IPC-WP-009

# A Summary of Tin Whisker Research References

Developed by the Cleaning & Coating Committee (5-30) of IPC

Users of this publication are encouraged to participate in the development of future revisions.

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## A Summary of Tin Whisker Research References

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**ABSTRACT**

As most of the world converts to lead-free manufacturing, the concern over tin whiskers as a reliability hazard has grown due to the emergence of pure tin as a dominate component surface finish. A significant amount of research on tin whisker formation and tin whisker mitigating strategies has been performed in both commercial and defense industries. David Pinsky [11] summarizes the concern well:

*Whiskers are elongated single crystals of pure tin that have been reported to grow to more than 10 mm [0.250 in] in length (though they are more typically 1 mm or less) and from 0.3 to 10 µm [11.8 to 393.7 µin] in diameter (typically 1.0 –3.0 µm [39.4 – 118 µin] ). Whiskers grow spontaneously without an applied electric field or moisture (unlike dendrites) and independent of atmospheric pressure (they grow in vacuum). Whiskers may be straight, kinked, hooked, or forked and some are reported to be hollow. Their outer surfaces are usually striated. Whiskers can grow in nonfilament types which are sometimes called lumps or flowers. Whisker growth may begin soon after plating. However, initiation of growth may also take years. The unpredictable nature of whisker incubation and subsequent growth is of particular concern to systems requiring long term, reliable operation.*

This working paper is a summary of the predominant research on tin whiskers as of September, 2008.

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# Summary Bibliography of Papers


1. Tin Whiskers: A History of Documented Electrical System Failures, A Briefing Prepared for the Space Shuttle Program Office, Dr. Henning Leidecker/NASA Goddard, Jay Brusse/QSS Group, Inc. April 2006
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# Overview of Papers

1. Tin Whiskers: A History of Documented Electrical System Failures, A Briefing Prepared for the Space Shuttle Program Office, Dr. Henning Leidecker/NASA Goddard, Jay Brusse/QSS Group, Inc. April 2006

The phenomenon of tin whiskers is not new to the electronics industry. Early tin plating, especially bright acid tin, often showed this phenomenon. This paper, written by Dr. Henning Leidecker of the NASA Goddard Space Center, gives a short historical perspective of tin whisker failures in the industry.

Discussion:
This is an excellent presentation of many case studies where tin whiskers have been the cause of the catastrophic failures and some of the shortsighted actions that led to those failures. The NASA Goddard facility is a "center of excellence" for the documentation and dissemination of tin whisker information. Dr. Leidecker has a number of publications on the Goddard website [9] with additional information documenting actual tin whisker investigation cases. Figure 1 illustrates tin whiskers infestation on a connector for a commercial electronics application. The only negative commentary of the NASA Goddard information is that it is sometimes skewed by the severe reliability and failure aspects associated with space electronics which is much more conservative in relation to aerospace products/use environments.

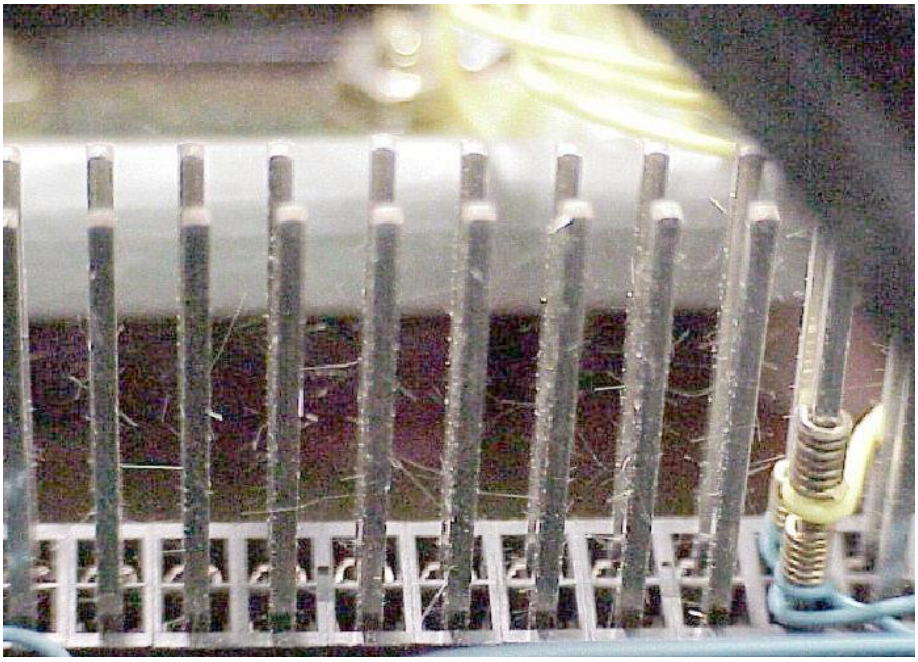

**Figure 1 Tin Whiskers on a Connector for Commercial Electronics Application**