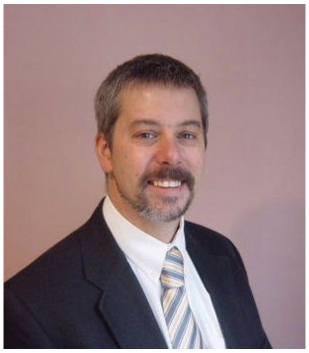
RoHS and WEEE
Not Just Lead-Free

New Zealand TRADE & ENTERPRISE | Electronics South | ceG

Newsletter No. 8 August 2006



Editorial

What an interesting time for RoHS aficionados. The deadline has come and gone and the world has not stopped. All is quiet on the enforcement front and we are all wondering if there is actually anything happening at the enforcement agencies. I guess in these days of privacy concerns it is unlikely that the NWML will publish a list of products currently under scrutiny on their website!

There have been many interesting and informative articles in the newsletters that I subscribe to, as well as the usual rash of inflammatory speculation - not I must add from Green Supplyline (www.greensupplyline.com) who still remain the best online news source for RoHS in my book.

In this issue we look at the 8 new exemptions, issues for the Military and Medical Device manufacturers who want to source non lead free parts, and also at how RoHS will be Enforced. We have an excellent article on "Compliance: Beyond RoHS" which needs to be read by all category 8 and 9 producers. Then for the technical bods an excellent article on bismuth and why it is not an issue as a coating on component legs.

Much of my time in the last 3 months has been taken up with researching and writing scope and exemption reports for various companies. Most are for companies either in the "grey area" or companies that are out of scope and wish to prove due diligence in assessing that they are out of scope. This is a very prudent idea as the enforcement authorities and indeed your customers may not agree with your position. With an independent scope and exemptions assessment you have a very good idea of your actual position and have something that you can give to the authorities in the event of your position being questioned. Please note, there is NO generic exemption for "high reliability" or for "mission critical" or "life dependent". There are still many companies out there with their heads in the sand, and indeed some pursuing full RoHS compliance where they do not need to - yet at least.

Now that the RoHS deadline has passed many companies are asking "What next?" The face of our industry has changed and the clued up companies are looking at the longer term and how to be better prepared for the future. RoHS and WEEE Specialists International are holding a 2 day Mini Conference on "RoHS and Beyond" in Christchurch, New Zealand and also in Sydney, Australia. The New Zealand Conference is end of September and the Australian one at end of October. The conference will cover EU RoHS training on day 1 with China, Japan, California RoHS, IPC1752 Databases, EuP, REACH and Category 8 & 9 update on the second day. Details are under "Upcoming Events" at the end of this newsletter.

To support SMEs with qualitative low cost testing we are now stocking the LeadCheck® test kits as well as ChromateCheck®, CadmiumCheck® and MercuryCheck®. We have these available for sale and also can provide an independent testing service using these kits. The kits range in price from $49.99 for an 8 swab test kit for Lead to $99.99for a 8 swab Cadmium or Chromate test kit. It is possible to test multiple components with one swab using the LeadCheck® Circuitboard test kit making these ideal for ongoing QA

Roland Sommer
Editor

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8 New Exemptions

At the meeting held on 26 June the TAC adopted a further six exemptions through a qualified majority. These six are: -

1. *Lead and cadmium in printing inks for the application of enamels on borosilicateglass.*
2. ***Lead in finishes of fine pitch components other than connectors with a pitch of 0.65mm or less with NiFe lead frames and lead in finishes of fine pitch components otherthan connectors with a pitch of 0.65 mm or less with copper lead-frames.***
3. *Lead in solders for the soldering to machined through hole discoidal and planar arrayceramic multilayer capacitors.*
4. *Lead oxide in plasma display panels (PDP) and surface conduction electron emitterdisplays (SED) used in structural elements; notably in the front and rear glass dielectric layer, the bus electrode, the black stripe, the address electrode, the barrier ribs, the seal frit and frit ring as well as in print pastes.*
5. *Lead oxide in the glass envelope of Black Light Blue (BLB) lamps.*
6. *Lead alloys as solder for transducers used in high-powered (designated to operate for several hours at acoustic power levels of 125 dB SPL and above) loudspeakers.*

Another two Commission Decisions covering an additional two exemptions were voted for at the 26 June meeting and these were also adopted under the qualified majority system: -

1. ***Hexavalent chromium in corrosive preventive coatings of unpainted metal sheetings and fasteners used for corrosion protection and Electromagnetic Interference Shielding in equipment falling under category three of Directive 2002/96/EC (IT and telecommunications equipment). Exemption granted until 1 July 2007.***
2. *Lead bound in crystal glass as defined in Annex I (Categories 1, 2, 3 and 4) of Council Directive 69/493/EEC.*

Where exemptions are agreed by the TAC, the UK enforcement body (NWML) will respect these from the time they are agreed, in advance of the formal publication of the Commission.

Adapted from the DTI Newsletter July 2006

Could RoHS mean the end of COTS as we know it?

By John Keller
Military & Aerospace Electronics July, 2006

The electronics industry's move away from using solders containing lead is setting up a clash between private industry and the U.S. military that may well lead to the end of the COTS era as we have come to know it.

COTS, of course, refers to commercial-off-the-shelf components, subsystems, and software that over the past decade have become the foundation of most military and aerospace electronic and opto-electronic integrated systems.

Among the benefits of COTS are affordability, broad availability, and the potential for rapid technology upgrades. Off-the-shelf, open-systems hardware and software are the rule now, and the rare exception is the custom-designed system built specifically to military specifications.

We soon may start seeing a change in this now-familiar COTS approach, however. The reason involves the Reduction of Hazardous Substances rules-better known as RoHS-which are pressuring electronics manufacturers to phase out their use of leaded solders in attempts to eliminate substances like lead from the environment where it can cause harm to humans.

RoHS takes effect this month in Europe, and other lead-free requirements are pending throughout the world. No company whose leaders want to continue selling into the lucrative European electronics market will keep using leaded solders on a large-scale basis. As a result, the electronics industry throughout the world is defaulting to nonlead solders.

The catch, however, is that nonlead solders simply don't work for the military, where system reliability is an imperative, not an option.

Lead-free solders, which RoHS mandate, tend to grow tin whiskers, which are physical abnormalities that form in nonlead solders. These tin whiskers can lead to unpredictable short circuiting and failures of electronic parts. These growths are electrically conductive, can grow in days or years, and can easily bridge between contacts, can touch each other to cause electrical problems, and can break off to bridge board traces and foul optics.

This phenomenon will compromise the reliability and reputation of most, if not all, COTS electronic parts and subsystems, and the military simply cannot abide this level of reliability; missions and lives depend on electronics that always work when fighting forces need them.

The military, meanwhile, has no effective and accepted tests to determine the susceptibility of platings to whiskering. Furthermore, no mitigation techniques exist to guarantee reliability levels that the Defense Department requires for high-reliability systems.

The only sure-fire way to ensure military-level electronics reliability is to add at least 3 percent lead to the tin-based solder, and this violates RoHS rules.

The military's short-term solution is to stay with leaded solder, at least for the foreseeable future. It is this policy that forms the threat to COTS as we know it. The commercial electronics industry is moving away from lead solder, and the military is staying put. With each passing day the two sides put more distance between each other.

Military leaders have no plans simply to settle for lead-free solder. They want to know for certain how lead-free solder influences system failure rates, and program managers will demand documented proof before they will accept lead-free solder. Today, no quantifiable means of predicting tin-whisker-related problems exist.

If no such data is available, then custom soldering with leaded compounds may be the only alternative. If the military persists in banning lead-free solders, and there are few alternatives on the commercial market, the military must resort to custom soldering solutions.

Inevitably, this alternative will prove to be expensive, slow, and inflexible. It promises to have many-if not all-of the drawbacks of the pre-COTS days before 1994 when everything the military bought was a custom design.

In light of these developments, it might make sense for small electronics shops to start gearing up to provide leaded solder for military applications.

I can see a whole new business line for electronics manufacturers to knock off the lead-free solder balls from ball-grid-array devices and replace them with leaded solder. Entire boards may need to be reflowed with leaded solder, and small companies are bound to step forward with such services.

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The ability to transform components built with lead-free solder into devices with leaded solder, for some, may promise to be a lucrative business opportunity-at least in the short term.

The biggest problem for the military most likely will not be a lack of suppliers of lead solder services. If there's a need, then a supplier base will appear. The big problem will likely be high costs and unpredictable availability-the same problems that COTS was intended to solve.

RoHS Enforcement explained

By Roland Sommer
Reprinted from Green Supplyline

Does anyone really know how the authorities will enforce RoHS or which products they will initially target? The answer is yes.
In May 2006, a group called the EU RoHS Enforcement Authorities Informal Network released a document called the "RoHS Enforcement Guidance Document" with detailed guidance on these questions. The document is aimed at both the authorities themselves and at industry. The document reveals that targeted products will be based on a number of potential criteria including:

- Market intelligence
- Random selection
- Products known to contain materials of high concern
- High-volume products
- Short-life products
- Consumer products unlikely to be recycled
- Notification of concern from external parties
- Notification of concern from other Member States

The possibility of policing by competitors and environmental groups has been widely speculated and clearly the enforcement authorities are anticipating this as well.

There is as much focus on infrastructure as on actual product compliance. The document provides a detailed flow chart of the enforcement process with XRF cited as the primary screening method. Upon investigation, an initial screening test will be performed with XRF and the authorities will request technical documentation from the producer to prove that the product is 100% RoHS compliant. If the authorities are not satisfied that the documentation is sufficient to prove that all homogeneous materials are RoHS compliant or the product fails XRF screening then they will initiate product and/or part testing.
The authorities will be looking for evidence that procedures are being followed to show that materials declarations have been assessed to determine if they can be trusted. The primary reason for failing a RoHS audit is credibility of material declarations.
RoHS and WEEE Specialists has seen numerous declarations that would not withstand scrutiny. For example a laboratory test report for a single component entitled "Electronic Component" submitted for 36 different components purchased from one supplier is not sufficient. We strongly recommend a photograph of the component on the test report as a base line requirement.
If any homogeneous material should fail the testing then either enforcement action will be taken or a remedial action required of the producer. The enforcement could be anything — impounding the product, a fine and/or a jail sentence depending on the Member State.
The document explicitly states that any material analysis must be at the homogeneous material level. We have seen many test reports from reputable test laboratories, primarily from Asia, where they have digested and then tested the entire component. This does not prove RoHS compliance unless the technique used detects to parts per trillion with absolutely none of the banned substances detected.
The guidance document also provides details on test methods and recommends keeping up with the variety of test specifications under development at various trade groups. They specifically name

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IEC111/54/CD(V) which is the second draft of IEC 111/24/CD. The document recommends screening with ED-XRF but warns of potential inaccuracies in inexperienced hands. Screening can result in a clear pass, a clear fail or a borderline result. Additional testing is required for a borderline result, or if bromine or chromium is found above the clear pass limit.
For testing, the authorities will focus on two primary areas. High concern materials and samples that can be easily separated using ordinary tools that would be typically found in a test laboratory, or by sectioning. (Sectioning is where a component is sliced in half or ground open very smoothly to allow test instruments to see inside a cross section. This is typically used for viewing the internal solder joint with a scanning electronic microscope.)
Interestingly, where a component meets three particular criteria the authorities may regard this as one homogeneous material. The document does also reiterate the European Commission's definition of homogeneous material.
The document also lists some examples of high concern material that the authorities are likely to target. These include the following:

- PVC (cadmium and lead as stabilizer and colorant)
- Polystyrene (PS) and acrylonitrile/butadiene/styrene (ABS) (PBDE as flame retardant)
- Red/orange/yellow plastics (cadmium, lead and chromium VI as lead Chromate; as colorant)
- Plated metal enclosures, fasteners, clips, and screws (hexavalent Chromium as chromate finish);
- Populated printed-wiring-boards (PWBs) and their components (lead as solder and terminal finish)
- Decorative name plates, buttons (mercury as additive, colorant, curing agent)
- Switches, relays (mercury as component of switch/relay)
- Lead solder used inside components
- Cadmium used in thick-film circuits.

The publicly issued document puts industry and the enforcement agencies on a level playing field. A copy of the document is available at www.raws.co.nz/pdf/rohs_enforcement_guidance_doc.pdf

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RoHS and Beyond

RoHS and WEEE Specialists International

A two day "Mini Conference" hosted by RoHS and WEEE Specialists.

Come and hear all about China RoHS, Upskill on IPC1752 Databases, find out what EuP and REACH mean to your company and a whole lot more. Held in Christchurch end of September and Sydney end of October
http://www.raws.co.nz/rohs_and_weee/upcoming_events.php
for more details

Compliance: Beyond RoHS

By Tony Bradley, Contributing Writer -- *Electronic Business*, 6/20/2006

RoHS takes effect on July 1, and as the deadline approaches other governments around the world are also busy crafting legislation to curb the use of hazardous substances in electronic equipment.
The European Union's RoHS (Restriction of Hazardous Substances) and WEEE (Waste Electrical and Electronic Equipment) directives are leading the way for manufacturing and disposing of electronic equipment in a manner that reduces the impact on the environment.

So what's next? Similar mandates are in the works in China, Japan, South Korea and the U.S., among others.
As the world starts to adopt eco-friendly regulations governing the substances that can be used in electronics or the proper

method of disposing of electronic equipment, businesses in all countries--not just the country that enacted the law--are affected. Companies that want to do business in the regulated countries, or who sell parts or equipment used in devices that are manufactured or sold in these countries, must comply with the environmental regulations or risk financial penalties and loss of business partnerships.

China passed environmental legislation that is being implemented in two phases. Phase one, which goes into affect March 1, 2007, requires that products containing restricted substances be appropriately marked. The restricted substances are lead, mercury, cadmium; hexavalent chromium, polybrominated biphenyl (PBB) and polybrominated diphenyl ether (PBDE). The timeline for enforcing the ban on restricted substances has not been finalized, but is expected to be announced later this year.
For the most part, China's legislation has a scope similar to the EU RoHS legislation. One significant difference, however, is that China has declared there will be no exemptions to the legislation. The EU has allowed certain industries, such as medical and telecommunications, exemptions from RoHS and has a process through which companies can apply for exemption under certain conditions. In China, every industry and product must comply.

California has current "RoHS" type restrictions in place but only for heavy metals and only for video display devices. The Electronic Waste Recycling Act (SB 20 / SB 50) mandates that retailers must collect a recycling fee and notify customers where they can dispose of electronic equipment.
Next year, restrictions will also be put in place on products being sold. The SB 20 / SB 50 legislation states that beginning January 1, 2007 "covered electronic devices cannot be sold in California if prohibited for sale in the EU under the EU RoHS Directive." Additionally, AB 2202 is pending that would extend CA 'RoHS' to the same product scope as EU RoHS."

South Korea, Argentina, Australia, Japan and the U.S. are also working on legislation to restrict the use of hazardous substances in electronics. South Korea's legislation, The Act for Resource Recycling of Electrical/Electronic Products and Automobiles, contains many of the same aspects as the RoHS and WEEE laws. It is scheduled to go into affect July 1, 2007 and outlines penalties, including one year in jail and fines up to $50,000 for violators.

Japan has had a law in place since 2000, the Law for the Promotion of Effective Utilization of Resources, and also introduced an amendment to the law, scheduled to take affect July 1. The amendment adds the disclosure of six chemical substances (mercury, cadmium, lead, hexavalent chromium, PBB and PBDE) across seven categories of electrical and electronic equipment, including personal computers and televisions.

Compliance management is a huge challenge

Simply put, as early as 2007 it will be virtually impossible to manufacture electronics or electronic components anywhere in the world without falling under the jurisdiction of at least one of these environmental regulations.

It will be difficult to track and understand the various regulations that apply, particularly for companies that do business throughout the world. The larger issue for companies however, is developing a strategy to enforce and track compliance.

Paul Tallentire, president of Newark InOne, a distributor of electronic components, stockroom management services and eProcurement solutions, recommends that "any company that buys or uses electronic components form a RoHS transition team, with representatives from cross-functional areas such as IT, procurement and legal. The team needs to keep up with the legislation itself, understanding how RoHS specifically impacts their company."
Tallentire warns that even companies that fall under exempt categories in the RoHS

legislation will most likely still find that the regulation impacts them as consumers. And an exemption in the EU is not necessarily an exemption in China or other countries, so it is also incumbent on the company to assure compliance internationally in all countries where they do business.

The EU Directive still has some areas of ambiguity regarding whether or not some equipment is covered by RoHS, and what constitutes equipment put in place after July 2006 versus repair or replacement parts for pre-RoHS equipment, which is exempt.

It is important to understand that, while the RoHS Directive applies to all countries within the EU, the methods of enforcement and penalties for violating RoHS are handled on a country-by-country basis.

Holly Evans of Technology Forecasters Inc. explains that the United Kingdom has outlined "due diligence" as a defense for RoHS compliance--a company must demonstrate that they took all reasonable steps to ensure RoHS compliance. "Although the UK does not prescribe a compliance methodology, it suggests the use of material declarations and component/material analysis to support a 'due diligence' finding," Evans says.

The penalties associated with violating the mandates could result in products removed from the marketplace, fines and in the most drastic case, jail time.

Advises Newark InOne's Tallentire, "A company should really concentrate on the business reasons for complying with RoHS: being able to manage its supply chain and staying competitive. A Federal RoHS-style law in the U.S. is inevitable. U.S. companies are wise to start their transition process now."

Bismuth and lead: Tests show no compatibility issues

By John McMahon, operations engineering consultant, Celestica and Joe Scala, director of global RoHS implementation, Celestica

Reprinted from Green Supplyline

The emergence of environmental legislation in Europe and other regions of the world is restricting the use of lead (Pb) in electronics and electrical products. For the past 50 years the industry has relied heavily on Pb and Pb-based substances to produce products which are desirable in terms of product reliability, cost, and ease of manufacturability. The removal of Pb from solder has received much attention and continues to be a focus of development effort. The current Pb-free solder of choice is tin-silver-copper (SAC). Solder notwithstanding, the removal of Pb significantly impacts other aspects of electronics and electrical products. One of these areas of concern surrounds component lead finishes.

Tin-lead (SnPb) has been a commonly used finish for years. The restriction of Pb has caused many component manufacturers to change to alternate alloys that do not contain Pb. Unfortunately, pure tin (Sn) coatings may grow tin whiskers, which could cause electrical shorts. Alloying tin with a second metal reduces the propensity for whisker growth. Bismuth (Bi) is considered to be an effective whisker suppressant.

When used in Pb-free solder assembly processes, tin-bismuth (SnBi) is a viable candidate for component finishes and is currently the most popular choice in Japan. However, some concerns exist in using SnBi finishes in SMT processes that still employ eutectic SnPb solder. This combination is likely to occur during a product's transition stage to full compliance and on enterprise products which have a Pb exemption but are still affected by the lead finish changes being made by component suppliers. The concern stems from the possible formation of low melting phases in the solder which could negatively impact product reliability.

Eutectic SnPb solder has a melting

temperature of 183°C. The low melting SnPbBi phases have liquid formation at 96°C and 137°C. For certain products and applications these temperatures can be approached or reached, with negative consequences to product performance and potentially reliability.
The perception of danger in Bi surface finishes persists. This article summarizes work performed at the University of Toronto and Celestica to determine if the risk is real or not (under typical electronics assembly and service conditions). A complete account of the work and findings can be found in the technical paper titled: "Microstructure and Properties of SnPb Solder Joints with SnBi Finished Component" (Snugovsky et al, 2006) which was presented at this year's Apex conference in California.

The dilution of SnBi lead plating in solder joints

While component suppliers generally consider that less than 2% Bi does not mitigate tin-whisker propagation; more than 6% does produce some challenges in the assembly process. Therefore, the industry norm for SnBi plating contains between 2% and 6% Bi. However, because the lead plating becomes a constituent of the solder joint, the resultant percentage of Bi in the solder joint is an order of magnitude lower.
Bi is very soluble in Sn, and SnPb solder wicks up and completely coats exposed leads plated with SnBi. This results in the Bi being evenly distributed throughout the solder joint. For the purposes of this research, the alloy compositions created for microstructure analysis had much higher Bi content than would ever be present in solder joints. The intent — to show that even 10 times the Bi content does not produce low melting phases.

Alloy preparation and analysis

Researchers at the University of Toronto analyzed phase diagrams present in existing literature to determine the theoretical composition limit of 11% Bi for the formation of the low-melting ternary SnPbBi phases through the addition of Bi to the standard SnPb soldering alloy. This is the low melting phase of concern, as previously mentioned.
Samples of eutectic SnPb solder with additions of 3%, 6% and 15% Bi were prepared and melted under controlled conditions to generate heating curves by DSC (deferential scanning calorimeter) methods. These same alloys were then solidified from the molten state using controlled cooling rates typical of electronics assembly processes, and the microstructure was analyzed to determine the grain size and the possibility of low melting phases which could both negatively impact the reliability and field performance of the product.
The results of each analysis method used were consistent with each other, and confirmed that the low melting phase was only present in the 15% Bi sample. The samples containing 3% and 6% percent Bi exhibited a microstructure with finer grains than the SnPb alloy without the Bi additions; and included the presence of a primary (alpha) Sn phase.
A general observation: the size of the eutectic colonies decreased as the Bi content and cooling rate increased. The 3% and 6% Bi samples did not contain any evidence of low melting phases. This result was confirmed by the absence of secondary reactions in the DSC curve.
The samples containing 15% Bi exhibited a disjointed Pb-rich phase in a field of primary tin and there was evidence of a third metallurgical phase identified as a low-melting beta phase (Pb-27.9 Bi-8.2 Sn). The DSC curve for this particular alloy showed a strong secondary reaction at 137°C. As previously cited, this temperature presents concerns because of its proximity to the operating temperature of some electronic equipment. This strong secondary reaction at 137°C was consistent with the formation of the beta phase. As the research team expected, there was no evidence that the higher Bi content phase (Pb-56 Bi-3 Sn) (99°C) existed in any of the prepared samples.

Leaded components (quad flat packs (QFP) and thin quad flat packs (TQFP) were

assembled onto boards fabricated with high-temperature laminate (FR4 epoxy). Three different surface finishes were used including organic solder protect (OSP), immersion silver (ImmAg), and Electroless nickel/immersion gold (ENIG) — the three most prominent Pb-free surface finishes.
Two reflow profiles were generated to accommodate eutectic SnPb solder pastes and a Pb-free paste containing Sn-3.8 Ag - 0.7 Cu. Reflow was carried out using no-clean pastes in an air atmosphere. "As-built" boards were aged at 125°C for 1,000 hours to produce a "thermally aged" lot and were subjected to five cycles of ship shock and vibration per Mil STD 202F condition 204A to produce a "vibration" lot.

Lead pull testing
The research team engaged in lead pull testing (through which a standard tensile tester was used to pull leads from solder connections) in order to determine relative solder joint strength. All of the following combinations of factors were included to accurately represent the pure Sn-Bi systems, pure Pb-free systems and mixed metal conditions expected during the industry's transition to pure Pb-free processes:

- SnPb eutectic solder vs. Pb-free solder (from the same vendor)
- Three different PWB surface finishes: OSP, ImmAg, and ENIG
- Three different component finishes: SnPb, SnBi and nickel-palladium-gold (NiPdAu)

Analysis of variance methods (ANOVA) were used to compare the pull strength in Newtons (N) on samples of the 18 combinations of solder joints in these three conditions. Pull tests were also performed on samples in the "as built" condition, after thermal aging and vibration conditioning had occurred. A total of 741 individual samples and 53 treatments were used. Each treatment included a minimum of 10 pull tests, and optical and scanning electron microscope (SEM) analyses of fracture surfaces were performed to determine the failure mode.

The grand average for all samples was 7.49 N which aligned with historical averages for SnPb solder in the industry. There were statistically significant differences in lot means across all of the analyzed factors as highlighted in the interaction plot below (paste, FAB-finish, lead finish and conditions).
There were also interesting interactions between the post-build conditions and plating systems. The SnBi lead finish generated higher average pull strengths than both SnPb and NiPdAu, using both the SAC alloy and SnPb paste. This was true for all board finishes and all of the tested conditions. This is evident in the center column of the interaction plot shown. The sub-lot mean for the SnBi lead finish was higher than that of SnPb and NiPdAu across every level of the other factors.
Further inspection of the plot showed that this benefit was primarily driven by the "vibration lot", which was substantially higher than other finishes. The "as built" and "thermally aged" lots were only marginally better than the other lead finishes. The higher strength of the "vibration lot" is attributed to work hardening — a phenomenon enhanced by small additions of Bi which acts as a grain refiner.

Thermal cycling reliability
In order to predict the field performance of assembly materials, Celestica performed two separate studies using accelerated thermal cycling (ATC) as defined in the IPC 9701specification, TC1 (0 to 100°C).
In leaded components, thermal cycling produced coarsened bands near the leads of SnPb solder joints on all the finishes and component terminations used. Micro cracks formed in the coarsened bands and eventually coalesced into continuous cracks that grew from the heel fillet of the solder joint towards the toe and increased resistance across the solder joint until failure occurred. This is aligned with standard crack propagation on SnPb assembly devices.
In the first study, microstructure was analyzed after 2,000 cycles. No significant coarsening was detected in all analyzed Pb-free solder joints. In SnPb solder joints, the

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most stable microstructure forms with the SnBi component finish on all three board finishes (OSP ImmAg, and ENIG). In the second study, no open joints were found with SnBi finished TQFPs in either SnPb or Pb-free solder when the testing was terminated at 6,010 cycles.

What does this mean?
SnBi has grown in popularity as a component lead finish as the electronics industry moves toward Pb-free, RoHS-compliant assemblies. SnBi is well suited for Pb-free soldering processes, but there is widespread concern in the technical community regarding its use with traditional SnPb soldering. The concern stems from the possible formation of low melting phases in the solder which could negatively impact product reliability.
Research carried out at the University of Toronto and Celestica dispels this misconception. More specifically, the following conclusions have been made:

- The low melting reactions do not occur in the near eutectic SnPb alloys with Bi additions up to 6% at the cooling rates employed at SMT processes. Therefore, there is no danger in using SnBi finished components with Bi content up to 6% that create final solder joints with Bi content five to 10 times lower.
- SnBi lead surface finish provides the highest pull strength in both Pb-free and SnPb solder joints. It also stabilizes SnPb joint microstructure during thermal cycling, reducing the grain growth and preventing crack formation.
- TQFP (0.5 mm and 0.4 mm) components with SnBi finish form reliable SnPb solder joints with an excellent fatigue life.

About the authors:
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A word of thanks to our Sponsors
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How to subscribe
Send an email to rsommer@raws.co.nz with "RoHS and WEEE Newsletter subscribe" in the subject heading

Upcoming Events

RoHS and Beyond - a mini conference

With Roland Sommer of RoHS and WEEE Specialists Ltd International

Christchurch, New Zealand: 28th, 29th September

Sydney, Australia: 26th, 27th October

Registration forms and further details are at http://www.raws.co.nz/rohs_and_weee/upcoming_events.php

Schedule

Time	Day 1	Day 2
9am to 10.15	RoHS Basics Scope and Exemptions	China RoHS Japan RoHS California RoHS
10.30 to 12.15	RoHS Enforcement RoHS Infrastructure	IPC 1752 Databases WEEE in brief
1pm to 2.30	Pb Free Issues Plastics Metals	EuP Directive REACH Directive
3.00 to 4.00	Testing strategies and methods Questions and wrap up	Category 8 and 9 Update (Medical and Monitoring and Control) Questions and Wrap up

The presenter for all sessions is Roland Sommer, Principal Consultant, RoHS and WEEE Specialists International

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The Commercial Page

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RoHS and WEEE Specialists (International) Ltd

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- IPC1752 Compliant Databases
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- Project Management
- Strategy advice and facilitation
- WEEE label testing (Hexane).

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www.buyusa.gov/europeanunion/weee

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The Commercial page

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