



Sterling™ Silver

Sterling™ Metallic Solderability Preservative

Product Code No. 75097

DESCRIPTION: Sterling™ Silver is an immersion process for plating a silver deposit on copper, designed to be used as a final finish for printed circuit boards.

FEATURES & BENEFITS:

<u>Features</u>	<u>Benefits</u>
High Stability	Long solution life
Uniform bright deposit	Improved cosmetics
Wide operating window	Process control simplicity
Replenishable	Reduced make-up costs

PHYSICAL & CHEMICAL PROPERTIES:

	<u>Sterling™ Silver Part A</u>	<u>Sterling™ Silver Part B</u>
Appearance	Colorless to light brown liquid	Dark yellow liquid
Odor	Odorless	Odorless
Flash Point	Non-flammable	Non-flammable
Freezing Temperature	-2°C (28°F)	-2°C (28°F)
Min. Storage Temperature	3°C (37°F)	3°C (37°F)

EQUIPMENT: For both the Sterling™ Predip and Sterling™ Silver Baths

Tanks	CPVC, polypropylene, polyethylene.
Agitation	Work rod agitation and solution movement at 3 to 5 turnovers/hour are required. <i>Air agitation is detrimental.</i>
Vibration	While implemented the vertical mode, vibration may be required for parts with plated through holes of 5:1 and larger aspect ratios, or boards 0.125”(3.2mm) and thicker, or via holes 0.008”(0.2mm) and smaller in diameter
Filtration	Required. Continuous, through 20-micron polypropylene filter cartridges, at 3 to 5 turnovers/hour.
Ventilation	Required. 50 FPM (15 MPM) face velocity is recommended.
Heaters	Teflon, Teflon coated steel (316), Quartz.

NOTE: No exposed metal is permitted in these tanks

MAKE-UP**PROCEDURE(*):****Sterling™ Predip**

DI Water	93.4% by volume
Sterling™ Silver Part B (75098)	5% by volume
Concentrated Nitric Acid, reagent grade	1.6% by volume

Sterling™ Silver

DI Water	81.8% by volume
Sterling™ Silver Part B (75098)	10% by volume
Concentrated Nitric Acid, reagent grade	3.2% by volume
Sterling™ Silver Part A (75097)	5% by volume

(*) Add components in the order listed; mix thoroughly before adding next component.

**OPERATING
CONDITIONS:**

	Acid Normality	Chelator Molarity	Silver g/L	Copper mg/L	Temperature	Contact time seconds(**)
Sterling™ PreDip bath	0.25 (0.2 – 0.3)	0.015 (0.01-0.02)	N/A	1000 max.	°C 38 (32 - 43) °F 100 (90 – 110)	30 – 45
Sterling™ Silver bath	0.5 (0.4-0.6)	0.03 (0.02-0.04)	1.5 (1 – 2)	3000 max.	°C 49 (43 - 54) °F 120 (110 - 130)	Vertical : 60 – 90 Horizontal : 60 – 180

(**) these contacts time may not be applicable when processing BMVs; please contact your MacDermid representative for specific recommendations.

**BATH MAINTENANCE
& REPLENISHMENT:****STERLING™ PREDIP BATH & STERLING™ SILVER BATH****I. Acid Normality****A. Reagents**

- 0.1N sodium hydroxide [NaOH]
- Phenolphthalein indicator

B. Procedure

- Pipette a 5mL sample of the working bath into a 250 Erlenmeyer flask.
- Add 50mL of DI water.
- Add 4 - 6 drops of phenolphthalein indicator.
- Titrate with 0.1N NaOH to a pink (fresh bath)/orange (used bath) endpoint.

C. Calculation

$$\text{Acid Normality} = \frac{(\text{mL of NaOH}) \times (\text{N of NaOH})}{\text{Sample Size}}$$

D. Maintenance

- Maintain the acid normality within the range detailed in the Operating Conditions.
- An addition of 0.63mL/L (2.4mL/gal) of concentrated Nitric Acid will raise the acid normality by 0.01N.

II. Chelator Molarity

A. Reagents

1. 0.05M Copper Nitrate (11.63g $\text{Cu}(\text{NO}_3)_2 \cdot 2.5\text{H}_2\text{O}$ to 1.0 L with DI water)**
2. Acetate Buffer (82g/L Anhydrous Sodium Acetate & 60mL/L Glacial Acetic Acid)
3. PAN indicator

B. Procedure:

1. Pipette 20mL bath sample into 250ml Erlenmeyer flask
2. Add 25mL Acetate buffer
3. Dilute to 100mL with DI water
4. Add 3-5 drops PAN indicator
5. Slowly titrate to permanent purple end point

C. Calculation:

$$\text{Chelator Molarity} = (\text{mL of Copper Nitrate}) \times (\text{M of Copper Nitrate}) \times 0.05$$

** 0.05 M Copper Sulfate can be used in place of Copper Nitrate.

D. Maintenance:

1. Maintain the chelator molarity within the range detailed in the Operating Conditions.
2. An addition of 3.3mL/L (12.5mL/gal) of Sterling™ Silver Part B will raise the chelator molarity by 0.001M.
3. When adding more than 15ml/L of Part B # 75098, it is necessary to add 1 part nitric acid for every 4 parts Part B added. Re-analyze after all adds are well mixed, and adjust if necessary.

III. Copper Concentration

A. Reagents

1. 1 mg/L Copper Standard
2. 5 mg/L Copper Standard

B. Procedure (dilution factor =100)

1. Pipette a 1mL sample of working bath into a 100 mL volumetric flask.
2. Dilute to volume with DI water. Mix well.
3. Set up the atomic absorption spectrophotometer for copper:

Wavelength:	324.8 nm
Slit width:	0.7 nm
Flame	Lean, blue
4. Aspirate the 1 mg/L copper standard.
5. Aspirate the 5 mg/L copper standard.
6. Aspirate the diluted sample and record the reading.

Note: *If reading is out of range, adjust dilution made in Step 1 and repeat the procedure. Remember to adjust dilution factor.*

C. Calculation

$$\frac{\text{mg}}{\text{L}} \text{ Copper} = \text{AA Reading} \times \text{Dilution Factor}$$

D. Maintenance:

Dump the bath per specification outlined in the **OPERATING CONDITIONS** section.

IV. Silver Concentration

A. Reagents

1. 100 mg/L Silver standard
2. 4 mg/L Silver standard

B. Procedure

1. Pipette a 10mL sample of the working bath into a 100-mL volumetric flask.
2. Dilute to volume with DI water. Mix well.
3. Pipette a 1mL aliquot of the above solution into each of 3 separate 100mL volumetric flasks labeled A, B and C.
4. Pipette 1mL of the 100 mg/L Silver Standard into the flask labeled B and 2mL of the Silver Standard into the flask labeled C.
5. Dilute all three flasks to volume with DI water. Mix well.
6. Set up the Atomic Absorption Spectrophotometer for Silver:

Wavelength: 328.1 nm
Slit Width: 0.7 nm
Flame Lean, blue

7. Optimize the Atomic Absorption Spectrophotometer with the 4 mg/L Silver standard.
8. Read the absorbency for each solution (A, B and C) a minimum of three times and average the readings for each.

C. Calculation

$$\frac{0.5 \times Abs_A}{Abs_B - Abs_A} + \frac{Abs_A}{Abs_C - Abs_A} = \frac{g}{L} \text{ Silver}$$

D. Maintenance

1. Maintain the Silver concentration between 1 and 2 g/L.
 2. An addition of 3.3mL/L (12.5mL/gal) of Sterling™ Silver Part A will raise the concentration by 0.1 g/L.
 3. Add 0.5mL of Sterling™ Silver Part B for every 1mL of Sterling™ Silver Part A added.
- * Note: On make-up, replenish Part B by molarity analysis only.**

V. Alternative method for Silver Analysis – new silver bath only.

NOTE: Copper interferes with this analysis; the accuracy decreases with the increase of copper concentration in the analyzed sample. The preferred analysis is by AA Spectrophotometry.

A. Reagents

1. 0.01N Potassium Iodide [KI]
2. Potassium nitrite
3. Nitric acid, concentrated
4. Starch indicator solution

B. Procedure

1. Pipette a 5-mL sample of working bath into a 250 mL Erlenmeyer flask.
2. Add 25-mL DI water. Mix well.
3. Add 1 mL of nitric acid. Mix well.
4. Add 0.5g of potassium nitrite. Mix until dissolved.
5. Add 3 - 5 mL starch indicator.
6. Titrate with 0.01N KI to the first color change.

C. Calculation

$$\frac{g}{L} \text{ Silver} = \frac{(mL \text{ of KI}) \times (N \text{ of KI}) \times 107.9}{\text{Sample Size}}$$

D. Maintenance(*)

1. Maintain the Silver concentration between 1 and 2 g/L.
2. An addition of 3.3mL/L (12.5mL/gal) of Sterling™ Silver Part A will raise the concentration by 0.1 g/L.
3. Add 0.5mL of Sterling™ Silver Part B for every 1mL of Sterling™ Silver Part A added.

*** Note: On make-up, replenish Part B by molarity analysis only.**

SOLUTION LIFE:

The **Sterling™ Predip** working bath must be replaced when the copper concentration exceeds 1000 mg/L or whenever the Sterling™ Silver bath is dumped, whichever comes first.

The **Sterling™ Silver** working bath must be replaced when 5 metal turns are achieved or when the copper concentration exceeds 3000 mg/L, whichever comes first.

SAFETY & WARNING:

MacDermid Inc. recommends that the company/operator read and review the MacDermid MSDS for the appropriate health and safety warnings before use.

The Sterling™ Silver working bath is acidic. Avoid eye, skin and oral contact. When handling, wear protective clothing, rubber gloves and safety goggles. Flush exposed areas with large amounts of clean, cold water. Contact a physician in case of injury.

Flush spillage generously with water. Do not mix the Sterling™ Silver with strong alkaline solutions as an explosive reaction may occur.

Store Sterling™ Silver Part A and B in a cool and dry area in tightly closed containers.

Material Safety Data Sheets are available from MacDermid, Inc.

WASTE TREATMENT:

Prior to using any recommendations or suggestions by MacDermid Inc. for waste treatment, the user is required to know the appropriate local/state/federal regulations for on-site or off-site treatment, which may require permits. If there is any conflict regarding our recommendations, local/state/federal regulations take precedence.

MacDermid Sterling™ Silver is a complexed silver/organic system. The spent bath can be treated in the following way:

1. Add 1.0 g/L sodium chloride. The silver will precipitate as AgCl.
2. Filter or decant the solution to separate the supernatant from the precipitate.
3. Slowly add 15mL/L of MRA-10 metal reducing agent (Product Code #75057) while mixing.
4. Continue agitation until reaction has stopped and copper has precipitated out of solution.
5. Filter or decant the spent bath to separate the supernatant from the sludge.
6. Adjust the pH of the supernatant to 7.0 with additions of 20% by volume sulfuric acid.
7. Dispose of supernatant and sludge in accordance with local, state, and federal waste treatment regulations.

Observe all local, state and federal waste treatment regulations.

ORDER INFORMATION:

<u>Product</u>	<u>Product Code</u>	<u>Container</u>
Sterling™ Silver Part A	75097	5, 55 gal
Sterling™ Silver Part B	75098	5, 55 gal

Also read carefully warning and safety information on the Material Safety Data Sheet. This data sheet contains technical information required for safe and economical operation of this product. READ IT THOROUGHLY PRIOR TO PRODUCT USE. **Emergency directory assistance Chemtrec 1-800-424-9300.**

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