die-cast, 1.0 oz/gal for other substrates by adding E-Brite Ultra Cu-Mg.
Blistering/loss of adhesion on magnesium die-cast surfaces	Silver or zinc contamination	Change anodes to remove silver. Dummy plate out the zinc at low current density.
	Poor cleaning and surface Preparation.	Ensure proper soak, electroclean and acid or acid salt along with good, counter-flow rising.
	Exhausted zincate	Change or adjust zincate

CAUTION

Do not work with the **E-Brite Ultra Cu-Mg** solutions or other **EPI** products without first reading and understanding the **MATERIAL SAFETY DATA SHEET** furnished by **EPI**.

Packaging

Five (5), and 55 gallon non-returnable containers.

IMPORTANT NOTICE! For Industrial Use Only

The following is made in lieu of all warranties, expressed or implied, including the implied warranties of merchantability and fitness for purpose: seller's and manufacturer's only obligation shall be to replace such quantity of the product as proved to be defective. Before using user shall determine the suitability of the product for its intended use, and user assumes all risk and liability whatsoever in connection therewith. **Neither seller nor manufacturer shall be liable either in tort or in contract for any loss or damage, direct, incidental or consequential arising out of the use or the inability to use the product.**

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