PROBLEM ADVISORY

1. TITLE *(Class, Function, Type, etc.)*		2. DOCUMENT NUMBER
HYBRID INTERNAL COMPONENTS WITH PURE-TIN TERMINATIONS; MICROCIRCUIT, HYBRID, VOLTAGE REGULATOR		FV5-P-05-01A
		3. DATE *(DD-MMM-YY)* 07 DECEMBER 2005
4. MANUFACTURER AND ADDRESS International Rectifier HiRel 205 Crawford Street Leominster, MA 01453	5. PART NUMBER SEE DOCUMENT	6. NATIONAL STOCK NUMBER NOT AVAILABLE
	7. SPECIFICATION MIL-PRF-38534	8. TYPE DESIGNATOR NOT AVAILABLE
	9. LOT DATE CODE START 0305	10. LOT DATE CODE END 0440
11. MANUFACTURER'S POINT OF CONTACT Paul Hebert	12. CAGE 69210	13. MANUFACTURER'S FAX (978) 537-4246
14. MFR. POC PHONE (978) 514-6180	15. MANUFACTURER'S E-MAIL phebert@irf.com	
16. CROSS REFERENCE VENDOR 1)Novacap Inc. 2)Nemco Electronics Corp.	17. CROSS REFERENCE 1) 65238 2) OB5H1	18. CROSS REFERENCE PART 1)0805B104K250Y 2)PCT4.7/10AK

19. PROBLEM DESCRIPTION / DISCUSSION / EFFECT

AMENDMENT IS BEING ISSUED TO ANNOUNCE FURTHER INFORMATION RECEIVED FROM MANUFACTURER. PAGE 1 THROUGH PAGE 13 CONTAINS ORIGINAL DOCUMENT. PAGE 14 CONTAINS AMENDMENT "A". THIS AMENDMENT IS COMPLETE.

The OMR9601 voltage regulator and its derivative designs were identified with internal elements that contained pure tin during the performance of DPA (Destruct Physical Analysis) whereby a MLCC (Multilayer Ceramic Capacitor) and Tantalum capacitors component with pure tin plating were used to build the hybrid microcircuit products. SEM/EDS elemental analysis detected the presence of pure tin on the component plated terminations. MIL-PRF-38534, General Specification for Hybrid Microcircuits, paragraph E.4.2.7.1 states that the use of pure tin is prohibited from internal element finishes. Tin is considered to be pure if it contains less than 3% alloy material. In addition, NASA requirements prohibit the use of pure tin in any application due to a phenomenon called 'whisker growth' and/or 'sublimation' (refer to the following web site for further information. http://nepp.nasa.gov/whisker/). While no field operational failures have been reported with the hybrid product which is directly or indirectly related to this issue, industry studies have shown that the use of pure tin finish can promote the growth of tin (Sn) whiskers, which might cause potential reliability risks related to electrical short circuits, debris or contamination.

(continued on page 2)

20. ACTION TAKEN/PLANNED

1. The subject hybrids constructed with the subject components have been identified and contained. Customers were notified of the problem including product affected. See Table 1 herein for part number family and date code range.
2. All plated component raw material procured was identified for review and contained for validation. Plating finish validation was performed using EDS analysis on the suspect components.
3. International Rectifier has instituted EDS testing to verify plating composition on a sample basis for each new component lots received. This test is performed to validate proper component termination finish.

(continued on page 4)

21. DATE MFR. NOTIFIED	22. MANUFACTURER'S RESPONSE	23. ORIGINATOR ADDRESS/POINT OF CONTACT
29 Mar. 2005	[X] REPLY ATTACHED (Cross Reference Vendors) [ ] NO REPLY	Paul Hebert International Rectifier - HiRel (978) 514-6180 phebert@irf.com

24. REPRESENTATIVE	25. SIGNATURE	26. DATE
Paul Hebert		05 MAY 2005

19. PROBLEM DESCRIPTION / DISCUSSION / EFFECT (Continued)

1) The MLCC component was manufactured by Novacap Inc. and supplied with a certificate of conformance stating the 90Sn/10Pb plated termination code. Subsequent EDS (Energy Dispersive Spectrum) testing revealed a pure tin finish on the terminations (refer to Figure 1 herein). MIL-PRF-123, the Performance Specification for fixed ceramic capacitors states that tin plating is prohibited as a final finish or as an undercoat. Tin-lead (Sn-Pb) finishes are acceptable provided that the minimum lead content is four percent. For additional information, see ASTM B545 (Standard Specification for Electrodeposited Coatings of Tin).

An investigation by Novacap revealed that the plating line chemistry did not produce the required amount of Lead (Pb). Novacap's failure to detect the proper content of lead can be attributed with inadequate testing and analysis method used to verify the plating line chemistry. The lead content of the plating line was monitored with the use of XRF (X-Ray Fluorescence) equipment.

The subject MLCC component part number used in the hybrid was manufactured by Novacap, specifically a ceramic, multilayer, 0.1uF, 25V, Part Number 0805B104K250Y.

2) The Tantalum component was manufactured by Nemco Electronics Corp. EDS (Energy Dispersive Spectrum) testing revealed a pure tin finish on the leads.

An investigation revealed that the manufacturer converted the 90Sn/10Pb plating finish to pure tin (100% Sn Matte tin finish) beginning January 2004. This change was made in response with the growing demand for environmentally friendly components / lead-free initiatives. The component part number nomenclature was not changed to reflect the new plating type, hence not detected by International Rectifier.

The subject Tantalum component part number used in the hybrid was manufactured by Nemco, specifically Low Profile, Tantalum Capacitor, 4.7uF, 10V, Part Number PCT4.7/10AK.

Experiment:
In an effort to evaluate and assess the tin (Sn) whisker growth from the subject MLCC with pure tin end-terminations, experiments were conducted on a sample base. The evaluation consisted of capacitor termination inspection, specifically for the presence of tin whiskers and growth thereof. The samples used originated from QCI life test groups (post 1,000 hours at 125 ^{0}C). Following the inspection of the chip capacitor terminations, samples from the groups were submitted to temperature cycling and re-assessed.

Samples: Samples used in the evaluation consist of ten hybrids: (5) F-packs (OMR9601SFK), and (5) C-packs (OMR9601SCK).

Results:
As received (post life test), nine (9) of ten (10) hybrids exhibited tin whiskers. All ten (10) devices were screened through burn-in and steady state life for a total of 1,240 hours @ + 125 ^{0}C and a minimum of ten (10) temperature cycles during lot screening. At this stage, whiskers detected using SEM method measured ~ 5 µm and were randomly observed on the capacitor end-terminations. Following submission through 100 temperature cycles (-65 ^{0}C to 150 ^{0}C), inspection revealed growth of whiskers which measured up to 20.5 µm. Following submission through an additional 100 temperature cycles (210 cumulative cycles), whisker lengths were unchanged, however whisker growth/count was greater per unit area as seen following 110 temperature cumulative cycles where growth was only observed on upper and lower edges of the capacitor end-terminations. Refer to SEM Image 1 herein for reference. (IR HiRel report 05-004b).

19. PROBLEM DESCRIPTION / DISCUSSION / EFFECT (Continued)

Figure 1 – SEM / EDS
Measures & Results

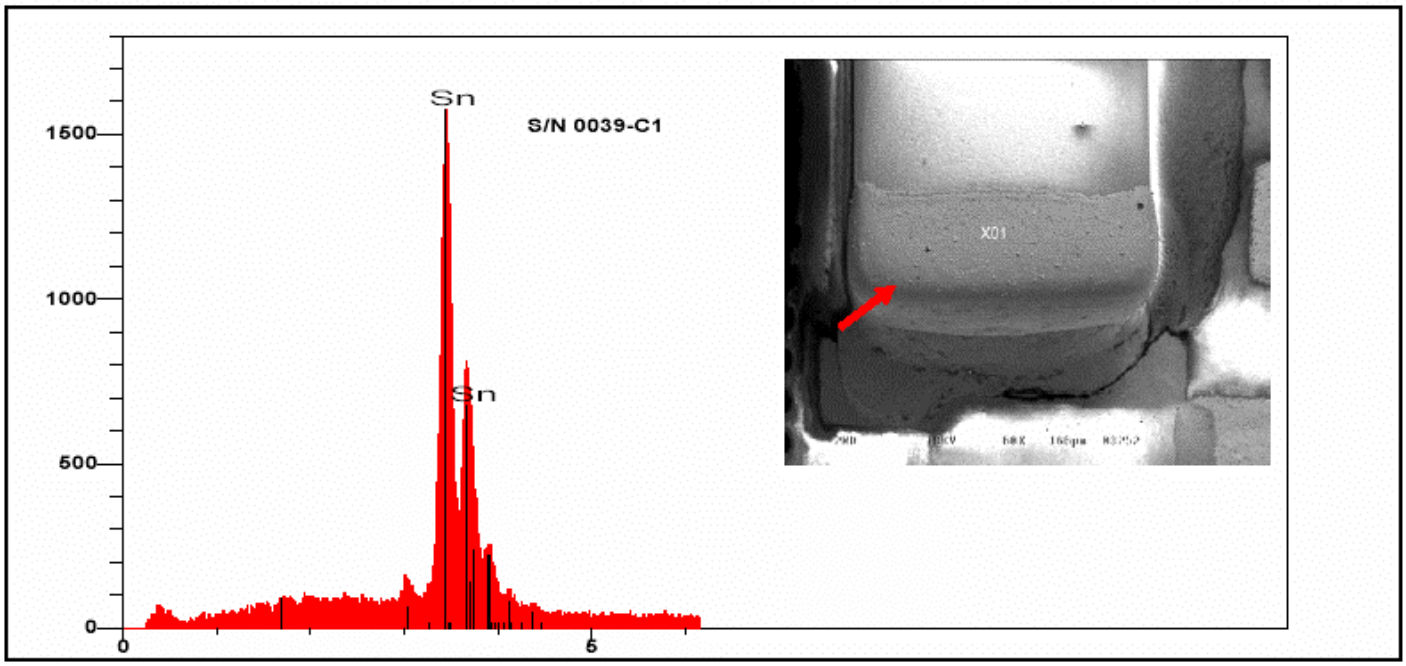


IMAGE 1 – Whisker Growth on Capacitor End-Terminations

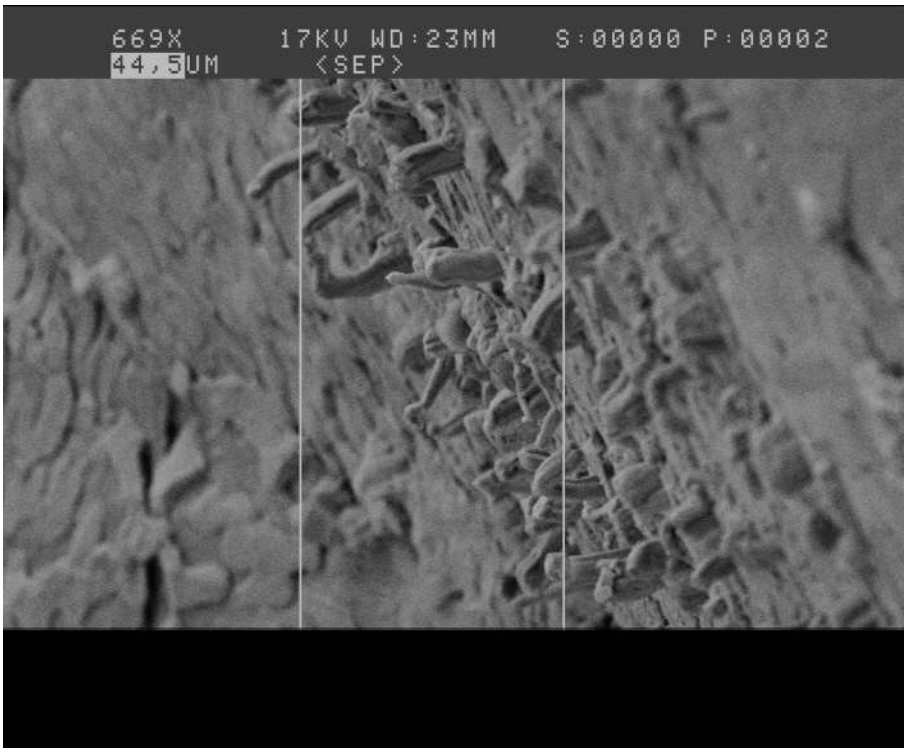


Image 1
Part #: OMR9601SCK
Date Code: 0423
Life Test: 1,240 hrs @ 125C
Temp Cycle: 110 (-65 to 150C)
Magnification: 20.4X
Accel Voltage: 17KV
Cluster of Whiskers Growth
Whisker Length = 20.5um

20. ACTION TAKEN/PLANNED (continued)

Table 1 - Affected Hybrids with Pure Tin

Part List 1/		Effectivity
OMR9601SCK		DC 0305 - 0440
OMR9604SCK		DC 0305 - 0440
OMR9605SFK		DC 0305 - 0440
OMR9608SFK		DC 0305 - 0440
OMR13529SCK		DC 0305 - 0440
OMR13530SCK		DC 0305 - 0440
OMR13577SCK		DC 0305 - 0440
OMR1357SCX		DC 0305 - 0440
OMR13587SCX		DC 0305 - 0440
OMR13622SCX		DC 0305 - 0440
OMR13733SCX		DC 0305 - 0440
OMR13776SCX		DC 0305 - 0440
OMR13777SCX		DC 0305 - 0440

Note 1/ - Through EDS analysis, IR determined that the following part numbers and date code range contained component(s) with pure tin termination.

NOVACAP
A DOVER COMPANY

25136 Anza Drive, Valencia CA 91355 ●Tel (661) 295-5920 ● Fax (661) 295-5928 ● www.novacap.com

Brian Crowley
Quality Assurance Manager

April 19, 2005

Paul Hebert
QA Manager / GIDEP Representative
International Rectifier HiRel
204 Crawford Street
Leominster, MA 01453
Email: phebert@irf.com

Re: GIDEP FV5-P-05-01, Final updated version of April 13 Report.

Hello Paul,

We have supplied answers to the four questions asked and have included them following the background, investigations and test results sections. Please review and let us know if you need any additional information.

Background

Novacap provides a full range of termination compositions and has been providing 90%Sn/10%Pb electroplated terminations on ceramic capacitors for space applications for over twenty years. We have not had any reported failures of Novacap capacitors for tin whiskers. Novacap part number suffixes define the termination finish; "Y" indicates 90Sn/10Pb and "N" indicates 100% Sn.

We have participated with other customers in discussions and analysis of the variables that reduce tin whiskers. Working closely with Boeing/JPL/NASA we duplicated the NASA tin whiskers study and correlated with their results. Both studies identified parameters that minimize the length and quantity of tin whiskers resulting from **thermal cycling**. The use of **Ag termination** versus Cu reduces whiskers. **Higher plating thicknesses** of nickel and tin or tin/lead alloys reduce whiskers. The **addition of Pb** in Sn plating reduces whiskers. Use of **matte** Sn/Pb chemistry versus bright chemistry reduces whiskers. The use of **annealing** process after plating reduces whiskers. The process of **reflow** reduces whiskers. We are aware that **Tin/Antimony and Tin/Bismuth** have been determined to not grow whiskers. The other test conditions run in both studies did not produce whiskers.

Novacap has historically controlled the plated composition by maintaining chemistry of the plating bath solutions, according to the vendor specifications. Furthermore, the plating bath contains 90Sn/10Pb metal anodes, which directly dissolve and maintain the metal content at all times. Bath titrations are done at Novacap on a regular basis as well as samples verified at an outside lab to assure 90Sn/10Pb chemistry. NASA/Boeing and MIL-PRF-38534 require a minimum of 3% Pb to prevent tin whiskers. Novacap's X-Ray Fluorescence (XRF) is calibrated with Veeco certified standards and is used to measure the compositions and plated thicknesses to assure we meet this minimum Pb content.

International Rectifier instituted an EDS-measured verification of composition to assure the Pb content. IR reported two lots both measuring 1.4% Pb and one lot measuring 7.37% Pb. Novacap's XRF results indicate all three in excess of 5% Pb. IR indicated that EDS was their measurement of choice and that lots must meet their measured limits or be rejected. Novacap accepted returns for lots that measured acceptable on XRF at Novacap and began investigations to assess measurement techniques.

Investigation

We interviewed a variety of individuals with various backgrounds in an attempt to gain a better understanding of the EDS capability versus XRF:

Cyrus Razmara, American Environmental Testing Laboratory
- ICP expert/PhD in Chemistry from Empirial College University of London/30 yrs in chemical and compositional analysis.

Ron Barauskas, Rohm/Haas Electronic Materials
- Beta backscatter/EDS/XRF/plating chemical expert.

Edward Li, AEM Inc
- EDS/XRF/plating expert

Joe Brady, Fischer Technology
- XRF expert

Hans Shin, Pacific Testing Laboratories
- EDS expert

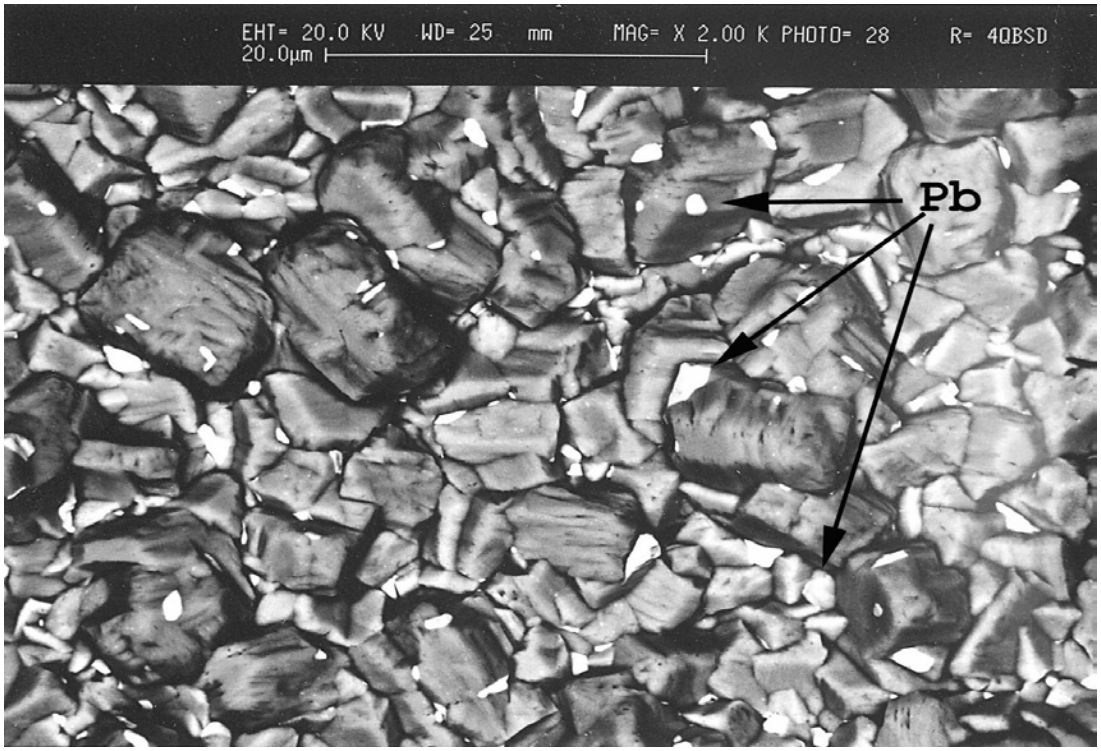
Frank Ferrandino, Matrix Technologies
- XRF/EDS expert

All these industry experts indicated a similar experience of different %Pb composition readings when using EDAX vs. XRF measurements, and that XRF should be more accurate than EDAX based on the larger area and depth of measurement performed by XRF.

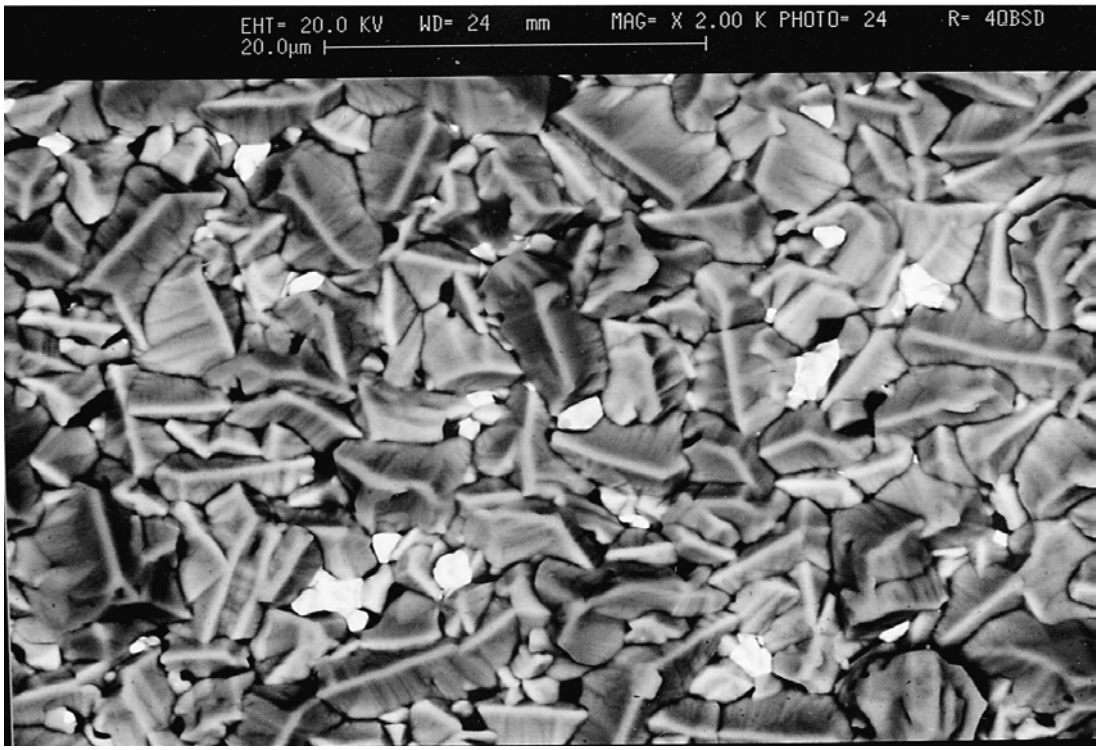
XRF uses certified standards for calibration, uses highest energy lines to determine elements and has the capability of measuring a depth up to 3,000 micro-inches.

According to the experts, SEM/EDS is a semi-quantitative standard-less test, which uses lowest energy lines to determine elements and measures a depth of approximately 40 -120 micro-inches.

Sn-Pb plating is typically non-homogenous in appearance, whereas the Pb appears like pepper scattered throughout the Sn crystals, as seen under SEM magnification (the white particles are Pb and the other areas are Sn). If the sample area measured happens to be an area of low lead concentration, this can contribute to error in an EDS measurement. This photo is of 7% Pb in composition:



This photo is of 10% Pb composition.



We think the minimal depth and area capability of the EDS combined with the typical non-homogenous Sn/Pb plating may result in inaccurate and inconsistent measurements. The XRF, with greater depth of field will measure a much larger volume sample, resulting in a more consistent and accurate measurement. We believe the data from the three lots mentioned above indicates the possible inconsistency in the reported EDS tests.

It was decided to verify controlled samples on XRF, EDS and ICP. ICP stands for Inductively Coupled Plasma and utilizes an acid digestion process to completely dissolve the sample and provide quantitative element results. Our thought is that ICP will remove measurement and sample variations and give us the most accurate result.

Test Results

Two of the test groups consisted of 85Sn/15Pb plated onto brass plates and copper strips, to remove any possible substrate effect (the ceramic capacitor material) from the ICP analysis. The Sn/Pb was scraped off some brass plates, and the scrapings analyzed separately, as an additional group to help eliminate any substrate effects in ICP. The Sn/Pb plating bath was certified at 11.7% Pb during the plating of these 3 plating tests. The results of ICP on the copper strips, brass plates and 85Sn/15Pb scrapings correlate with XRF much more closely than EDS. ICP showed the pure Sn/Pb scrapings as 15.8% Pb. The following shows the % Pb measured by each test method:

	XRF	EDS	ICP
Copper Strips 85/15	17.6 – 22.6	12.56-27.44	24.6
Brass Plates 85/15	12.5-20.7	31.73-60.45	20.8
Brass Scrapings 85/15	11.5-22	17.5-39.8	15.8

We sent two capacitor samples (one of which was returned from IR for low Pb from lot # 200330067) for ICP testing. The results of ICP and XRF appear much more similar than the EDS results. We believe this data gives an indication that the EDS method may not be the most accurate method.

	XRF	EDS	ICP
0402N101K500Y Lot 200330067	6.5-8.1	1.4	10.8
0805B471M101Y Lot 200402089	3.1-4.3	0.3-2.9	3.8

A final additional test performed solely at Novacap, was to measure the %Pb of various Pb composition platings by XRF. The composition 85Sn/15Pb, plated directly over nickel-plating, was found to give the expected 15% Pb content. However, when this same plating solution was plated over the top of a previously plated 100Sn/Ni part, the resultant XRF reading measured only 8% Pb, confirming that the XRF indeed penetrated through the entire thickness of Sn and Sn/Pb plating, and came up with an averaged %Pb for the two levels of plating. Once again, the XRF confirmed its depth of measurement and accuracy.

Root Cause

We believe the root cause of this issue at Novacap is due to the implementation of the EDS measurement at IR. It is stated in the problem description that "an investigation at Novacap revealed that the plating line chemistry did not produce the required amount of Pb" and further attributed Novacap with inadequate testing and analysis methods. We think the statement is not clear, and should instead state that the EDS results do not correlate to our plating line chemistry and we believe there is no information presented that confirms inadequate testing and analysis methods. Based on the data generated and information shared above, we believe our measurements are more accurate than the EDS implemented at IR. Additionally, we have not had any issues of failure reported to us, which reinforces our position that the controls of chemistry and XRF have produced conforming products for over 20 years.

Additionally, tin whiskers are known to grow even in verified 90Sn/10Pb plated compositions. The NASA study, as well as our own, verified presence of a small quantity of whiskers in the 5-10 um ranges with Sn/Pb plating. One large US-based electronics company has developed classifications based on the length of whisker grown under defined conditions. Our components have been classified as acceptable criteria A-2, passing their most stringent whisker length criteria with our 90Sn/10Pb and also passing their acceptable criteria A-1 with 100% Sn.

Corrective Actions

We implemented a change to our Pb targets in order to comply with the EDS measurements at IR. Our Pb range of the bath solution changed from 9-15% to 15-20%. Our specification of measured Pb content by XRF on finished parts has been increased to a minimum of 10%.

What lots or date codes are affected?

Returns were accepted on all parts identified by IR as not meeting their EDS measurement. Once we were informed of the EDS requirement and observed the poor offset correlation, the CA was implemented to assure we complied. We have systems in place to assure all outgoing product is verified prior to release. We do not believe there are any other lots affected.

Are there possible similar issues to other products at Novacap?

No, we do not see any correlation to other items.

Could this problem be systemic to other manufacturers?

We cannot answer with certainty. We are a specialty supplier that offers a variety of compositions and will continue to do so. Much of the world is trying to eliminate Pb and some suppliers may no longer offer 90/10. Each manufacturer will have to be addressed individually at the time of purchase to assure the customer and supplier has a clear understanding and agreement on the requirements.

Please let us know if you need any additional information.

Sincerely,

Brian D. Crowley
QA Manager

nemco
electronics corp

April 29, 2005

International Rectifier Hi-REL
205 Crawford Street
Leominstrer, MA 01453
Phone: (978) 514-6180

Attn: Mr. Paul Herbert

Reference : GIDEP FV5-P-05-01 March 29, 2005
Subject: Nemco response – P/N PCT4.7/10AK

Dear Mr. Herbert,

Thank you, for communicating your GIDEP alert to us, allowing us an opportunity to respond.

The subject alert describes an issue with regard to a potential problem with a tantalum capacitor part number PCT4.7/10AK. There was no failure of the device. The concern regards a 100% Sn termination finish on the product and the potential tin whisker growth that could result over time. The problem description of the alert suggests the application is Hi-Rel related and refers to NASA requirements.

The device in question is a commercial device. Commercial parts are supplied in accordance with catalog data or EIA specifications. The EIA does not specify material content of termination material as long as the termination is solderable. Catalog specifications on commercial devices are subject to change without notice especially in the interest of product improvement and/or mandates/directives/initiatives as was in this case. If a user has a specific material content requirement on a commercial device, this needs to be communicated to the supplier. This was not accomplished in this case.

Further, we are advised that these devices were purchased from a distributor; however, we have not been able to confirm the details of the transaction due to a lack of information provided and question whether the distributor may have been authorized at the time the product was purchased.

In any event, and based on description, we believe the product is Nemco brand and no negative reports have been filed relating to performance for these devices.

The development of Legislation began as early as 2001 worldwide to reduce the lead content and other hazardous substances in electronic products. This is being taken to reduce environmental impact when such products are discarded. Nemco (as well as all other global component suppliers) began introducing 100% Sn termination finishes to achieve complete conversion of all surface mount devices by July 2006. Our hard date for full conversion was January 1, 2004. This was accomplished. Accordingly, we are proud to report we are in compliance with lead free and RoHS initiatives.

nemco
electronics corp
675 Mariners Island Blvd.
San Mateo, CA 94404-1040
Telephone: (650) 571-1234
Toll Free: (800) 227-4058
Fax: (650) 571-0825
www.nemcocaps.com

Nemco Electronics Corp. believes it pursued reasonable methods of conveying this information to the market by modifying its part numbering system with the addition of optional suffix codes so customers could specify termination finish of 100% Sn or 90% Sn / 10% Pb. New catalogs were prepared, memos were sent throughout our sales organization including distributor network and our Web site www.nemcocaps.com was up-dated.

It should be noted that suppliers of commercial components to the electronics industry are handling the lead free conversion and communication of their conversion to the market in different ways. There is no organized approach among suppliers of passive components in the commercial sector.

At the component level, under reflow conditions, the solder paste into which the component is placed will wet most of the termination surface. This area will not be susceptible to whisker growth, as the additional elements alloyed in the solder paste will also alloy with the tin from the termination plating. Only a minor portion of the termination area may remain pure tin coated. Hence the whisker growth is related to pure tin present on board such as pad plating rather than component termination finish.

There have been no noted incidences of Sn whiskers in millions of component hours for tantalum capacitors in solder (wave or reflow) applications.

The reported test in the advisory shows 5-micron max growth - NEMI has a threshold of 10 microns as defining onset of whiskers.

Although we believe whisker growth can be significantly reduced by preventative actions, a 100% whisker free surface cannot be guaranteed when pure tin is used. Both MIL and NASA specifications for tantalum capacitors continue to require a minimum of 3% lead content in termination finish to guarantee a whisker free surface. In response, Nemco continues to make 90/10 Sn/Pb available by adding the suffix code PB to part numbers.

For background information, due to the lack of any whiskers documented in pcb applications, the EIA/ ECA posted a white paper on their web site as pertaining to capacitors.
"Have you seen Tin Whiskers? The Facts about Tin Whiskers" dated July 22, 2004 is attached.

Respectfully submitted,

Philip Kansky
Vice President

C: James Rapoport – Nemco
: Quality Team distribution list NQP3295 – Nemco

675 Mariners Island Blvd.
San Mateo, CA 94404-1040
Telephone: (650) 571-1234
Toll Free: (800) 227-4058
Fax: (650) 571-0825
www.nemcocaps.com

Attachment:

Have You Seen Tin Whiskers? The Facts about Tin Whiskers

A Statement Issued by members of ECA/EIA Passive Components Group
(***Approved by ECA member companies, Jul 22, 2004***)

Due to environmental regulations the push towards lead free products has gained momentum in the past couple of years. However, with the shift towards lead free products, we have seen a re-emergence of the "***Fear of Tin Whiskers***". We use the word "FEAR" intentionally, because it is in the best interest for the whole passive SMT component industry and their users not over react, but to understand and evaluate any risks based on facts and data.

Over 30 years ago, when attempts were first made to plate electronic components with pure tin (mostly on copper or copper-alloy surfaces), there were reports of tin whisker growth. With that prior knowledge, the SMT component manufacturers conducted numerous studies (published and unpublished) on this subject and effective countermeasures were put in place to eliminate or mitigate the growth of tin whiskers. In fact, tin whiskers have not been a problem for the surface mount components ever since pure tin plating really took off (about 15 years ago). It is not possible to delve into all the publications and studies on this subject within the scope of this paper, however we shall highlight some very effective countermeasures taken by the whole industry. These include: using matte tin finish rather than bright (to reduce residual stresses), applying uniform nickel undercoating (which acts to suppress whisker growth besides acting as a solder barrier), and having parts with rounded corners (to avoid stress points). On the processing side too, care is taken to control grain size of tin, use high purity tin, annealing, use controlled current densities for deposition for both nickel and tin, high process control via SPC, control additives, stabilizers, etc. However, the above countermeasures may not be all inclusive, because every manufacturer may have their own process for tin whisker mitigation.

And what does the component industry have to show for it? Just for surface mount ceramic capacitors, in the past 5-7 years alone, over 2 TRILLION have been shipped worldwide. Most of them had pure tin terminations. To our knowledge, in commercial applications, there have been no documented cases to date of equipment malfunction, field failures or surface mount parts being returned because of tin whiskers. By any measure this is an impressive record.

However, two questions remain to be answered. Under what conditions and why do whiskers grow? It is easier to answer the first question, because some of our member companies have been able to reliably grow whiskers under specific accelerated conditions. As to the second question, there are some good hypotheses in literature to which many people subscribe to, but again for sake of brevity they are excluded from this paper. Controlled experiments have shown that whisker formation is initiated and accelerated by residual stresses. In practice, thermal cycling is the single biggest contributor to whisker growth. Maximum growth has been observed when thermal cycling between –40C and 85C, BUT the maximum whisker length observed is about 50 um (some studies have shown maximum growth to approach 100 um) after 2500 cycles. Whisker growth is reported to reach a plateau after 2000 cycles. In fact some of us have done tests up to 8000 cycles with similar conclusions. Diffusion of nickel into the tin layer is hypothesized to prevent whisker formation (it is hypothesized to relieve stresses in tin layer). Humidity and long term room temperature storage by themselves have not been found to initiate whisker growth.

So is there an easy way to control this fear of whiskers? Yes, there is. If NONE the conditions noted below apply, you should stop worrying about whiskers If any of these conditions DO apply, please discuss with your vendor, as they do not in themselves automatically constitute a risk of whiskers.

1. Your products *are exposed* to extreme thermal cycling conditions repeatedly and well beyond accepted industry standards.

2. Your products *are used in extremely dense circuits* where the spacing between individual components becomes extremely critical.
3. Your parts *are used* in extreme conditions requiring established reliability products (such as space or special military applications).
4. You *have not followed the manufacturer's recommended assembly guidelines.* For example, you have assembled tin coated parts with epoxy or glue or other polymeric conductors (such assemblies should use parts having non-plated or precious metal plated terminations).
5. You *source parts* from reputable component manufacturers (with a long history of providing high quality and reliable parts) or via their authorized distribution channels.

Note that despite the trend towards lead free products and an impressive record of reliability for pure tin plated parts, some manufactures still offer options for providing tin-lead plated parts (in many cases at a premium). These parts are recommended for applications or conditions where the possibility of whisker growth is real and high. It should be emphasized that switch to lead free soldering does not lead to tin whisker formation. Under any circumstances please discuss your applications with your vendor of choice.

The passive component industry would once again like to emphasize that the safety, performance and reliability of your products is our main concern and we have developed technologies and processes to provide you very high quality parts at very competitive prices. And we all stand behind our products.

675 Mariners Island Blvd.
San Mateo, CA 94404-1040
Telephone: (650) 571-1234
Toll Free: (800) 227-4058
Fax: (650) 571-0825
www.nemcocaps.com

FV5-P-05-01A (revision 12/6/05)

THIS REVISION PROVIDES NEW INFORMATION FROM INTERNATIONAL RECTIFER CONCERNING ADDITIONAL PRODUCT PART NUMBER IDENTIFIED FOR PURE TIN CONTENT - IN CONJUNCTION WITH GIDEP AAN-U-05-061.

TABLE II

IR PN	*Custom No.*	*Hybrid Date Code*	*Customer Notified*
OMR13576SCX	**8192887-1**	**0414**	**YES**
OM13642SFX	**6994002022-1**	**NA**	**YES**
OM11525SFX	**21055560-101**	**NA**	**YES**
OM13682SFX	**SVSK127588-1**	**NA**	**YES**