

A continuous electroplating process designed to inhibit crystalline growth in pure tin (sn) finishes.



**msi** is a leading electroplater of continuous strip and progressive stamped and bandoleered components for the connector, electronics and automotive industries. With sixteen multi-finish continuous plating lines operating 24 x 7, quality certifications to ISO 9001, AS9100, IATF 16949 and FAA, **msi** provides state of the art continuous electroplating for today's demanding markets.

### Typical Process Combinations.

- Tin over Nickel
- Selective Gold & Tin over Nickel
- Selective Gold & Tin over Nickel, over Copper
- Selective Palladium-Nickel & Tin over Nickel.

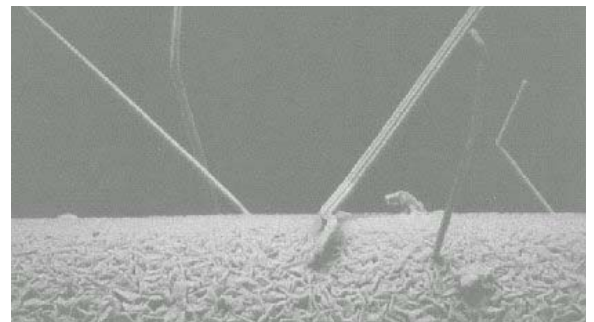
*inhibit-W* is a proprietary continuous plating process that combines custom designed continuous plating lines with the best of chemical solutions to inhibit both crystalline growth and surface oxidation on pure tin deposits. The drive to eliminate lead from electronics has resulted in the use of pure tin (sn) finishes as an economical lead free plating option. The use of pure tin however poses significant risks for electronic systems with the propensity of crystalline growth 'tin whiskers' and resulting failure risk.

Tin whiskers are elongated crystals typically 1mm or less in length and 1-3 microns in diameter that grow spontaneously. Their growth is unpredictable and may begin soon after plating or years later producing significant concerns for the reliable operation of electronic systems. Short circuits in low voltage, high impedance circuits and contamination in sophisticated micro-electromechanical products, such as MEMS, from crystalline debris are a major concern.

There are no industry accepted accelerated test methods designed to judge a particular processes propensity to grow whiskers, resulting with a reliance on extensive tests and accelerated field trials by major electronic and interconnect companies. During this last year successful results by chemical process manufacturers and extensive industry testing have brought process approvals leading to the *inhibit-W* addition to **msi** continuous process capability.

*inhibit-W* comprises a combination of unique state of the art continuous process plating lines with chemical stations designed to both significantly reduce whisker growth tendencies and discoloration through oxidation of the tin deposit after thermal exposure. *inhibit-W* is typically combined with Nickel and Copper under-plating and with Gold and Palladium-Nickel selective finishes. **msi** will process sample reels for customer evaluation. PPAP procedures are available as required for initial process runs.

**msi** provides a 'plate and hold' inventory system that allows customers to store reeled components in their own 'virtual' inventory in raw condition or plated for immediate release. This system allows for products to be received directly from the stamping or component supplier and does not impact customers inventory value with additional plating cost until required. Scheduled weekly shipments throughout the USA or individual releases can compliment JIT and Lean Manufacturing programs. Web based access for inventory and schedule verification is being provided.



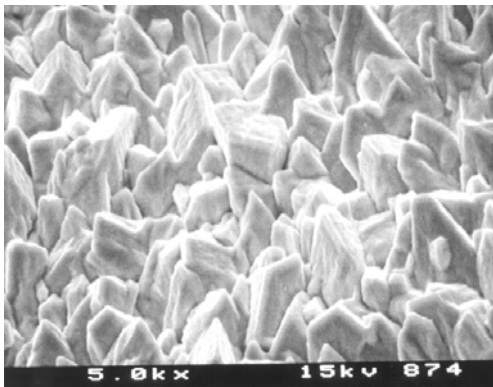
Typical whisker growth

**msi** maintains an extensive quality system certified to ISO 9001, AS9100, IATF 16949, and FAA. In addition **msi** maintains individual customer certifications including Boeing, Pratt & Whitney, Delphi and many others.

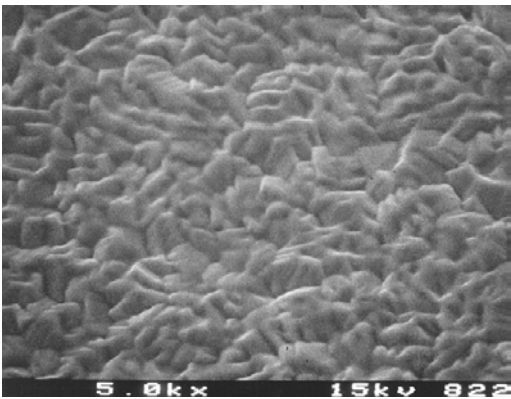
# DATA

*inhibit-W* is a proprietary continuous plating process designed to inhibit crystalline growth 'Tin Whiskers' and surface oxidation on pure tin (sn) deposits. The 'Tin Whiskers' phenomenon remains a critical Impediment for acceptance of pure tin as a Pb-free semiconductor, electrical and interconnect component lead finish. Traditional tin electroplating processes result in tin alloy deposits derived from a methane sulfonic acid (MSA) based electrolyte. *inhibit-W* utilizes a proprietary non-MSA process that provides increased stannous tin ion stability and lower corrosivity.

## GRAIN STRUCTURE



Conventional MSA based process



*inhibit-W* non-MSA process

## TESTING

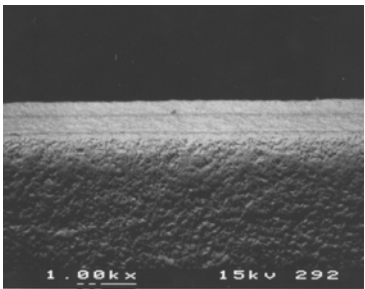
Three sets of test conditions were designed to compare results from MSA and non-MSA based processes and the results inspected by SEM at 2000-5000X, as plated and after deposit conditioning. Deposit thickness was 5-10 microns on Olin C194 stamped lead frames.

MSA BASED TEST	CONDITIONS	DURATION	WHISKERS
A	55 DEG C Dry Bake	1 Month	YES
B	Cycling -55 to +150 deg C	1000 Cycles	YES
C	20-25 deg C 40-60% RH	3 Months	YES

<i>inhibit-W</i> TEST	CONDITIONS	DURATION MONTHS	WHISKERS
A	55 DEG C Dry Bake	9 Months	NO
B	Cycling -55 to +150 deg C	1000 Cycles	NO
C	20-25 deg C 40-60% RH	1 Year	NO



Conventional MSA based process



*inhibit-W* non-MSA process