

Dear Colleague,

While July 1, 2006 is rapidly approaching, we can't forget that reliability issues exist, with or without Pb-free. With that in mind, our first article in this newsletter has nothing to do with Pb-free (will anybody read it?).

Understanding your risk and ceramic capacitors

Ever since the publication by Randall at CARTS 2003, there has been a general awareness that capacitors with high capacitance/volume (C/V) ratios could experience end-of-life within a relatively short time period, depending upon the use environment.

Based on a review of Randall's data, testing performed at DfR, and the experience of some of our customers, we now strongly encourage a thorough risk assessment for users of high C/V X5R/Y5V capacitors. Those companies that require long (10+ years) lifetime in elevated temperature environments are encouraged to consider alternative technologies (e.g., X7R). For more information on our rationale, please contact Gerd Fischer.

Field Failure Alert: Sulfur and Immersion Silver

A large consumer electronics manufacturer is reporting initial indications of a customer issue in regards to Pb-free product. In environments with elevated levels sulfur dioxide and/or hydrogen sulfide, silver sulfide crystals have been observed growing out of plated through holes and shorting adjacent components. If any readers have observed similar behaviors, they are asked to contact [Craig Hillman](#).

Not RoHS-compliant? How much money do you have?

The one aspect of RoHS is that the European Union left enforcement to the whims of the individual companies. The result is a wide variety of approaches and penalties. Fines for non-compliance now range from [€1,500 in France to almost €15m in Ireland](#). And that's only the direct costs. It has been reported that a [system is now in place](#) to ensure that your product is pulled from every EU country if there is a reported RoHS violation. Life has never been easier.

Swatch and Tin Whiskers

Much has been made of a recent [request for exemption from RoHS](#) by Swatch due to field failures from tin whiskering. However, closer review of the exemption raises more questions than it answers. The documentation seems to imply that the whiskering was from the Pb-free solder, not the Pb-free plating. In addition, the Swatch reports growth rates of several millimeters in only a few months. This is much faster than nominal for tin plating and is far beyond anything reported for Pb-free solder. There may be some misinterpretation or the vacuum environment may play some special role, but be careful about drawing any conclusions from this document until a more definitive statement is released by Swatch.

Pb-Free References

A number of useful references regarding Pb-free have recently been released. For tin whiskers, JEDEC has recently published [JESD201](#), "Environmental Acceptance

This issue:

[Ceramic Capacitors](#)

[Field Failure Alert](#)

[Not RoHS Compliant?](#)

[Swatch and Tin Whiskers](#)

[Pb-Free References](#)

[SAC305](#)

[Part Change Notification](#)

[RoHS/WEEE: Korea](#)

[New to DfR](#)

[Upcoming Events](#)

[Employment](#)



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Requirements for Tin Whisker Susceptibility of Tin and Tin Alloy Surface Finishes" (to be used in conjunction with [JESD22-A121](#), "Test Method for Measuring Whisker Growth on Tin and Tin Alloy Surface Finishes)," and [JP002](#), "Current Tin Whiskers Theory and Mitigation Practices Guideline." In addition, NASA has just published a web-based [Guideline for Optical Inspection of Tin Whiskers](#). Elfnet and Cost 531 Action have completed a [Database for Properties of Pb-Free Solder Alloys](#). IPC launched their [IPC-1752](#) in an attempt to standardize reporting for RoHS compliance. And finally, here is an excellent article on [China RoHS](#).

Is SAC305 on the way out?

Not surprisingly, the shakeout in Pb-free solder materials continues, even with July 1 only six weeks away. The primary driver, as always, tends to be cost. Recent 'surcharges' on silver-bearing solder, increasing the already high expense of this precious metal, has created severe financial constraints on using SAC305 in wave solder applications, resulting in a higher market share for lower-cost alternatives such as SnCuNi. On the surface mount side, an increasing number of ball grid arrays are being fabricated with SAC105 solder balls (again, less silver). Component manufacturers [claim improved mechanical shock performance](#). But beware: The melting point of SAC105 is 6-8 degrees hotter than SAC305.

Part change notification?

The greening of the component industry continues. An earlier attempt to replace bromide-based flame retardants with [red phosphorus](#) produced less than stellar results. Now component manufacturers are introducing a [new encapsulant formulation](#), multi-aromatic resin (MAR), and, unfortunately, contract manufacturers (CMs) and their customers are often not aware of this change until something goes wrong. So far, DfR has only identified failures during manufacturing (popcorning), but long-term field performance remains to be seen.

Pb-Free Marches On: Korea

Korea recently issued [its own RoHS/WEEE legislation](#), to go into effect on July 1, 2007. While initial indications suggested that the legislation would target anything electrical/electronic, more recent communications imply initial enforcement will be limited to 10 items (TVs, refrigerators, air conditioners, laundry machines, personal computers, audio devices, cellular phones, printers, copy machines, fax machines). Failure to comply? \$50,000 and 1 year in jail.

New to DfR Solutions

We would like to welcome our most recent hire, [Dr. Gerd Fischer](#). Dr. Fischer has a PhD in Physics and an extensive background in solid-state devices, with extensive work in test, measurement and development in the RF (GHz and THz range) and optics fields. Based on his understanding of solid state behavior and experiments carried out at DfR Solutions, Dr. Fischer has also developed a particular expertise in tin whiskering.

Due to our explosive growth over this past year, DfR has also recently brought on two new associates. [Norm Anderson](#) has over 30 years of experience in avionics and has been assisting DfR in projects involving part uprating/derating, obsolescence, FMEA/FTA, avionic-specific reliability issues, and general practices in reliability. [Jim McLeish](#) has over 20 years of experience in automotive electronics and has been assisting DfR in projects involving prognostics, supplier assessment, automotive-specific reliability issues, and general practices in reliability. If either of these two gentlemen could be of assistance to you and your company, please [let us know](#).

UPCOMING EVENTS

Components for Military and Space Electronics (Portsmouth, UK: June 27 – 29)

Nathan Blattau will be presenting a full-day seminar, "Performance of Pb Free Materials in Electronics." This course provides an overview of potential reliability issues, including end-of-life performance of Pb-free solders under typical military/space environments. For more information or to register, please contact [Nathan Blattau](#) or [Leon Hamiter](#).

Diminishing Manufacturing Sources and Materials Shortages (DMSMS) Conference (Charlotte, NC: July 11 – 12)

Craig Hillman will join Vance Anderson of DMEA, Charlie Minter of ONR, and Dr. Stephen Meschter of BAE Systems on an invited panel discussing the concerns regarding the RoHS legislation and government/military electronics. For more information, please contact [Cherelle Jeudy](#) or [Michael Erk](#).

Surface Mount Technology Association International (Chicago, IL: September 24)

Craig Hillman will be presenting his annual full-day seminar, "Reality of Pb-Free Reliability." Attendees will receive a clear and comprehensive presentation on all aspects of Pb-Free reliability concerns, including tin whiskering, popcorning, selecting a Pb-free solderability plating, choosing a Pb-free solder, and long-term reliability under thermal cycling, vibration, and mechanical shock. Especially informative will be an extensive review of relevant case studies. For more information, please contact [Craig Hillman](#) or [JoAnn Stromberg](#).

Surface Mount Technology Association International (Chicago, IL: September 28)

Nathan Blattau and Craig Hillman will be presenting their publication, "Epidemiological Study on SnAgCu Solder: Benchmarking Results from Accelerated Life Testing." This paper will be the first to provide test engineers with a general expectation of Pb-free performance based on standard test environments (0 to 100C, -40 to 85C, vibration per MIL-STD-810, etc.).

Accelerated Stress Testing and Reliability (San Francisco, CA: October 4-6)

DfR Solutions will introduce the "Therminator" to the electronics marketplace. This revolutionary test solution promises to simplify test setup, greatly reduce test times (>100 C/min ramp rates), significantly lower test costs (especially at the component level), and finally provide a practical solution for obtaining information for the development of physics-of-failure based models (think of all the Pb-free alloys entering the marketplace). Please join us for this momentous occasion or contact Nathan Blattau for more details.

Europe (September/October)

Dr. Fischer, who is fluent in German and Danish, will be visiting European customers of DfR this fall. If you are interested in a visit to learn about ceramic capacitors, tin whiskers, or other areas of expertise at DfR, please contact [Dr. Fischer](#) to make arrangements.

EMPLOYMENT

Positions Available

Positions for RoHS Engineers are currently available in Indiana. Please contact Faith Jaskulski at fejaskulski@SanfordRose.com or (888) 860-6997 for more details

A growing medical device company in the Minneapolis/St. Paul area is currently searching for a Reliability Engineer. Prior experience in the medical field is helpful, but not necessary. For more information, please contact [Cherelle Jeudy](#).

Interested in spending your later years in Austin, Texas? An electronics company is interested in hiring a Reliability Engineer with extensive (20+ years) experience. Very strong compensation package. For more information, please contact [Craig Hillman](#).

Positions Wanted

A manufacturing/process engineer with 30 years of experience, including 0201's, micro-BGAs/CSPs, and Pb-free, is looking for a position in the Washington-Baltimore area. Previous products include telecommunications, high-end servers, military, consumer, and oil drilling. For more information, please contact [Cherelle Jeudy](#).