TINGLO CULMO™ Bright Acid Tin Electroplating (with Starter/Brightener 2.5X)

For Electronic Finishing Applications

Regional Product Availability

- North America

Description

The TINGLO CULMO™ Process offers extremely bright tin deposits with excellent solderability and ductility, capable of meeting the requirements for electronic, industrial and decorative applications. The process is distinguished by its stability, economy, ease of operation and exceptional throwing power.

Advantages

- Bright, levelled deposit
- Good solderability after long periods of storage
- Relatively non-porous deposit
- Meets Mil T-10727A for corrosion protection (salt spray)
- Economy and ease of use

Deposit Properties

Solderability:	Excellent
Shelf Life:	Excellent
Hardness:	8–9 HV_{25}
Density:	7.31 g/cm^3
Electrical Conductivity (AG=100):	13.0
Heat Conductivity (AG=100):	15.0
Melting Point:	233°C (451°F)
Electrical Resistivity:	11.5 microhm-cm^3

Bath Make-Up

Bath Make-Up		
Chemicals Required	Metric	(U.S.)
Deionized (D.I.) Water	750 mL/L	(75% v/v)
Sulfuric Acid	100 mL/L	(10% v/v)
Stannous Sulfate	30 g/L	(4.0 oz./gal.)
TINGLO CULMO™ Starter (2.5X)	40 mL/L	(4% v/v)

Make-Up Procedure

1. Add D.I. water to a clean tank.
2. Slowly add sulfuric acid with good agitation.
   Caution: Use extreme care when handling sulfuric acid. Always add acid to water with constant mixing during addition. The reaction is exothermic (generates heat) and temperatures may exceed 70°C (158°F). If this

occurs, stop addition and allow temperatures to drop below 50°C (120°F) before recommencing.

3. In a separate container, mix small portions of the required amount of stannous sulfate with D.I. water into a slurry. Add slurry to the tank and mix until completely dissolved.
4. Allow solution to cool to below 24°C (75°F).
5. Add TINGLO CULMO™ Starter (2.5X) and mix thoroughly.
6. Dilute to final volume with D.I. water and mix thoroughly.

Operating Parameters—Metric		
Component	Range	Recommended
Tin Metal	10.0–25.0 g/L	15.0 g/L
Sulfuric Acid	85.0–110.0 mL/L	100.0 mL/L
TINGLO CULMO™ Starter (2.5X)	20–40 mL/L	40 mL/L
Temperature	15–30°C	
Cathode Current Density	0.1–4.0 A/dm^2	
Anode Current Density	0.2–2.5 A/dm^2	
Agitation	Continuous cathode rod parallel to the anodes	
Cathode Efficiency	95–100%	
Deposition Rate	1 micron per minute at 2 A/dm^2 based on 100% cathode efficiency	

Operating Parameters—U.S.		
Component	Range	Recommended
Tin Metal	1.3–3.3 oz./gal.	2.0 oz./gal.
Sulfuric Acid	8.5–11.0% v/v	10.0% v/v
TINGLO CULMO™ Starter (2.5X)	2.0–4.0% v/v	4.0% v/v
Temperature	60–85°F	
Cathode Current Density	1–40 A/ft^2	
Anode Current Density	2–25 A/ft^2	
Agitation	Continuous cathode rod parallel to the anodes	
Cathode Efficiency	95–100%	
Deposition Rate	40 micro inches per minute at 20 A/ft^2 based on 100% cathode efficiency	

Pre-Treatment

A barrier plate of copper or nickel should be used to prevent zinc migration when plating tin over zinc or brass.

A final activation step of 10–20% sulfuric acid is recommended prior to entering the electroplating cell.

Bath Maintenance

The TINGLO CULMO™ Process is a two-component system that imparts brightness to the deposit over a wide range of current densities. The solution in most cases is maintained by adding 20 mL of TINGLO CULMO Starter (2.5X) and 10 mL of TINGLO CULMO Brightener (2.5X) per 100 ampere hours. If TINGLO CULMO is being used as an etch resist for a Circuit Board Technologies application, then, it may be possible to replenish the bath only with TINGLO CULMO Starter (2.5X) at a rate of 30 mL per 100 ampere hour.

TINGLO CULMO Starter (2.5X)

For makeup and replenishment. For maintaining deposit grain refinement and operating current density range.

TINGLO CULMO Brightener (2.5X)

TINGLO CULMO Brightener (2.5X) is used for replenishment to maintain deposit uniformity and brightness. Additions are made based upon Hull cell determination.

NEUTRA RINSE™ 80 Post-Rinse

NEUTRA RINSE 80 is a specially designed post-plate rinse for parts plated in the TINGLO CULMO Bright Tin Process. NEUTRA RINSE 80 will Neutralize the acid film left on parts, thus improving solderability and minimizing staining of parts after plating. (For more information, see NEUTRA RINSE 80 datasheet.)

CLAROSTAN™ S.O. Clarifier

CLAROSTAN S.O. is a liquid clarifier and flocculating agent used to minimize turbidity commonly found in aged sulfate tin plating solutions. The turbidity is caused by oxidized tin solids suspended in the solution and the treatment with CLAROSTAN S.O. precipitates these solids. Regular treatment of the plating solution is recommended to optimize the plating efficiency.

Spectrophotometric Analysis of TINGLO CULMO™ Starter (2.5X)

I. Equipment
   a) Five 100 mL volumetric flasks
   b) 0.5 mL pipette
   c) 2 mL and 4 mL volumetric pipettes
   d) UV Spectrophotometer
   e) Quartz cell cuvettes

II. Reagents

a) Tin stock; 30 g/L $SnSO_4$, 105 mL/L H_2SO_4

b) 2% TINGLO CULMO™ Starter (2.5X) solution; pipette 2 mL TINGLO CULMO Starter (2.5X) into a 100 mL volumetric flask and dilute to mark with tin stock

c) 4% TINGLO CULMO Starter (2.5X) solution; pipette 4 mL TINGLO CULMO Starter (2.5X) into a 100 mL volumetric flask and dilute to mark with tin stock

d) Sulfuric acid

III. Procedure

a) Prepare 2% and 4% TINGLO CULMO Starter (2.5X) standard solutions.

b) Pipette 0.5 mL of each standard, tin stock (used for a blank) and production electrolytes into separate 100 mL volumetric flasks and dilute to the mark with a 5% solution of sulfuric acid.

c) Set the UV spectrophotometer up to do a single wavelength reading at 280 nm.

d) Measure the absorbance of the two standards and the production electrolytes at 280 nm and record them.

e) Plot the absorbance vs. the % TINGLO CULMO Starter (2.5X) on a graph for the two standards.

f) Using the above curve, determine the % TINGLO CULMO Starter (2.5X) of the production electrolytes from their absorbance.

*Note: Filtering may be necessary before pipetting for second dilution.

Tin Metal

Stannous sulfate contains 55.3% tin metal and is used to maintain the tin metal content. To raise tin metal content by 1.0 g/L (0.13 oz./gal.) add 1.8 g/L (0.24 oz./gal.) stannous sulfate.

Determination of Tin Metal

I. Equipment

a) 5 mL Class A volumetric pipette

b) 250 mL Erlenmeyer flask

c) 50 mL burette

d) 100 mL graduated cylinder

e) Eye dropper

II. Reagents

a) Hydrochloric acid, 20% v/v

b) Starch indicator solution

III. Titrants

a) Iodine solution, 0.10N standardized

Dissolve 12.7g iodine in approximately 750 mL of 10% potassium iodide solution. Dilute to 1 liter with D.I. water. Then standardize against a know sodium thiosulfate solution.

IV. Procedure

a) Pipette 5 mL of the tin plating solution to be analyzed into 250 mL Erlenmeyer flask.

b) Add 100 mL of distilled water.

c) Add 20 mL of 20% hydrochloric acid (20%).

d) Add 1 mL starch indicator solution.

e) Titrate with 0.1N iodine solution to a blue color, which persists for 30 seconds.

V. Calculation

stannous sulfate in oz./gal. = mL of 0.1N Iodine used × 0.286

Sulfuric Acid

Sulfuric acid concentration must be maintained for optimum throwing power.

Determination of Sulfuric Acid

I. Equipment

a) 5 mL Class A volumetric pipette

b) 250 mL Erlenmeyer flask

c) 50 mL burette

d) Eye dropper

II. Reagents

a) Tin plating solution

b) Ammonium oxalate (4%)

c) Bromocresol purple indicator

III. Titrants

a) Sodium hydroxide solution, 1.0N

IV. Procedure

a) Pipette 5 mL of the tin plating solution to be analyzed into 250 mL Erlenmeyer flask.

b) Add 50 mL of ammonium oxalate solution (4%).

c) Add 5 drops of bromocresol purple indicator.

d) Titrate with 1.0N sodium hydroxide solution until the color changes from yellow to purple.

V. Calculation

sulfuric acid in % v/v =

mL of 1.0N sodium hydroxide × 0.53

Anode Maintenance

Anode area should be maintained for optimum results. Inspect anodes on a regular basis and replace worn or severely necked slab anodes.

Recommended Control Schedule

Analysis of	Procedure	Frequency
Stannous Tin	Volumetric	Daily
Sulfuric Acid	Volumetric	Daily
Metallic Contamination	Atomic Absorption	Weekly
Chloride Contamination	Ion Specific Electrodes	Weekly
Deposit Appearance	Hull Cell	Daily
Deposit Thickness	X-ray, Beta backscatter, Cross section	Daily
Throwing Power	Cross section, X-ray	Weekly

Contaminants

The maximum tolerable level of typical contaminants are listed below:

Copper	5 ppm
Iron	1,000 ppm
Nickel	100 ppm

Product Data

For the specific Product Data values, please refer to the Certificate of Analysis provided with the shipment of the product(s).

Associated Products

TINGLO CULMO™ Starter (2.5X)

TINGLO CULMO Brightener (2.5X)

NEUTRA RINSE™ 80 Post-Rinse

CLAROSTAN™ S.O. Clarifier

Equipment

Tanks:	Polypropylene, Polyethylene, CPVC
Agitation:	Cathode movement and solution agitation. Work rod speed = 3–4 m/min. (2.0–2.6 in./sec.) Stroke length = 50–70 mm (2.0–2.8 in.) Continuous solution agitation at 3 to 4 turnovers per hour
Filtration:	Periodic through 1 micron polypropylene or Dynel cartridges

Solution Cooling:	May be required for certain operations; Teflon fluoropolymer coils are recommended
Anodes:	Pure tin slabs, minimum purity of 99.95%; the use of titanium anode baskets is not recommended
Rectifier:	Continuous voltage control with 5% maximum ripple

Equipment Preparation

Prior to makeup, the process tank and ancillary equipment should be thoroughly cleaned and then leached with a sulfuric acid solution.

This procedure is particularly important for new equipment or equipment previously used for other processes.

I. Cleaning Solution
   a) Trisodium Phosphate: 15 g/L (2 oz./gal.)
   b) Sodium Hydroxide: 15 g/L (2 oz./gal.)

II. Leaching Solution
   Sulfuric Acid: 100 mL/L (10% v/v)

III. Procedure
   a) Thoroughly wash down tank and ancillary equipment with clean water.
   b) Recirculate water through the complete system to remove water soluble materials.
   c) Discard water.
   d) Add cleaning solution to the tank, heat to 55–60°C (130–140°F) and recirculate through the complete system.
   e) Discard cleaning solution.
   f) Recirculate water through the complete system.
   g) Discard water.
   h) Add leaching solution and recirculate through the complete system.
   i) Leave leaching solution in tank for minimum of 8 hours.
   j) Recirculate leaching solution through the complete system.
   k) Discard leaching solution.
   l) Recirculate water through the complete system.
   m) Discard water.

Handling Precautions

Before using this product, associated generic chemicals or the analytical reagents required for its control, consult the supplier's Material Safety Data Sheet (MSDS)/Safety Data Sheet (SDS) for details on product hazards, recommended handling precautions and product storage.

CAUTION! Keep combustible and/or flammable products and their vapors away from heat, sparks, flames and other sources of ignition including static discharge. Processing or operating at temperatures near or above product flashpoint may pose a fire hazard. Use appropriate grounding and bonding techniques to manage static discharge hazards.

CAUTION! Failure to maintain proper volume level when using immersion heaters can expose tank and solution to excessive heat resulting in a possible combustion hazard, particularly when plastic tanks are used.

Storage

Store products in tightly closed original containers at temperatures recommended on the product label.

Disposal Considerations

Dispose in accordance with all local, state (provincial) and federal regulations. Empty containers may contain hazardous residues. This material and its container must be disposed in a safe and legal manner.

It is the user's responsibility to verify that treatment and disposal procedures comply with local, state (provincial) and federal regulations. Contact your Dow Electronic Materials Technical Representative for more information.

Product Stewardship

Dow has a fundamental concern for all who make, distribute, and use its products, and for the environment in which we live. This concern is the basis for our product stewardship philosophy by which we assess the safety, health, and environmental information on our products and then take appropriate steps to protect employee and public health and our environment. The success of our product stewardship program rests with each and every individual involved with Dow products - from the initial concept and research, to manufacture, use, sale, disposal, and recycle of each product.

Customer Notice

Dow strongly encourages its customers to review both their manufacturing processes and their applications of Dow products from the standpoint of human health and environmental quality to ensure that Dow products are not used in ways for which they are not intended or tested. Dow personnel are available to answer your questions and to provide reasonable technical support. Dow product literature, including safety data sheets, should be consulted prior to use of Dow products. Current safety data sheets are available from Dow.

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