

# Tinmac Stannolyte

## Bright Acid Tin Solution

# EU86305

Tinmac Stannolyte is a bright acid tin solution that is effective for the production of bright electroplated tin deposits which have applications in the electrical and electronics industries, for food processing equipment and for kitchen and domestic tableware, for which it provides a bright, clean, corrosion resistant finish. Tinmac Stannolyte provides an alternative to bright nickel where a corrosion resistant finish is required and the use of bright zinc would not be acceptable. The deposits are bright, even in deep recesses and the coating is relatively easy to solder. For electronics use a copper additive is available which prevents "whiskering" of the deposit in storage.

### 1. SOLUTION COMPOSITION

#### For Rack Plating

Stannous Sulphate SF41751 (50% Sn)	60 g
Sulphuric Acid (pure) sp.gr.1.84	70 ml
Tinmac Stannolyte Initial EU 86305	40 ml
Water (deionised)	to 1 litre

For preparation see paragraph 15

#### For Barrel Plating

Stannous Sulphate SF41751 (50% Sn)	30 g
Sulphuric Acid (pure) sp.gr.1.84	100 ml
Tinmac Stannolyte Initial Brightener( EU86305)	50 ml
Water (deionised)	to 1 litre

For preparation see paragraph 15

### 2. OPERATING CONDITIONS SUMMARY

#### Brightener Maintenance

3 – 3.25 L/10KAh of Tinmac Stannolyte Brightener Maintenance (EU 86307) for rack and barrel plating. See paragraph 3.

**Current Density**

Rack	1.5 to 2.0 A/dm <sup>2</sup>	
Barrel	1 to 1.5 A/dm <sup>2</sup>	See paragraph 4
Voltage	1 to 5 volts.	See paragraph 5
Temperature	15 - 30°C	See paragraph 6
Agitation	Mechanical cathode rod movement. Barrel plating 8 to 12 r.p.m. See paragraph 7	
Anodes	Pure tin. See paragraph 8	
Rate of Deposition	Average 10 microns in 11 minutes at 2 A/dm <sup>2</sup> . See para 9.	

**Equipment** See paragraph 14.

**3. SOLUTION MAINTENANCE**

The brightness of the tin plate is maintained by frequent additions of Tinmac Stannolyte Brightener Maintenance ( EU86307). It will also be necessary to make regular additions of Tinmac Stannolyte Booster (EU 86308) and Tinmac Stannolyte Corrector (EU 86309), the quantity depending on the operating conditions and the degree of drag-out. A freshly made-up solution is highly tolerant to excesses of addition agents producing no noticeable effect on the brightness of the deposit. As the bath ages, however, these excesses which have accumulated will begin to cause dull deposits which may be taken for deficiencies. Endeavouring to correct this will only cause further problems.

Therefore, when the bath is new, care should be taken to only add minimum quantities of the addition agents and carry out frequent plating tests. Typical addition rates per 10KAH are:

	<b>Rack Plating</b>	<b>Barrel Plating</b>
Tinmac Stannolyte Brightener Maintenance(EU 86307)	3.00 – 3.25 L	3.00 – 3.25 L
Tinmac Stannolyte Corrector* (EU 86309)	0.04L	0.08 L
Tinmac Stannolyte Booster* (EU 86308)	0.02 L	0.04 L

*\* The quantities required will depend on the operating conditions and are best determined on the basis of plating tests.*

#### 4. CURRENT DENSITY

The operating range for rack plating is 1 to 4.5 A/dm<sup>2</sup>, but for normal operation 1.5 to 2 A/dm<sup>2</sup> is recommended.

For barrel plating it is important that the average cathode current density is neither less than 1 A/dm<sup>2</sup> nor more than 1.5 A/dm<sup>2</sup>. With the anodic current density of 2 A/dm<sup>2</sup> this cathodic current density can be obtained at 4 - 5 volts. The current passed through the electrolyte in a barrel should not exceed 0.44 Amps/Litre.

#### 5. VOLTAGE

For normal operation at 1.5 to 2 A/dm<sup>2</sup> the voltage required would be 1 to 3 volts depending upon the cathode area and the anode/cathode spacing.

Where higher current densities are employed and also on large installations such as automatics, up to 5 volts may be needed.

#### 6. TEMPERATURE

The temperature of the solution should be maintained between 15 and 30°C. However, best results will be obtained in the range of 15 to 20°C, since this will give the most uniform brightness to the tin plate. The lower temperatures favour brightness at low current densities and are best for deeply recessed articles, while higher temperatures enable higher current densities to be used.

#### 7. AGITATION

While it is possible to operate this solution without agitation, slow movement of the cathode at the rate of 3 m/min is most beneficial. This will allow a higher current density to be used and also produce a better and more uniform brightness. Barrels should only be filled to 75% of their capacity. The speed at which the barrel rotates is critical: for smaller components and electronics parts 8 to 12 r.p.m. should be used, while for larger components up to 20 r.p.m. may be used.

#### 8. ANODES

Pure tin, Procon anodes should be used. The should be removed if the solution is to be idle for periods of 3 days or more, and scrubbed with a bristle brush before re-use.

It is important that the anode current density does not exceed 2.5 A/dm<sup>2</sup>. At higher current densities the anodes will go passive and cease to dissolve satisfactorily, the brightener will be decomposed and oxidation of the tin will occur in the solution.



Where steel or copper anode hoods are used it is essential that the hook length be such that the hook is above solution level.

## 9. RATE OF DEPOSITION

At 2 A/dm<sup>2</sup> a deposit of average thickness 10 microns is obtained in 11 min. Where articles are to be plated to comply with a specification requiring a certain minimum thickness of deposit, the plating time must be increased to allow for unavoidable variations in deposit thickness. For example, on many articles a plating time of at least 35 min at 2 A/dm<sup>2</sup> would be needed, to give a minimum thickness of 25 micrometer, and even longer times may be required on very complex shapes.

## 10. ANALYTICAL STANDARDS

The solution should be regularly analysed to determine the stannous sulphate and sulphuric acid contents. The brightener concentrations are best estimated from plating tests. Additions should be made as indicated by the results of these analyses and test.

	Rack Plating	Barrel Plating
Density	S.G. 1.125 15°Be	S.G. 1.13 15.4°Be
Stannous Sulphate (SnSO <sub>4</sub> )	50 to 62 g/L	28 to 38 g/l
Sulphuric Acid sp.gr. 1.84	70 to 75 ml/L (128 to 138 g/L)	95 to 105 ml/L (175 to 195 g/L)
Maximum Chloride Content	200 mg/L (200 ppm)	

## 11. VISUAL CONTROL

NATURE OF DEFECT	POSSIBLE CAUSE	METHOD OF CORRECTION
(1) Deposit dull in low current density areas.	(a) Excess of chloride  (b) Deficiency of Tinmac Stannolyte Brightener	(a) See paragraph 12  (b) Add 0.5 to 1 ml/L of Tinmac Stannolyte Brightener Maintenance

<p>(2) Deposit dull in high current density areas</p>	<p>(c) Temperature of solution too high</p> <p>(d) Sulphuric acid concentration too low</p> <p>(e) Anodes passive</p> <p>(f) Anode area too low</p> <p>(g) Current density too low</p> <p>(h) Metal concentration too high</p> <p>(a) Deficiency of Tinmac Stannolyte Booster and Tinmac Stannolyte Corrector</p> <p>(b) Temperature too high</p>	<p>(c) Check and correct</p> <p>(d) Add 5 ml/L of pure sulphuric acid</p> <p>(e &amp; f) Remove and scrub anodes adjust the anode area to at least twice the cathode area</p> <p>(g) Adjust the current density so that it is not below 1 A/dm<sup>2</sup></p> <p>(h) Adjust the metal concentration and correct the sulphuric acid concentration</p> <p>(a) Add 8 ml/L of Tinmac Stannolyte Corrector and 1 to 2 ml/L of Tinmac Stannolyte Booster</p> <p>(b) Reduce the temperature to within 15 to 20°C</p>
<p>(2) Deposit dull in high current density areas</p> <p>(3) Poor coverage</p> <p>(4) Pitting of Deposit</p>	<p>(c) Solution contains suspended solids</p> <p>(a) Current density too low</p> <p>(b) Inter-electrode distance too large</p> <p>(c) Metal content too high or acid content too low</p> <p>(a) In new solution</p> <p>(b) Current density too high (in excess of 4.5 A/dm<sup>2</sup>)</p> <p>(c) Agitation too low</p>	<p>(c) Filter the solution</p> <p>(a) Treat as in 1 (g)</p> <p>(b) Reduce inter-electrode distance</p> <p>(c) Add amount required by analysis</p> <p>(a) Plate out for a period or add 5 ml/L of Tinmac Stannolyte Corrector</p> <p>(b) Reduce the current density of below 4.5 A/dm<sup>2</sup></p> <p>(c) Improve agitation</p>



(5) Rapid tarnishing of deposit	<p>(d) Possible deficiency of Tinmac Stannolyte Corrector</p> <p>(a) On brass and zinc alloys - migration of zinc into tin (dezincification)</p> <p>(b) Poor rinsing of deposit</p> <p>(c) Low in Addition Agents</p>	<p>(d) Add 5 ml/L of Tinmac Stannolyte Corrector</p> <p>(a) Copper or nickel flash 2 microns before tin plating</p> <p>(b) Improve rinsing</p> <p>(c) Add 5 ml/L up to 20 ml/L of Tinmac Stannolyte Initial Brightener</p>
(6) Dark streaks on the plate possibly with ridging	(a) Excess of Tinmac Stannolyte Brightener. Slight excess of Brightener results in glossing deposit. Higher excesses in aged solutions will give dark streaks and deposit missing	(a) Add 10 ml/L of Tinmac Stannolyte Corrector plus 1 to 2 ml/L of Tinmac Stannolyte Booster. If this does not cure the defect, make a further addition of these additives
(7) Haze on deposit not removed by an addition of Tinmac Stannolyte Brightener	(a) Lack of Tinmac Stannolyte Booster	(a) Make an addition of 1 to 5 ml/L of Tinmac Stannolyte Booster. This may be required after vat has been standing idle for a long period

## 12. PURIFICATION

If metallic contamination is suspected from the plating tests, the solution should be electrolysed at low current density. If organic contamination is suspected, the solution should be treated with 5 g/L of Activate Carbon and filtered. After the carbon treatment, the full addition of Tinmac Stannolyte Initial Brightener should be made before the plating is recommenced.

If the solution is out of balance, the dullness in the deposit may be due to one or more of the causes listed in the table on previous pages.

A chloride concentration up to 150 mg/L is generally acceptable but measures should be taken to prevent it rising above 200 mg/L. 'Good Housekeeping' will help to minimise the drag-in of chloride from other stages and hydrochloric acid in particular should not be used in any pre-treatment line. If the mains water has a chloride content of greater than 20 mg/l then it should not be used for topping-up the Tinmac Stannolyte solution. Excess chloride can only

economically be corrected by disposal of part or all of the solution and making up with fresh material.

### **13. PRE-TREATMENT FOR RACK AND BARREL PLATING**

The usual alkaline cleaning is required but too high an anodic current density should not be used, for this may cause loss of tin-plate brightness especially on edges. Hydrochloric acid pickling must not be used on work to be Tinmac Stannolyte plated, zinc chlorides carried over into the solution are detrimental to the brightness of the plate.

On brass components to be tin plated as an aid to solderability or for electronic purposes, it is advisable to apply a thin coating of either copper or preferably nickel before tin plating.

### **14. EQUIPMENT**

For this solution a tank lined with approved material must be used. For small volumes, a polythene tank may be employed. Continuous filtration of the solution is recommended. The capacity of the filter need only be such that its throughput per hour is equal to half the solution's volume. The use of polypropylene filter cloths preferably with papers is advised.

Copper anode and cathode bars are subject to severe corrosion; to avoid copper contamination of the solution, the busbars should be protected either with a substantial deposit of nickel or by wrapping with PVC tape except where contact is required.

For warming the solution, if necessary, a hot water jacket or silica cased electric immersion heater may be used.

With most barrel plating installations solution cooling will be essential to keep the temperature within the required limits for bright plating. For solution cooling a titanium coil may be used.

It is essential that before use, the tank and any pipework be thoroughly cleaned with dilute sulphuric acid - concentration 10 ml/L. After filling the tank with clean, cold water the acid should be added slowly with care, while the water is stirred. If heating facilities are available it is advantageous to heat the dilute acid to 40°C.

The acidified water should be left in the tank for at least 8 hours, after which it should be pumped out. Finally, the tank must be thoroughly rinsed out with clean water. (If a titanium cooling coil is present, it should be made anodic during this treatment).

### **15. PREPARATION OF THE SOLUTION FROM INDIVIDUAL CHEMICALS**



Where a solution is prepared from chemicals as in paragraph 1, the following procedure should be followed:

The tank after being treated with diluted sulphuric acid (as described above) and washed out with water, should be half filled with cold deionised water. The requisite amount of pure sulphuric acid is then slowly and cautiously poured in with constant stirring. (It is advisable for operators to wear goggles and protective clothing while doing this). The stannous sulphate should then be added and the bath well stirred until all of this has dissolved.

The solution should now be filtered until clear. The Tinmac Stannolyte Initial should then be added and the bath diluted with clean water to the required level and again well stirred. The solution is then ready for use.

## 16. SAFETY IN HANDLING AND USE

Refer to relevant Material Safety Data Sheets.

## 17. Effluent

It is recommended that wastewater treatment be carried out to conform to the specific requirements of the local authority. Advice on how to meet these requirements, once known, can be obtained from MacDermid.

### Disclaimer:

Any information given here relating to Health & Safety should be regarded as general advice and is not to be regarded as comprehensive or definitive.

Every user should also be in possession of Safety Data Sheets for each individual product/chemical used. These are available for all products sold by MacDermid.

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