



PRODUCT INFORMATION

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CHEMTREC 800-424-9300

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MARTRON MSA 20 MATTE TIN PROCESS An Extremely Versatile Matte Tin and Tin-Lead Plating Process

1. GENERAL DESCRIPTION

The **Martron MSA 20 Matte Tin** process is a very versatile, yet extremely easy to use, addition agent system for depositing a fine-grained, satin-like deposit from several types of acid baths containing a large variety of metal contents. This enables the **Martron MSA 20 Matte Tin** process to plate any alloy from pure Tin to 60/40 Tin-Lead, by simply varying metal ratios within the bath. This flexible additive can be used in methane sulfonic, fluoboric, or sulfuric acid-based electrolytes.

The process operates with a single proprietary liquid, **Martron MSA 20 Matte**, which is used for new bath make-up and for normal replenishment. Generally, small additions of **Martron MSA 20 Anti-Ox** are also suggested to retard the build-up of stannic tin in the operating baths.

The **Martron MSA 20 Matte Tin** process can be used for many specialized, high current density applications such as the continuous plating of strip, wire, or tabs. However, it is also equally effective in more conventional, lower current density applications, such as rack or barrel plating, as well as for depositing etch resists in printed circuit board manufacturing. In all cases, deposits exhibit a very high degree of uniformity of appearance and alloy, yet they reflow easily because they do not contain a large amount of occluded organic matter.

2. PRODUCT FEATURES

- A non-fluoborate electrolyte can simplify waste treatment and improve anode utilization.
- Process can be used to deposit many different alloys, ranging from pure tin coatings to conventional 60/40 solder coatings.
- No finish variation from high to low current density.
- Process can be used in methane sulfonic, Fluoboric or sulfuric acid-based electrolytes.
- Process offers improved tolerance to presence of excess addition agent without affecting low current density performance and solderability.
- Process versatility allows for a lower total number of additives in a job shop environment.
- Stability of the process eliminates the need for extra additions after a long shutdown.
- Bath make-up and replenishment are easy and inexpensive.
- Low organic occlusion in the deposit.
- Outstanding reflow and solderability characteristics.
- Reproducible alloy deposition at all current densities.

3. SOLUTION COMPOSITION AND OPERATING CONDITIONS

General Remarks

The **Martron MSA 20 Matte Tin** process is extremely versatile and can be used to deposit a very wide range of different alloys from several electrolytes. In general, the alloy deposited will directly correspond to the ratio of the tin and lead metal concentrations that are maintained in the bath. For example, to deposit a 90/10 alloy, the tin concentration should be equal to 90% of the total metal content and the lead concentration should be equal to 10% of the total.

The following formulations are typical for depositing 60/40 and 90/10 alloys, respectively, plus 100% tin from each electrolyte. Additionally, users are encouraged to experiment with other bath formulations to determine the precise bath composition that provides optimum performance for the specific application under consideration.

To Deposit 60/40 Tin-Lead from Methane Sulfonic Acid Electrolytes

	<u>Normal-Rack</u>	<u>HighSpeed-Strip</u>	<u>HighThrow-Rack/Barrel</u>
Cathode Current Density	1.5-10A/dm ² (15-100 ASF)	5-60A/dm ² (50-600 ASF)	0.1-7A/dm ² (1-70 ASF)
Tin Metal	30.0 g/l (4.0 opg)	75.0 g/l (10.0 opg)	15.0 g/l (2.0 opg)
Martron Stannous Methane Sulfonate	10% vol	25% vol	5% vol
Lead Metal	15.0 g/l (2.0 opg)	37.5 g/l (5.0 opg)	7.5 g/l (1.0 opg)
Martron Lead Methane Sulfonate	3.3% vol	8.3% vol	1.7% vol
Tin-Lead Metal Ratio	2:1	2:1	2:1
Methane Sulfonic Acid	200 g/l (26.7 opg)	150 g/l (20 opg)	200 g/l (26.7 opg)
Martron Methane Sulfonic Acid	21.4% vol	16.0% vol	21.4% vol
Martron MSA 20 Matte	4.0% vol	5.0% vol	4.0% vol
Martron MSA 20 Anti-Ox	0.4% vol	0.4% vol	0.4% vol
Temperature	24-43°C (75-110°F)	24-5°C (75-130°F)	24-43°C (75-110°F)
Agitation	Continuous	Vigorous	Continuous
Anodes	63/37 Sn/Pb	63/37 Sn/Pb	63/37 Sn/Pb
Anode Bags	Dynel or Polypropylene	Dynel or Polypropylene	Dynel or Polypropylene
Anode Current Density	0.5-5.4 A/dm ² (5-50 ASF)	0.5-5.4 A/dm ² (5-50 ASF)	0.5-5.4 A/dm ² (5-50 ASF)
Filtration	Continuous 10 micron	Continuous 10 micron	Continuous 10 micron
Voltage	3-9 volts	3-9 volts	3-9 Volts

4. SOLUTION COMPOSITION and OPERATING CONDITIONS

To Deposit 90/10 Tin-Lead from Methane Sulfonic Acid Electrolytes

	<u>Normal-Rack</u>	<u>HighSpeed-Strip</u>	<u>HighThrow-Rack/Barrel</u>
Cathode Current Density	1.5-10A/dm ² (15-100 ASF)	5-50A/dm ² (50-500 ASF)	0.1-7A/dm ² (1-70 ASF)
Tin Metal	30.0 g/l (4.0 opg)	75.0 g/l (10.0 opg)	15.0 g/l (2.0 opg)
Martron Stannous Methane Sulfonate	10% vol	25% vol	5% vol

	<u>Normal-Rack</u>	<u>HighSpeed-Strip</u>	<u>HighThrow-Rack/Barrel</u>
Lead Metal	3.0 g/l (0.4 opg)	7.0 g/l (0.9 opg)	2.0 g/l (0.3 opg)
Martron Lead Methane Sulfonate	0.7% vol	1.6% vol	0.4% vol
Tin-Lead Metal Ratio	10:1	11:1	8:1
Methane Sulfonic Acid	200 g/l (26.7 opg)	150 g/l (20 opg)	200 g/l (26.7 opg)
Martron Methane Sulfonic Acid	21.4% vol	16.0% vol	21.4% vol
Martron MSA 20 Matte	4.0% vol	5.0% vol	4.0% vol
Martron MSA 20 Anti-Ox	0.4% vol	0.4% vol	0.4% vol
Temperature	24-43°C (75-110°F)	24-55°C (75-130°F)	24-43°C (75-110°F)
Agitation	Continuous	Vigorous	Continuous
Anodes *	90/10 Sn/Pb	90/10 Sn/Pb	90/10 Sn/Pb
Anode Bags	Dynel or Polypropylene	Dynel or Polypropylene	Dynel or Polypropylene
Anode Current Density	0.5-5.4 A/dm ² (5-50 ASF)	0.5-5.4 A/dm ² (5-50 ASF)	0.5-5.4 A/dm ² (5-50 ASF)
Filtration	Continuous 10 micron	Continuous 10 micron	Continuous 10 micron
Voltage	3-9 volts	3-9 volts	3-9 Volts

* It is possible to operate continuously using pure tin anodes, making up the lead difference in the bath using lead salts as required for replenishment. However, since the anodic dissolution of tin is 100% efficient, while its deposition efficiency at the cathode is much lower (since part of the current is used to deposit lead ions), a progressive build-up of tin in solution will typically follow. Thus, this method of operation should be used only with alloys containing up to 5% Pb, as in this case, drag-out losses and tin oxidation serve to keep the tin concentration in solution more or less constant.

5. SOLUTION COMPOSITION and OPERATING CONDITIONS

To Deposit 100% Tin from Methane Sulfonic Acid Electrolytes

	<u>Normal-Rack</u>	<u>HighSpeed-Strip</u>	<u>HighThrow-Rack/Barrel</u>
Cathode Current Density	1.5-10 A/dm ² (15-100 ASF)	5-50 A/dm ² (50-500 ASF)	0.1-7 A/dm ² (1-70 ASF)
Tin Metal	30.0 g/l (4.0 opg)	75.0 g/l (10.0 opg)	15.0 g/l (2.0 opg)
Martron Stannous Methane Sulfonate	10% vol	25% vol	5% vol
Lead Metal	N/A	N/A	N/A
Martron Lead Methane Sulfonate	N/A	N/A	N/A
Tin-Lead Metal Ratio	N/A	N/A	N/A

	<u>Normal-Rack</u>	<u>HighSpeed-Strip</u>	<u>HighThrow-Rack/Barrel</u>
Methane Sulfonic Acid	200 g/l (26.7 opg)	150 g/l (20 opg)	200 g/l (26.7 opg)
Martron Methane Sulfonic Acid	21.4% vol	16.0% vol	21.4% vol
Martron MSA 20 Matte	4.0% vol	5.0% vol	4.0% vol
Martron MSA 20 Anti-Ox	0.4% vol	0.4% vol	0.4% vol
Temperature	24-43°C (75-110°F)	24-55°C (75-130°F)	24-43°C (75-110°F)
Agitation	Continuous	Vigorous	Continuous
Anodes	100% Sn	100% Sn	100% Sn
Anode Bags	Dynel or Polypropylene	Dynel or Polypropylene	Dynel or Polypropylene
Anode Current Density	0.5-5.4 A/dm ² (5-50 ASF)	0.5-5.4 A/dm ² (5-50 ASF)	0.5-5.4 A/dm ² (5-50 ASF)
Filtration	Continuous 10 micron	Continuous 10 micron	Continuous 10 micron
Voltage	3-9 volts	3-9 volts	3-9 Volts

* Operating at the upper end of the temperature range tends to produce a slightly denser, "whiter" deposit with fewer propensities for high current density dendritic growth. Deposition efficiency at high current densities is also enhanced.

6. SOLUTION COMPOSITION and OPERATING CONDITIONS

To Deposit 60/40 Tin-Lead from Fluoboric Acid Electrolytes

	<u>Normal-Rack</u>	<u>HighSpeed-Strip</u>	<u>HighThrow-Rack/Barrel</u>
Cathode Current Density	1.5-10 A/dm ² (15-100 ASF)	5-30 A/dm ² (50-300 ASF)	0.1-7 A/dm ² (1-70 ASF)
Tin Metal	30.0 g/l (4.0 opg)	60.0 g/l (8.0 opg)	15.0 g/l (2.0 opg)
(50% Stannous Fluoborate Solution)	9.2% vol	18.5% vol	4.6% vol
Lead Metal	15.0 g/l (2.0 opg)	30.0 g/l (4.0 opg)	5.0 g/l (0.7 opg)
(50% Lead Fluoborate Solution)	3.2% vol	6.5% vol	1.1% vol
Tin-Lead Metal Ratio	2:1	2:1	3:1
Fluoboric Acid	200 g/l (26.7 opg)	150 g/l (20 opg)	200 g/l (26.7 opg)
(48% Fluoboric Acid)	29.9% vol	22.4% vol	29.9% vol
Boric Acid	40.0 g/l (5.3 opg)	40.0 g/l (5.3 opg)	40.0 g/l (5.3 opg)
Martron MSA 20 Matte	4.0% vol	5.0% vol	4.0% vol

	<u>Normal-Rack</u>	<u>HighSpeed-Strip</u>	<u>HighThrow-Rack/Barrel</u>
Martron MSA 20 Anti-Ox	0.4% vol	0.4% vol	0.4% vol
Temperature	24-43°C (75-110°F)	24-55°C (75-130°F)	24-43°C (75-110°F)
Agitation	Continuous	Vigorous	Continuous
Anodes	63/37 Sn/Pb	63/37 Sn/Pb	63/37 Sn/Pb
Anode Bags	Dynel or Polypropylene	Dynel or Polypropylene	Dynel or Polypropylene
Anode Current Density	0.5-5.4 A/dm ² (5-50 ASF)	0.5-5.4 A/dm ² (5-50 ASF)	0.5-5.4 A/dm ² (5-50 ASF)
Filtration	Continuous 10 micron	Continuous 10 micron	Continuous 10 micron
Voltage	3-9 volts	3-9 volts	3-9 Volts

* As the temperature increases, the deposit tends to shift to a richer tin alloy. It may be necessary to decrease the tin-lead metal ratio to compensate if extended high temperature operation is the norm.

7. SOLUTION COMPOSITION and OPERATING CONDITIONS

To Deposit 90/10 Tin-Lead from Fluoboric Acid Electrolytes

	<u>Normal-Rack</u>	<u>HighSpeed-Strip</u>	<u>HighThrow-Rack/Barrel</u>
Cathode Current Density	1.5-10A/dm ² (15-100 ASF)	5-30A/dm ² (50-300 ASF)	0.1-7A/dm ² (1-70 ASF)
Tin Metal	30.0 g/l (4.0 opg)	60.0 g/l (8.0 opg)	15.0 g/l (2.0 opg)
(50% Stannous Fluoborate Solution)	9.2% vol	18.5% vol	4.6% vol
Lead Metal	3.0 g/l (0.4 opg)	6.0 g/l (0.8 opg)	1.2 g/l (0.2 opg)
(50% Lead Fluoborate Solution)	0.65% vol	1.3% vol	0.26% vol
Tin-Lead Metal Ratio	10:1	10:1	12.5:1
Fluoboric Acid	200 g/l (26.7 opg)	150 g/l (20 opg)	200 g/l (26.7 opg)
(48% Fluoboric Acid)	29.9% vol	22.4% vol	29.9% vol
Boric Acid	40.0 g/l (5.3 opg)	40.0 g/l (5.3 opg)	40.0 g/l (5.3 opg)
Martron MSA 20 Matte	4.0% vol	5.0% vol	4.0% vol
Martron MSA 20 Anti-Ox	0.4% vol	0.4% vol	0.4% vol
Temperature	24-43°C (75-110°F)	24-55°C (75-130°F)	24-43°C (75-110°F)
Agitation	Continuous	Vigorous	Continuous
Anodes*	90/10 Sn/Pb	90/10 Sn/Pb	90/10 Sn/Pb

	<u>Normal-Rack</u>	<u>HighSpeed-Strip</u>	<u>HighThrow-Rack/Barrel</u>
Anode Bags	Dynel or Polypropylene	Dynel or Polypropylene	Dynel or Polypropylene
Anode Current Density	0.5-5.4 A/dm ² (5-50 ASF)	0.5-5.4 A/dm ² (5-50 ASF)	0.5-5.4 A/dm ² (5-50 ASF)
Filtration	Continuous 10 micron	Continuous 10 micron	Continuous 10 micron
Voltage	3-9 volts	3-9 volts	3-9 Volts

* It is possible to operate continuously using pure tin anodes, making up the lead difference in the bath using lead salts as required for replenishment. However, since the anodic dissolution of tin is 100% efficient, while its deposition efficiency at the cathode is much lower (since part of the current is used to deposit lead ions), a progressive build-up of tin in solution will typically follow. Thus, this method of operation should be used only with alloys containing up to 5% Pb, as in this case, drag-out losses and tin oxidation serve to keep the tin concentration in solution more or less constant.

8. SOLUTION COMPOSITION and OPERATING CONDITIONS

To Deposit 100% Tin from Fluoboric Acid Electrolytes

	<u>Normal-Rack</u>	<u>HighSpeed-Strip</u>	<u>HighThrow-Rack/Barrel</u>
Cathode Current Density	1.5-10A/dm ² (15-100ASF)	5-30A/dm ² (50-300ASF)	0.1-7A/dm ² (1-70ASF)
Tin Metal	30.0 g/l (4.0 opg)	60.0 g/l (8.0 opg)	15.0 g/l (2.0 opg)
(50% Stannous Fluoborate Solution)	9.2% vol	18.5% vol	4.6% vol
Lead Metal	N/A	N/A	N/A
(50% Lead Fluoborate Solution)	N/A	N/A	N/A
Tin-Lead Metal Ratio	N/A	N/A	N/A
Fluoboric Acid	200 g/l (26.7 opg)	150 g/l (20 opg)	200 g/l (26.7 opg)
(48% Fluoboric Acid)	29.9% vol	22.4% vol	29.9% vol
Boric Acid	40.0 g/l (5.3 opg)	40.0 g/l (5.3 opg)	40.0 g/l (5.3 opg)
Martron MSA 20 Matte	4.0% vol	5.0% vol	4.0% vol
Martron MSA 20 Anti-Ox	0.4% vol	0.4% vol	0.4% vol
Temperature	24-43°C (75-110°F)	24-5°C (75-130°F)	24-43°C (75-110°F)
Agitation	Continuous	Vigorous	Continuous
Anodes	100% Sn	100% Sn	100% Sn
Anode Bags	Dynel or Polypropylene	Dynel or Polypropylene	Dynel or Polypropylene
Anode Current Density	0.5-5.4 A/dm ² (5-50 ASF)	0.5-5.4 A/dm ² (5-50 ASF)	0.5-5.4 A/dm ² (5-50 ASF)

	<u>Normal-Rack</u>	<u>HighSpeed-Strip</u>	<u>HighThrow-Rack/Barrel</u>
Filtration	Continuous 10 micron	Continuous 10 micron	Continuous 10 micron
Voltage	3-9 volts	3-9 volts	3-9 Volts

* Operating at the upper end of the temperature range tends to produce a slightly denser, “whiter” deposit with fewer propensities for high current density dendritic growth. Deposition efficiency at high current densities is also enhanced.

9. SOLUTION COMPOSITION and OPERATING CONDITIONS

To Deposit 100% Tin from Sulfuric Acid Electrolytes

	<u>Normal-Rack</u>	<u>HighSpeed-Strip</u>	<u>HighThrow-Rack/Barrel</u>
Cathode Current Density	1.5-10 A/dm ² (15-100 ASF)	5-25 A/dm ² (50-250 ASF)	0.1-7 A/dm ² (1-70 ASF)
Tin Metal	15.0 g/l (2.0 opg)	60.0 g/l (8.0 opg)	10.0 g/l (1.3 opg)
(as solid stannous sulfate)	27.1 g/l (3.6 opg)	108.5 g/l (14.5 opg)	18.1 g/l (2.4 opg)
(as Martron Tin Sulfate Concentrate)	10.0% vol	40.0% vol	6.7% vol
Sulfuric Acid	176 g/l (23.5 opg)	140 g/l (18.7 opg)	211 g/l (28.1 opg)
(66° Bé or CP grade)	10.0% vol	8.0% vol	12.0% vol
Martron MSA 20 Matte	4.0% vol	5.0% vol	4.0% vol
Martron MSA 20 Anti-Ox	0.4% vol	0.4% vol	0.4% vol
Temperature	24-43°C (75-110°F)	24-55°C (75-130°F)	24-43°C (75-110°F)
Agitation	Continuous	Continuous	Vigorous
Anodes	100% Sn	100% Sn	100% Sn
Anode Bags	Dynel or Polypropylene	Dynel or Polypropylene	Dynel or Polypropylene
Anode Current Density **	0.5-3.0 A/dm ² (5-30 ASF)	0.5-3.0 A/dm ² (5-30 ASF)	0.5-3.0 A/dm ² (5-30 ASF)
Filtration	Continuous 10 micron	Continuous 10 micron	Continuous 10 micron
Voltage	3-9 volts	3-9 volts	3-9 Volts

* Operating at the upper end of the temperature range tends to produce a slightly denser, “whiter” deposit with fewer propensities for high current density dendritic growth. Deposition efficiency at high current densities is also enhanced.

** Anode current densities are limited in sulfate baths due to less efficient anode dissolution predicated on lower solubility of tin in the sulfate electrolyte as compared to fluoborate or methane sulfonate electrolytes. Likewise, sulfate baths also have lower maximum cathode current densities at which plating can be done without burning occurring.

10. SOLUTION MAKE-UP PROCEDURE**Methane Sulfonic Acid Baths**

1. Fill plating tank to approximately 45% of its final volume with deionized water.
2. Add required amount of **Martron Methane Sulfonic Acid**, **Martron Stannous Methane Sulfonate**, and **Martron Lead Methane Sulfonate**. Mix well.
3. Dilute bath to approx. 90% of its final volume.
4. Add the required amounts of **Martron MSA 20 Matte** and **Martron MSA 20 Anti-Ox**. Mix well.
5. Dilute bath to final operating volume and mix well by recirculating solution through the filter within the plating tank for 1 hour.
6. Continue filtering and dummy bath for 1 hour at 0.26 A/dm² (2.5 ASF).
7. The bath is ready for production use.

Fluoboric Acid Baths

1. Fill plating tank to approximately 45% of its final volume with deionized water.
2. Add the required amount of Fluoboric Acid and mix well.
3. With continued mixing, add the required Boric Acid. Mix until dissolved.
4. Add the necessary Stannous Fluoborate and Lead Fluoborate. Mix well.
5. Dilute bath to approximately 95% of its final volume.
6. Add the required amounts of **Martron MSA 20 Matte** and **Martron MSA 20 Anti-Ox**. Mix well.
7. Dilute bath to final operating volume and mix well by recirculating solution through the filter within the plating tank for 1-2 hours.
8. Continue filtering and dummy bath for 1 hour at 0.26 A/dm² (2.5 ASF).
9. The bath is ready for production use.

Sulfuric Acid Baths*Normal and High Throw Applications:*

1. Fill plating tank to approximately 70% of its final volume with deionized water.
2. With mixing, slowly add the required amount of Sulfuric Acid. **CAUTION:** extreme heat is generated during this step. Please wear proper protective safety gear and clothing.
3. Allow solution to cool to 27-38°C (80-100°F).
4. Add the necessary **Martron Tin Sulfate Concentrate**. Mix well.
5. Add the required amounts of **Martron MSA 20 Matte** and **Martron MSA 20 Anti-Ox**. Mix well.
6. Dilute bath to final operating volume and mix well by recirculating solution through the filter within the plating tank for one hour.
7. Continue filtering and dummy bath for 1 hour at 0.26 A/dm² (2.5 ASF).
8. The bath is ready for production use.

High Speed Applications:

1. Fill plating tank to approximately 40% of its final volume with deionized water.
2. With mixing, slowly add the required amount of Sulfuric Acid. **CAUTION:** Extreme heat is generated during this step. Please wear proper protective safety gear and clothing. Maintain solution temperature below 60° C (140°F) during the additions to protect plastic tanks.
3. Allow solution to cool to 27-38°C (80-100°F).
4. Add the necessary **Martron Tin Sulfate Concentrate**. Mix well.
5. Add the required amounts of **Martron MSA 20 Matte** and **Martron MSA 20 Anti-Ox**. Mix well.
6. Dilute bath to final operating volume and mix well by recirculating solution through the filter within the plating tank for one hour.
7. Continue filtering and dummy bath for 1 hour at 0.26 A/dm² (2.5 ASF).
8. The bath is ready for production use.

11. USEFUL INFORMATION ON ACID and METAL CONCENTRATES

Ultra-pure concentrates are a critical element for achieving consistent quality and predictable performance on a long-term basis.

	Concentration	Specific Gravity
Martron Stannous Methane Sulfonate	300 g/l Tin Metal (40.0 opg)	1.530 g/ml
Martron Lead Methane Sulfonate	450 g/l Lead Metal (60.0 opg)	1.650 g/ml
Martron Methane Sulfonic Acid	935 g/l Methane Sulfonic Acid (124.7 opg)	1.350 g/ml
Martron Tin Sulfate Concentrate	150 g/l Tin Metal (20.0 opg)	1.250 g/ml
Sulfuric Acid (66° Bé or CP Grade)	1760 g/l Sulfuric Acid (234.7 opg)	1.84 g/ml
Tin Fluoborate Solution, 50% w/w	325 g/l Tin Metal (43.3 opg)	1.600 g/ml
Lead Fluoborate Solution, 50% w/w	465 g/l Lead Metal (62.0 opg)	1.710 g/ml
Fluoboric Acid, 48% w/w	670 g/l Fluoboric Acid (89.3 opg)	1.400 g/ml

12. REPLENISHMENT ADDITIONS

The consumption rates of the additives that comprise the **Martron MSA 20 Matte Tin** process are predictable and only vary slightly from installation to installation. Typically, the following rates will apply.

Martron MSA 20 Matte	1 liter per 3,960-5,285 AH (1 gallon per 15,000-20,000 AH)
Martron MSA 20 Anti-Ox	0.05-0.075% vol per week

Alternatively, the **Martron MSA 20 Matte** can be replenished based upon solution drag out estimates. If this method is employed, replenish at a rate 4-5% of the drag out volume.

The solution must be kept in chemical balance to provide the desired alloy composition and to maintain necessary throwing power.

In Sulfate Solutions:

To raise the tin content 1 g/l, add 6.7 ml of **Martron Tin Sulfate Concentrate** per liter of bath. To raise the acid content 10 g/l, add 5.7 ml of Sulfuric acid (66° Bé) per liter of bath.

In MSA Solutions:

To raise the lead content 1 g/l, add 2.2 ml of **Martron Lead Methane Sulfonate** per liter of bath. To raise the tin content 1 g/l, add 3.4 ml of **Martron Stannous Methane Sulfonate** per liter of bath. To raise the acid content 10 g/l, add 10.7 ml of **Martron Methane Sulfonic Acid** per liter of bath.

In Fluoborate Solutions:

To raise the lead content 1 g/l, add 2.1 ml of Lead Fluoborate Solution (50% w/w) per liter of bath. To raise the tin content 1 g/l, add 3.1 ml of Tin Fluoborate Solution (50% w/w) per liter of bath. To raise the acid content 10 g/l, add 14.9 ml of Fluoboric Acid (48% w/w) per liter of bath.

13. PROCESS GUIDELINES

A. Total Metal Content

The optimum metal concentration depends upon the application for which the process is being used. In general, the higher the current densities, the higher the total metal concentration needed to maintain proper cathode efficiency. Furthermore,

the higher the total metal concentration, the lower the throwing power or the ability to cover low current density areas. Thus, the optimum bath composition for a given installation is the one that provides the lowest total metal concentration, yet maintains the proper cathode efficiency.

B. Tin-Lead Metal Ratio

The ratio of tin metal to lead metal in the bath is the primary factor that affects the alloy that is deposited. The ratio can also affect deposit color. The optimum ratio depends upon the alloy desired and the current density at which plating will be done. In general, ratios in the range of 1.8:1 to 3.0:1, Sn:Pb are suggested for 60/40 applications; and 8:1 to 12.5:1, Sn:Pb for 90/10 applications.

C. Acid Concentration

The acid provides bath conductivity and ensures total solubility of the tin and lead metals in solution. A low concentration generally decreases throwing power, reducing the effectiveness of the addition agents and deposit covering power in low current density areas. The low acid concentration also increases the voltage required to achieve the proper current density. A slightly high concentration typically has no detrimental effects. Very high concentrations can cause brown, streaky deposits in high current density areas. Very high concentrations also increase the likelihood of anode polarization.

D. Boric Acid

When fluoborate electrolytes are used, it is recommended that an anode bag filled with boric acid be hung in a corner of the tank. This boric acid serves to guard against the liberation of free fluoride ion from the hydrolysis of the fluoboric acid. If the boric acid concentration is allowed to drop in a Sn/Pb bath, free fluoride will form an insoluble lead fluoride, lowering the lead content in solution and increasing the probability of rough deposits from the precipitate. The boric acid bag should be checked periodically to ensure boric acid is dissolving and maintaining a concentration near saturation.

E. Addition Agent Concentrations

The concentration of the **Martron MSA 20 Matte** can be determined empirically through in plant Hull cell plating tests. Mechanical agitation of the solution is strongly recommended. A magnetic stirrer should be used for solutions operated at higher current densities, while sweep-type agitation is satisfactory for installations using lower current densities. Surface tension analysis can also be used to determine additive concentration.

Two-amp panels, run for 3 minutes, are suggested for normal rack and/or barrel plating installations. Either five or ten-amp panels, run for 1 minute, are suggested for high-speed strip and/or wire plating installations. A typical Hull cell panel should be uniformly matte and burn-free at current densities from 0.5 to approximately 40 A/dm² (5-400 ASF), dependent upon metal concentration considerations.

A high current density burn generally indicates either too low a total metal concentration, a low concentration of additive, or organic contamination. If this occurs, the bath composition should be adjusted to the proper range, and another panel run. If high current density performance is still less than satisfactory, **Martron MSA 20 Matte** should be added in increments of 1.0% vol. until a burn-free panel is produced. If a burn-free panel is not achieved with the equivalent of a full make-up charge, then the solution is likely suffering from organic contamination, and carbon treatment, or bath dilution should be considered.

A slightly high concentration of **Martron MSA 20 Matte** generally has no noticeable effect on operating performance. If this occurs, the bath should be diluted to eliminate excess, since working out the excess through normal operation will require an impractical length of time. See analytical control section and troubleshooting guide for more information. The concentration of **Martron MSA 20 Anti-Ox** has no noticeable effect on plating performance. In fact, the only consequence of a low concentration is that it will allow stannic tin to build in the bath at an accelerated rate. A higher than suggested concentration has no known deleterious effect.

F. Alloy of the Deposit

Periodic monitoring of production-processed parts is suggested to ensure the alloy is within the proper range. This can be accomplished in several ways: X-ray Fluorescence (XRF) analysis of the deposit; Atomic Absorption analysis (or ICAP) of a dissolved deposit; or, wet techniques on dissolved samples. "XRF" is the suggested method because of its speed, accuracy, and its non-destructive nature.

G. Temperature

Operating temperatures above 35°C (95°F) can “whiten” deposits, improve grain density, and plating efficiency. Alloy shift toward more tin-rich deposits is also common as temperature increases. Operating temperatures below 21°C (70°F) can produce a darker deposit, loss of high current density tolerance, and improve throwing power. Alloy shifts toward more lead-rich alloys are common at lower temperatures.

H. Cathode Current Density

The overall cathode current density is an extremely important factor in determining the alloy deposited at the extremes of current density ranges. All other factors remaining equal, at very high current densities, higher tin alloy content is likely. Likewise, alloys start to shift toward lead rich plating at very low current densities. Care should be taken to adjust baths metal ratios accordingly if plating at the extremes is to be the norm. Under typical conditions with proper bath chemistries, cathodic current densities up to 54 A/dm² (500 ASF) are possible with MSA electrolytes, 32 A/dm² (300 ASF) with fluoborate electrolytes, and 27 A/dm² (250 ASF) with sulfate electrolytes.

I. Anode Current Density

The anode current density should be maintained between 0.5 and 5.4 A/dm² (5-50 ASF) to ensure optimum performance. Operating with too small an anode area for the current being drawn (i.e., too high an anode current density) causes the anodes to dissolve non-uniformly and become spongy. High anode current densities can also lead to anode polarization. Additionally, insoluble stannic oxide sludge can be formed from oxygen generation at the anode due to water electrolysis from excess electrical potential. Too low an anode current density occurs if the anode area in the bath is too great for the current being drawn. This high anode area tends to cause the concentration of tin metal to rise during normal operation. Proper anodic current density should generate an even, black film on the anode entirety.

J. Conversion of Existing Solutions

When converting an existing bath to the **Martron MSA 20 Matte Tin** process, a one-gallon sample should be submitted to **Martron Inc.** for laboratory evaluation and recommendations.

In general, tin/lead solutions contain high levels of surfactants, and, when coupled with stannic ion, are difficult to carbon treat making conversions troublesome. In some situations, “slide” conversions are possible, but careful monitoring is necessary. The **Martron MSA 20 Matte Tin** process addition agents do not contain chelators or complexing agents: thus, the possible presence of these agents in existing systems can have a detrimental effect on the performance of the **Martron MSA 20 Matte Tin** process and waste treatment.

14. EQUIPMENT

A. Processing Tanks

Tanks should be constructed of polypropylene, PVC, polyethylene, HDPE or polyvinylidene fluoride. Additionally, the rinse tank(s) immediately following the plating tank should be lined with, or fabricated from, the same material as the plating tank to prevent premature attack of the rinse tank(s). The outside surfaces of all lined tanks should be coated with high quality, acid resistant, epoxy paint.

B. Heating and Cooling Equipment

In instances where bath heating is necessary, quartz or Teflon coated heaters are recommended for MSA or sulfate solutions and Teflon coated heaters are to be used with fluoborate solutions. In high current density applications, it is possible to have resistance heating of the solution, necessitating solution cooling. In these cases, Teflon cooling coils should be employed.

C. Filtration

Continuous filtration through in-tank, cartridge-type equipment is highly recommended. Most filter manufacturers offer a variety of materials satisfactory for use with acidic solutions. Ten-micron absolute, polypropylene cartridges are recommended, but they must be leached in clean, cold, running water prior to use. Failure to do so will introduce sizing and/or anti-static agents to the plating bath which are detrimental, and extremely difficult to remove.

D. Ventilation

Martron MSA 20 Matte Tin process Tin and Tin/Lead solutions manufactured with ultra-pure concentrates give off very little odor. However, in many production environments a corrosive mist can be generated around the tanks from barrel agitation, filtration, cascading agitation in strip applications, etc. It is therefore prudent to vent the immediate area around the tanks and said ventilation equipment should be manufactured from plastic or fiberglass.

E. Agitation

Continuous agitation of the solution via high flow rate, in-tank filtration is beneficial and is strongly recommended. Air agitation should never be used. In addition to generating a significant amount of foam, it forms insoluble stannic tin in the bath, which cannot be removed except by lengthy filtration. No secondary agitation is normally required in barrel plating operations. The movement of the barrel and parts being plated through the solution provides sufficient agitation to provide a fresh and continuing flow of metal ions to the surface of the cathode. Gentle, oscillating cathode agitation is beneficial in rack installations. Impinging solution and part movement through the solution generate sufficient metal replenishment in strip and wire plating applications. Insufficient agitation is often characterized by brown streaked deposits in high current density areas or dendritic growth (treeing) in high current density areas.

F. Anodes

Tin Plating:

99.99% pure tin slabs with Monel hooks or plastisol coated titanium hooks are recommended. Monel hooks are strongly recommended for use in Fluoborate baths, as titanium will dissolve if the plastisol coating is compromised. In Sulfate and MSA electrolytes titanium baskets filled with anode chunks may be employed. Other suitable anode basket materials are zirconium and Iridium oxide. If anode baskets are utilized, the use of anode bags is strongly recommended. Anode baskets are not recommended for use in Fluoborate electrolytes.

In 60/40 and 90/10 Tin/Lead Plating

63% Tin/37% Lead and 90% Tin and 10% Lead extruded slab anodes with plastisol coated Monel or titanium hooks are suggested for the two alloys respectively. Because of the corrosive nature of the fluoborate electrolyte, it is imperative that the complete hook is above the electrolyte and Monel is the recommended material of construction. In most instances, the anode alloy should mirror the alloy being deposited. By using anodes of the same alloy, a steady state metal concentration and ratio remains in solution.

One of the advantages of MSA electrolytes is the stability of titanium in solution. This allows for its use as a material for anode hooks without the need for plastisol coating. It is also possible to use titanium baskets filled with Sn/Pb balls or chunks. This is especially useful in high current density applications. However, titanium is very sensitive to trace halogen contamination (chloride, fluoride), which attack the passive layer of titanium oxide. Any contamination has to be avoided. When, for example, an MSA based electrolyte is installed in a line that previously contained fluoborate, it is very difficult to remove traces of fluoride from the tank and equipment. In these situations, uncoated titanium hooks and titanium anode baskets are not recommended. This sensitivity also requires that processing lines have rinsing that ensures chloride from hydrochloric acid-based pickles is not carried downstream. If anode baskets are utilized, the use of anode bags is strongly recommended.

G. Anode Bags

The use of anode bags is optional. The use of anode bags greatly reduces the likelihood of particulate contamination from the anode film. If utilized, the material of construction must be acid resistant, such as Dynel or polypropylene, and non-napped. When used, the anode bags should be changed on a regular basis to guard against weave plugging from stannic tin build-up. In addition, solution agitation is essential so that solution exchange at the anode takes place, lowering the incidence of anode polarization. When anode bags are used, it is imperative that careful attention be paid to anode area. If anode baskets are utilized, the use of anode bags is strongly recommended.

15. SAFE HANDLING

The **Martron MSA 20 Matte Tin** process additives are safe to handle. However, the solutions in which they are used are highly acidic, corrosive, and dangerous to handle. Take all possible precautions to avoid any contact with the skin or eyes. Wear proper protective clothing and all necessary safety gear. In the event of any contact, flush affected area immediately with large volumes of fresh water, and seek medical attention, if necessary. If solution is splashed in the eyes, flush for at least 15 minutes with fresh running water, and immediately obtain medical attention.

16. STORAGE

No special storage considerations are required, other than ensuring that neither of the **Martron MSA 20 Matte Tin** process additives is subjected to freezing temperatures for extended periods, as they can separate at very low temperatures. If this occurs, material should be moved to a warm area and allowed to come to room temperature. Additionally, it should be thoroughly mixed prior to use to ensure a homogenous composition. If the above suggestions are followed, the additives offer excellent shelf life, though **Martron MSA 20 Anti-Ox** will darken in color with age. This has no effect on its performance.

17. WASTE TREATMENT

The **Martron MSA 20 Matte Tin** process additives, themselves, do not require waste treatment prior to disposal. However, the solutions in which they are used are highly acidic and generally require treatment to precipitate the metals present, and to neutralize the acidity, prior to discharge. Standard methods of treatment are satisfactory, as are proprietary treatment methods. If proprietary treatment methods are utilized, **Martron Inc.** has a complete line of wastewater treatment chemistry. For more information, check with **Martron Inc.** on treating wastewater streams containing dissolved tin or tin/lead salts.

18. ANALYTICAL PROCEDURES

The control of an operating solution is straightforward. The following factors should be regularly monitored to ensure consistent, high quality performance.

- Total Metal Concentration
- Tin-Lead Metal Ratio
- Acid Concentration
- Addition Agent Concentration
- Alloy of the Deposit
- Operating Temperature
- Cathode Current Density
- Anode Current Density

Standard wet chemical analytical techniques can be used to determine the tin metal, lead metal, and acid concentrations. The concentration of **Martron MSA 20 Matte Tin** can be monitored empirically through periodic Hull cell tests, or samples can be sent to **Martron Inc.** for more complete analysis.

A. Wet Methods

Tin Metal Analysis

1. Pipette exactly 5 ml of the plating bath into a 500-ml flask and dilute with approximately 100 ml distilled water.
2. Add 50 ml concentrated Hydrochloric Acid.
3. Add 0.5 g Sodium Bicarbonate.
4. Add 1-2 g Starch Indicator.
5. Titrate with 0.1N Potassium Iodate to a blue endpoint. Blue endpoint should last at least 30 seconds. If the endpoint fades, continue to titrate.

Calculation:

$$\text{ml of 0.1N Potassium Iodate} \times 1.186 = \text{g/l Tin Metal (g/l} \times 0.133 = \text{opg)}$$

Lead Metal Analysis

Instrumental methods (ICAP or AA) are preferred for lead analysis. Wet methods are either tedious or of questionable accuracy. The following wet analysis is offered as one possibility, if ICAP or AA methods are not available.

1. Pipette exactly 2 ml of the plating bath, (10 ml if Lead content is low), into a 250-ml flask and dilute with approximately 100 ml distilled water
2. Add 1.0 ml concentrated sulfuric acid and filter through Whatman #3 12.5 cm filter paper. Discard the filtrate.
3. Rinse the flask a few times with distilled water and pour through filter paper.
4. Dissolve 1 g Tartaric Acid or Potassium Tartrate in approximately 100 ml distilled water and pour through filter paper from Step #3.
5. Place filter paper in a 250-ml flask with filtrate from Step #4.

6. Neutralize with 25% Sodium Hydroxide, using red litmus paper. Solution has been neutralized when litmus paper turns blue.
7. Add 20 ml Ammonium Chloride/Hydroxide Buffer Solution (see make-up below), 10 ml 10% Formaldehyde and Eriochrome Black T Indicator and titrate with 0.0575M EDTA to a blue endpoint.

Calculation:

$$\text{ml } 0.0575\text{M EDTA} \times 5.951 = \text{g/l Lead Metal (using 2 ml sample) (g/l} \times 0.133 = \text{opg)}$$

$$\text{ml } 0.0575\text{M EDTA} \times 1.190 = \text{g/l Lead Metal (using 10 ml sample) (g/l} \times 0.133 = \text{opg)}$$

Ammonium Chloride / Hydroxide Buffer – Dissolve 100 g of Ammonium Chloride and 350 ml CP grade Ammonium Hydroxide in distilled water and dilute to one liter.

Methane Sulfonic Acid

1. Pipette exactly 10 ml of the plating bath into a 250-ml flask and dilute with 50 ml distilled water.
2. Add 1.0-2.0 ml Metanil Yellow Indicator.
3. Titrate with 1.0N Sodium Hydroxide until color changes from reddish-purple to yellow.

Calculation:

$$\text{ml } 1.0\text{N Sodium Hydroxide} \times 9.6 = \text{g/l Methane Sulfonic Acid (g/l} \times 0.133 = \text{opg)}$$

Fluoboric Acid

1. Pipette exactly 10 ml of the plating bath into a 250-ml flask and dilute with 50 ml distilled water.
2. Add 1.0-2.0 ml Metanil Yellow Indicator.
3. Titrate with 1.0N Sodium Hydroxide until color changes from reddish-purple to yellow.

Calculation:

$$\text{ml } 1.0\text{N Sodium Hydroxide} \times 8.8 = \text{g/l Fluoboric Acid (g/l} \times 0.133 = \text{opg)}$$

Boric Acid

1. Pipette exactly 10 ml of plating bath into a 250-ml beaker and dilute with 100 ml of distilled water.
2. Add 10 ml Sodium Sulfate solution (135 gm Na₂SO₄ in 950 ml water).
3. Titrate with 1.0N Sodium Hydroxide to a pH 7 using a previously standardized meter.
4. Add 5 g Mannitol.
5. Titrate with 1.0N Sodium Hydroxide to pH 8. This volume is used for the calculation.

Calculation:

$$\text{ml } 1.0\text{N Sodium Hydroxide (pH 7 to 8)} \times 6.18 = \text{g/l Boric Acid (g/l} \times 0.133 = \text{opg)}$$

Sulfuric Acid

1. Pipette exactly a 5 ml sample of plating solution into a 250 ml flask and dilute with 50 ml of a 4% Ammonium Oxalate Solution. *
2. Add 2-3 ml Methyl Red Indicator.
3. Titrate with 1.0N Sodium Hydroxide to a yellow endpoint.

Calculation:

$$\text{ml } 1.0\text{N Sodium Hydroxide} \times 0.56 = \% \text{ by volume Sulfuric Acid}$$

$$\text{ml } 1.0\text{N Sodium Hydroxide} \times 9.80 = \text{g/l Sulfuric Acid (g/l} \times 0.133 = \text{opg)}$$

* If the tin bath is very murky, before adding the Ammonium Oxalate, add 5 drops 35% Hydrogen Peroxide.

B. Hull Cell Testing

Hull cell testing, though interpretive, is by far the best method available to control, maintain, or troubleshoot tin-lead plating baths. An operator can readily learn to interpret these panels and quickly become highly skilled at maintaining these baths. The real beauty of the Hull cell lies in its simplicity. By using the current densities running in your bath you can duplicate those conditions in the Hull cell. For example, if you have a bath that is not throwing well, you can expose the low current density areas on the panel to diagnose the problem. By expanding the low current density areas, one can then monitor the results of the additions that remedy the problem.

C. The Hull Cell Ruler

The Hull Cell Ruler is used to determine the current density at any point on the cathode. For example, a 3-amp, 5-minute panel produces a current density range of 0.16-13 A/sq. dm. (1.5-120.0 ASF). To determine the current density at any

point on the panel, simply line up the left edge of the panel with the corresponding amperage on the Hull Cell Ruler. The numbers that line up across the bottom of the panel indicate the current density at that point. Knowing the average current density available in a plating tank allows a direct comparison from the panel to the plated work.

1 AMP		40	30	25	20	15	12	10	8	6	4	3	2	1	0.5
2 AMP		80	60	50	40	30	24	20	16	12	8	6	4	2	1
3 AMP		120	90	75	60	45	36	30	24	18	12	9	6	3	1.5
5 AMP		200	150	125	100	75	60	50	40	30	20	15	10	5	2.5

Amps/ft² – 267 ml Hull Cell

D. 267 ml Hull Cell Testing Parameters

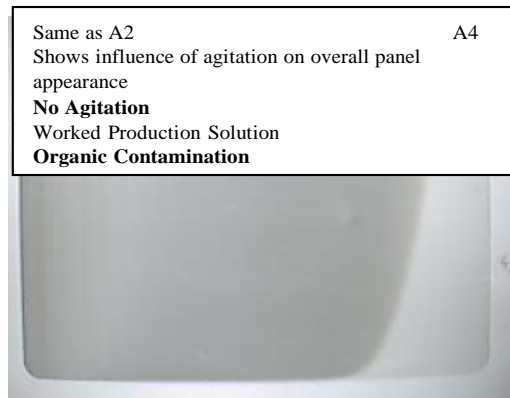
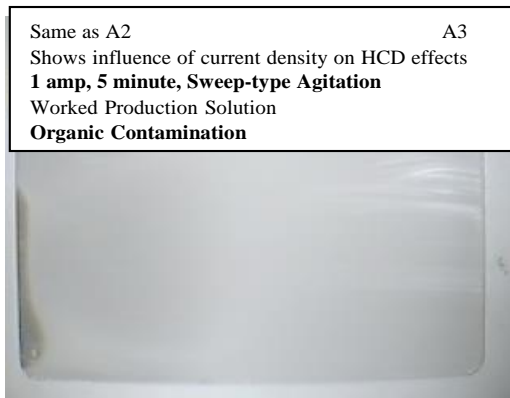
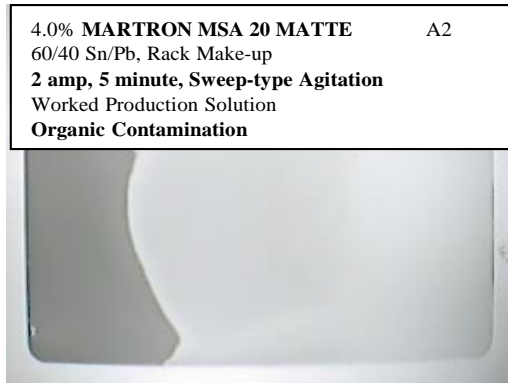
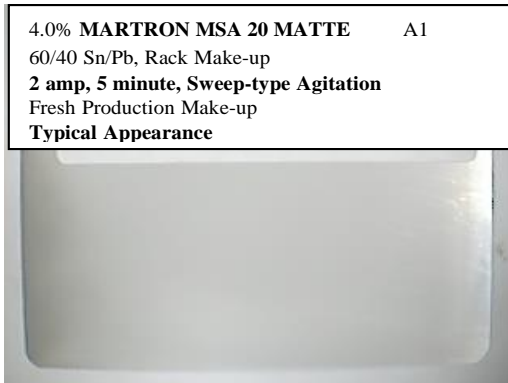
Depending on the average current density in the plating solution to be analyzed, anywhere from 1-amp, 5-minute to 5-amp, 1-minute panels generated from a 267 ml Hull cell may be used for control. Mechanical agitation (stir bar or sweep-type) is necessary to provide fresh ions to the cathode during the testing. Chemical additions made to enhance the appearance of the Hull cell panel at one amperage may be checked at a second amperage to ensure the desired effect occurs. This can be illustrated by the following example. Assume a 2-amp 3-minute panel shows high current density treeing between 6.5 and 8.6 A/sq. dm. (60 and 80 ASF), and a 1% addition of **Martron MSA 20 Matte** corrects the problem. Running a second 3-amp, 3-minute panel should exhibit an expanded high current density range, thus verifying that the addition did, in fact, correct the high current density anomaly.

Two-amp panels, run for 3-minutes, are suggested for normal rack and/or barrel plating installations. Generally, 5, and up to 10-amp panels, run for 1-minute, are suggested for high-speed strip and/or wire plating installations. A typical Hull cell panel should be uniformly matte and burn-free at current densities from 0.5 to approximately 40 A/dm² (5-400 ASF), dependent upon metal concentration considerations.

A high current density burn generally indicates (1) too low a total metal concentration, (2) a low concentration of additive, (3) insufficient agitation, or (4) organic contamination. If this occurs, the bath composition should be adjusted to the proper range, and another panel run. If high current density performance is still less than satisfactory, **Martron MSA 20 Matte** should be added in increments of 1.0% vol. until a burn-free panel is produced. If a burn-free panel is not achieved with the equivalent of a full make-up charge, the agitation should be changed in the cell to see if the burn area is affected. If there is no appreciable change, then the solution is likely suffering from organic contamination, and carbon treatment, or bath dilution should be considered.

Dark low current density deposits are an indication of metallic or organic contamination. If metallic contamination is suspected, the solution should be dummy-plated at a low current to remove it. If the contaminant is discerned to be organic, carbon treatment or bath dilution is the standard remedy.

E. Appearance of typical panels



19. ADDITIONAL TROUBLESHOOTING INFORMATION

Metallic Contamination

Common metallic impurities, such as nickel, copper, zinc, and iron are readily soluble in a plating bath using **Martron MSA 20 Matte**. These metals will co-deposit, thereby changing both the appearance and solderability properties of the plated deposit. Typically, such contamination manifests itself as a dark, low current density deposit. Thus, precautionary steps should be taken to prevent metallic impurities from entering the plating solution.

If metallic contamination does occur, low current density electrolytic purification (dummying) is an effective remedy. Apply at 0.2-0.3 A/dm² (2-3 ASF) for 8-16 hours. In addition, the source of contamination should be located and eliminated.

Chloride Contamination

The introduction of chloride ions will form a precipitate in the plating solution that ultimately causes deposit roughness. This precipitation process eventually removes the interfering ion, but poor-quality plating will occur until all of it is removed, and the precipitate is filtered out of the solution. The standard source for chloride contamination is insufficient rinsing between a hydrochloric acid pretreatment tank and the plating tank. If chloride contamination occurs, rinses should be replaced and flow rates and/or rinsing times increased.

Organic Contamination

Organic contamination can also affect plating appearance and alloy distribution. In some cases, the contaminant can be removed from solution through means of carbon treatment. A 5.0 g/l (5 pound per 100 gallon), 4-hour carbon treatment is usually recommended. It is worth noting that, if the solution contains excessive stannic tin, filtration for removal of the carbon

can be difficult due to filter plugging. Testing in the lab is recommended before attempting tank treatment. If filtration is extremely difficult, it may be better to replace part of the contaminated solution with fresh solution in order to lower contaminant concentrations to an acceptable level.

Carbon Pack Filtration Treatment

Carbon filtration may remove the more common organic impurities. Filter cartridges or packs should be operated outside the tank prior to solution treatment to ensure that no carbon “dust” or filter-aid is introduced into the plating cell. Failure to do so may result in possible deposit roughness. Careful monitoring is then necessary to guarantee that filter packs do not rupture, spewing carbon into plating solutions.

20. COMMON IMPURITIES

IMPURITY	SOURCE	LIMIT	EVIDENCE	REMEDY
Copper	Base Metal and/or Anode Cathode Bar	10 ppm	Dark LCD and/or blistering	LCD dummyming
Zinc	Base Metal	20 ppm	Dark LCD	LCD dummyming
Iron	Base Metal	40 ppm	Poor solderability	LCD dummyming
Nickel	Base Metal and/or Nickel Strike Bath	40 ppm	Poor solderability	LCD dummyming
Oils/Grease	Drag-in	N/A	Blistering and/or dark deposit	Carbon treat with 5 g/l (5 lb/100 gal)

21. TROUBLESHOOTING CHART

Problem	Cause	Remedy
Poor thickness distribution, or thin deposits in low current density areas	High tin/lead metal	Lower tin/lead metal proportionally and/or decrease anode area
Burning in high current density areas	Low metal content, or plating at too high a current density	Raise metal content in 0.25 opg (1.8 g/l) increments; check current and maintain within correct range
Poor cathode efficiency	Low metal content	Raise metal content in 0.25 opg (1.8 g/l) increments, check current and maintain within correct range
Streaky deposits	Insufficient agitation for current applied, and/or metal content	Improve agitation; check applied current and solution chemistry
Poor adhesion or blisters	Copper contamination in bath; oil in acid activator; or wrong type of acid being used; poor cleaning; excessive time in plating bath without applied current	Dummy bath at low current density; improve cleaning; replace acid activator (Do not use hydrochloric acid!); remove source of oil; avoid leaving parts in tank without current
Rough deposits	Solid particles in bath due to stannic tin, or torn anode bags, or drag-in of chloride ion, or sulfate ion to a lead alloy bath	Filter out the particulate; remove and clean sludge from anode bags. Replace torn bags. Improve rinsing. Check for air entering bath from filter or agitator
Metal concentration(s) decreasing	Insufficient anode area in bath	Increase as needed; decrease acid content
Excessive additive usage	Heavy drag-out; presence of metallic impurities, or oxidizing agents	Check for metallic contamination and drag-in of etch materials
Poor throwing power	Low bath temperature; low acid concentration; high metal content	Raise the temperature and add acid, lower metal content
Dark deposits	Alloy too high in lead content; excessive additive content in bath; metallic contamination	Analyze and adjust bath concentration, stop additive additions, dummy bath at low current density
High current density treeing	Low concentration of additive; low metal content; plating at too high a current density	Add Martron MSA 20 Matte ; analyze and adjust metal level(s); reduce current density
Poor solderability	Organic contamination; metallic contamination (usually Cu or Zn); depositing the incorrect alloy	Carbon treat or cut solution, dummy bath at low current density, and/or analyze metals and adjust

Problem	Cause	Remedy
Brittle deposit	Presence of iron, copper, chloride, or organic contamination	Dummy bath at low current density, cut bath, or carbon treat
Bright deposits in high current density areas	Presence of organic contamination	Carbon treat or cut bath

22. COMMENTS ON TROUBLESHOOTING

When troubleshooting tin/lead plating problems, first check the obvious: temperature, metal concentrations and acid levels. If these parameters are correct, then by far most problems are a result of inadequate cleaning either of the parts or the plating tank. Look for airborne contaminants from exhaust hoods, rust from ceilings, etc. Look at the filter to see what contaminants are present. Remember, pre-plate treatment issues (cleaning, acid activation and rinsing), or electrical conditions (poor electrical contact, rectification or stray current) create most plating problems, not the bath chemistry.