Users

Bob Landman Thomas Borman Cindy Bohler Rick Bell Mike Buetow Juan Ramon Molina Mark Geerling Hal Winslow Glenn Dody Gary Crowell Mike Bennett andy kish Krista Fabian, Circuits Assy. Robert Kay Jennifer Burk Ron Knight

Bob Landman you have joined The Hard Truths of Tin Whiskers

Mike Buetow (03/03/2010 1:59:20 PM):Hi everyone, and welcome to the Tin Whiskers chat.

Bob Landman (03/03/2010 1:59:31 PM):**Hello Mike**

Mike Buetow (03/03/2010 1:59:32 PM):Our moderator today is Bob Landman, chief technical officer, H&L Instruments. Bob is an IEEE Life Senior Member, and a reliability expert with nearly three decades' experience in electronics. He is member of several industry task groups on tin whisker causes and mitigation.

Mike Buetow (03/03/2010 1:59:54 PM):Bob, I'd suggest we wait a couple minutes more as people enter the room.

Bob Landman (03/03/2010 2:00:09 PM):**Thanks for the intro - I'll be posting two references in a minute**

Bob Landman (03/03/2010 2:00:57 PM):**My personal collection of papers on this subject**

Bob Landman (03/03/2010 2:01:12 PM):**http://www.hlinstruments.com//RoHS_articles/**

Bob Landman (03/03/2010 2:01:48 PM):**the home planet: http://nepp.nasa.gov/WHISKER/**

Bob Landman (03/03/2010 2:03:25 PM):**lets get started, does someone have a question or comment ?**

Mike Buetow (03/03/2010 2:04:30 PM):I do.

Bob Landman (03/03/2010 2:04:50 PM):**ok, lets hear it**

Hal Winslow (03/03/2010 2:04:56 PM):Bob, maybe you could start this off with a short statement about "Why manufacturing engineers should be (or should not be) very afraid of tin whiskers."

Mike Buetow (03/03/2010 2:05:18 PM):Hal just said it and in a much better way than I could hope to.

Hal Winslow (03/03/2010 2:05:27 PM):LOL, thanks Mike!

Bob Landman (03/03/2010 2:06:05 PM):**right. they should be concerned because there is nothing that stops tin whiskers from growing**

Mike Bennett (03/03/2010 2:06:29 PM):how about a little siver?

Mike Bennett (03/03/2010 2:06:35 PM):silver

Bob Landman (03/03/2010 2:07:00 PM):**no, that won't do it. lead is the element that works**

Bob Landman (03/03/2010 2:07:21 PM):**SAC alloys whisker**

steve gregory (03/03/2010 2:07:26 PM):Is there any evidence that major companies are in the process of discovering the tin whisker issues but not being forthcoming about how serious a problem it is?

Gary Crowell (03/03/2010 2:07:26 PM):Hi Bob, I was just reading your posts on the LF board this morning.

Mike Buetow (03/03/2010 2:08:28 PM):Steve, which companies might you mean? haha

Bob Landman (03/03/2010 2:08:38 PM):**there is evidence - NASA (Dr Leiddecker) assures me they call him and tell him ot problems. 7 auto electronics makers have reported and asked for help**

Bob Landman (03/03/2010 2:09:14 PM):**they all request to remain anonymous**

steve gregory (03/03/2010 2:09:17 PM):Ummmm...I can think of a few. hahaha

Bob Landman (03/03/2010 2:10:03 PM):**NASA gets about 5 calls a month reporting problems. No-one wants to go public and that is THE problem**

ET Products (03/03/2010 2:10:07 PM):Bob, I'm curious how NASA knows tin whiskers are at fault in lost sats in space? Obviously you can't perform a visual inspection.

Bob Landman (03/03/2010 2:10:47 PM):**they have duplicates of many of the components in space (such as the Hubble) so when they have a problem, they look at the dupliucate**
ET Products (03/03/2010 2:11:17 PM):ah, ok. that's still not conclusive but would obviously provide some clues.

andy kish (03/03/2010 2:11:43 PM):Is there a time frame that they grow the most/fastest or does it seem random?
Bob Landman (03/03/2010 2:11:45 PM):**they also have internal telemetry that gives them a lot of info about what is wrong and they then go back and look at the design and can sometimes find a part slipped in that was not lead plated**
Bob Landman (03/03/2010 2:12:13 PM):**no, and that's one of the problems. it can be days, weeks, months or years**
Bob Landman (03/03/2010 2:12:50 PM):**it depends on the environment - high temp, humidity, mechanical stress increase the chances**
andy kish (03/03/2010 2:13:18 PM):perfect for cars
Rick Bell (03/03/2010 2:13:24 PM):is it a self limiting process? i.e. is there a maximum distance they can "grow"?
Bob Landman (03/03/2010 2:13:27 PM):**yes, I'm afraid so**
Bob Landman (03/03/2010 2:13:59 PM):**there is no self limiting process - a millimeter to an inch or longer**
Bob Landman (03/03/2010 2:14:19 PM):**and some are gnarly they grow a few microns**
Bob Landman (03/03/2010 2:15:07 PM):**time frame isnt random - we doin't know what causes the wide distribution of time period for whiskers to erupt**
andy kish (03/03/2010 2:15:41 PM):is the rate of growth random also?
Bob Landman (03/03/2010 2:15:44 PM):**we know that grains in the tin are important so annealing seems to help reduce the likelyhood they will grow**
Bob Landman (03/03/2010 2:16:16 PM):**yes, the rate is random too. we talked today of a statistical model - no one has a good one**
steve gregory (03/03/2010 2:16:55 PM):With the growing body of evidence that whiskers becoming are a serious issue, you would think that there would be more voices out there pushing back against lead free? I wonder why that is? Is it all about money?
Bob Landman (03/03/2010 2:18:01 PM):**I think that it's unfortunate that so miuch time and money has passed and so many "experts" have said "no problem" $40B is the estimate of the conversion to lead-free**
Bob Landman (03/03/2010 2:18:45 PM):**Steve, you know Warner Englemier, from Lucent Bell Labs - he's very clear it's an unsolved problem.**
Bob Landman (03/03/2010 2:19:32 PM):**and it's created a host of metalurgical problems with all the solders that have been developed to solve the problems**
Bob Landman (03/03/2010 2:19:53 PM):**BGAs for example**
Bob Landman (03/03/2010 2:20:23 PM):**In my company (we still use tin/lead solder) we only use tin/lead BGAs**
Bob Landman (03/03/2010 2:20:38 PM):**and if we can't get them, we reball**
Gary Crowell (03/03/2010 2:21:10 PM):If TW are suspected in the current Toyota problem, would a regional analysis of the problems reveal anything? Say we found that the problems occur with significantly less frequency in Arizona, New Mexico, Nevada?

ET Products (03/03/2010 2:21:26 PM):I've been to several recent DFR seminars and training where industry reliability experts make it clear they're still seeing whiskers as one of the top causes of failures. The consensus among those I've had contacat with is go leaded for critical products or those that need a long lifespan.

Bob Landman (03/03/2010 2:22:09 PM):**I think that a region like Florida would be likely to see more problems**
Bob Landman (03/03/2010 2:22:40 PM):**DFR has been very honest about the problems - Craig Hillman is a good source of knowledge**
Bob Landman (03/03/2010 2:22:57 PM):**heres the best study of statistics**
http://www.hlinstruments.com//RoHS_articles/SMTA%202009%20Slides_McCormack-Monte%20Carlo%20for%20Tin%20Whisker%20Risk-Telecon%207-15-2009.pdf
ET Products (03/03/2010 2:23:10 PM):It's been eye opening for me.

Bob Landman (03/03/2010 2:23:45 PM):**it was for me as well. Two years ago I woke up. Until then I believed they had solved the problems**
Bob Landman (03/03/2010 2:24:24 PM):**then I began to dig deep and fortunately for me, Dr Leidecker at NASA happened to be my former physics professor**
ET Products (03/03/2010 2:24:25 PM):Do you know of any efforts to lobby governments (i.e. the EU, etc.) on behalf of this issue to relax the lead free regulations?

Bob Landman (03/03/2010 2:25:12 PM):**Its been tried with limited success to lobby the EU - the OK Institute fights any attempts to reverse the decison**
Bob Landman (03/03/2010 2:25:46 PM):**I know of a medical products group that hired a lobbist and did get beryliium taken off the banned list**
ET Products (03/03/2010 2:25:52 PM):And has anyone studied the environmental impact of all the high volume consumer electronics being scrapped due to whisker failures vs if those same devices did not need to be replaced? Sadly most small consumer electronics ends up in landfills when they die.

Bob Landman (03/03/2010 2:26:34 PM):**not yet - it will happen but it will take I'd guess 3 or more years to see a significant uptick**
Bob Landman (03/03/2010 2:27:38 PM):**we know that in the past it has happened and it took years to eliminate the problems. I fear we will have to go through that period all over again**
steve gregory (03/03/2010 2:28:05 PM):We use both leaded and lead free solder here. The lead free stuff we build is less than 25%. The problem that I see is that you can't get components without tin finishes on them anymore. Do you think that is any resistance from component manufacturers having to switch back to tin/lead finishes?
Bob Landman (03/03/2010 2:28:50 PM):**yes, there's a big resistance as they tossed their lead baths - saved money on environmental issues**
Mike Buetow (03/03/2010 2:29:14 PM):Steve, I'll jump in a mention that a person at Intel who would know these sorts of things told me they spend an average $100k a year on admin costs per product line.
Mike Buetow (03/03/2010 2:29:23 PM):And they have, what, 2100 products?
ET Products (03/03/2010 2:29:39 PM):I realize governments move slowly, and it doesn't help that some think the problems have been solved and are behind us, but I believe the more hard evidence that is presented as to the current state of the art, and the real-world costs and even negative environmental impact related to it, the better off we'll all be.

Mike Buetow (03/03/2010 2:30:06 PM):So there is definitely a strong financial incentive for the component manufacturers to have a uniform finish.
Bob Landman (03/03/2010 2:30:17 PM):**TI is one of the few companies who has a solution - palladium plating with gold**
Bob Landman (03/03/2010 2:31:26 PM):**I'm in a group called PERM - and we are trying to get federal (DOD) funding to solve the problems. We estimate $95M and three years is what it will take**
Bob Landman (03/03/2010 2:31:48 PM):**and TIN is the cheapest finish there is**

ET Products (03/03/2010 2:32:32 PM):I'm told by the quality engineer at our assembly contractor that using leaded solder with tin-finished parts signfigantly mitigates the risk. Do you believe that?

Bob Landman (03/03/2010 2:33:00 PM):**no it does not mitigate the risk**

Bob Landman (03/03/2010 2:33:22 PM):**above the solder line there is pure tin on the leads and they will whisker and short to each other**

ET Products (03/03/2010 2:33:51 PM):But the whiskers can now only form on uncovered tin areas, correct? They're not likely to emerge from the leaded soldered areas?

Bob Landman (03/03/2010 2:33:52 PM):**I hate the word MITIGATE - it's a word without metric**

Bob Landman (03/03/2010 2:34:10 PM):**they will not emerge from soldered areas, that is true**

Bob Landman (03/03/2010 2:34:26 PM):**what percentage is unsoldered?**

Bob Landman (03/03/2010 2:35:10 PM):**the very small 0402 resistors can easily be bridged by a whisker between the ends**

Bob Landman (03/03/2010 2:35:35 PM):**lets not forget connectors and shields**

ET Products (03/03/2010 2:35:57 PM):I think that depends greatly on the types of components being used. A BGA with tin plating soldered with leaded solder would be low risk I would think? So, I see some truth in leaded solder reducing risk in the real world?

Bob Landman (03/03/2010 2:36:16 PM):**NASA has photos of connectors (DB-25 and RJ-45) with whiskers**

Bob Landman (03/03/2010 2:37:11 PM):**the problem there is that the joints between the BGA balls and the solder will thermally expand at different rates**

Rick Bell (03/03/2010 2:37:21 PM):the majority of the bga ball would still be sn, though, i'd think

Bob Landman (03/03/2010 2:37:40 PM):**and that leads to the BGA delaminating off the board or of what is called pad cratering.**

Bob Landman (03/03/2010 2:38:00 PM):**the balls are hard and they push into the board and collapse layers within the board**

Bob Landman (03/03/2010 2:38:32 PM):**all kinds of nasty things happen with the new metal alloys**

Bob Landman (03/03/2010 2:38:52 PM):**things we never had to be concerned about - voids between the balls and the solder**

ET Products (03/03/2010 2:38:59 PM):from what I know of DFR, thermal cycling, expansion rates, etc. opens up an entirely different can of reliability worms than whiskers.

Bob Landman (03/03/2010 2:39:34 PM):**yes, that is true - I have a study on my website showing the problems - see above link**

Bob Landman (03/03/2010 2:40:42 PM):**and the boards themselves have problems http://www.hlinstruments.com//RoHS_articles/APEX%2009%20Bare%20Board%20Material%20Performance%20after%20Pb-free%20Reflow%20-presentation.pdf**

Bob Landman (03/03/2010 2:41:56 PM):**this link is the Manhattan project report - lists many probllems (350 pages!) http://www.hlinstruments.com//RoHS_articles/The%20Pb-free%20Manhattan%20project.pdf**

ET Products (03/03/2010 2:42:33 PM):The scary part to me is, because of the unpredictable timelines involved, it's very difficult for any study to conclude with a high level of confidence that the problem is solved or even greatly improved by a given process change.

Bob Landman (03/03/2010 2:42:34 PM):**we called it the Manhattan project as it is that critical to our nation's warfighters**

Bob Landman (03/03/2010 2:43:36 PM):**I'm afraid so. We have been at this for about ten years and every time someone introduces a new process we need to wait several years to be sure it is better than what we had before**
Bob Landman (03/03/2010 2:44:37 PM):**You can't accelerate the testing with any degree of confidence. The best studies take a long time. the industry has a 6 month test - not long enough**
ET Products (03/03/2010 2:44:58 PM):Exactly. And, to complicate things further, in even 3 years many other variables in this industry change for most of us--most notably package types. Certain industries have the luxury of using 3+ year old parts in their designs, but many (if not most) do not if they want to remain competitive.

Bob Landman (03/03/2010 2:45:36 PM):**that's true -Im looking for a good example of a long term study - will find it**
Bob Landman (03/03/2010 2:46:48 PM):**found it**
http://www.hlinstruments.com//RoHS_articles/NASA_DoD%20LFE%20Project-June-24-2009_SN%20whisker%20tele.pdf
Bob Landman (03/03/2010 2:47:38 PM):**take a look at it - you'll see a flock of BGAs that all popped off the boards**
ET Products (03/03/2010 2:47:49 PM):thanks

Bob Landman (03/03/2010 2:48:28 PM):**The testing at NASA continues. Thank goodness for NASA! I don't know what we would do without their honest work**
Bob Landman (03/03/2010 2:49:42 PM):**also thank the DoD industries - Raytheon, Rockwell Collins, Honeywell, Celestica, ... all doing their own R&D to find what works. Us small companies are helpless, we need them to do what we cannot**
Mike Buetow (03/03/2010 2:50:26 PM):Bob, we're coming close to the end of the hour...which is longer than I promised you would have to type(!).
Mike Buetow (03/03/2010 2:50:36 PM):Does anyone have any final thoughts or questions?
ET Products (03/03/2010 2:50:37 PM):It's good some out there are sharing their findings. Obviously if we're going to pressure all the players involved into solving this problem a high level of visibility and consensus is needed. Thanks to everyone.

Bob Landman (03/03/2010 2:50:44 PM):**my two fingers thank you :-)**
Mike Buetow (03/03/2010 2:51:17 PM):Also, I would ask whether those present would find it valuable if Circuits Assembly would dedicate a portion of our website/magazine to this issue for the near future?
Bob Landman (03/03/2010 2:51:20 PM):**this has been a very good session.**
Bob Landman (03/03/2010 2:52:37 PM):**any other questions?**
Mike Buetow (03/03/2010 2:52:56 PM):OK, well I think that does it. Thanks, Bob; it was great having you here!
Bob Landman (03/03/2010 2:53:39 PM):**your welcome - the PERM website is http://www.aia-aerospace.org/resource_center/affiliate_sites/perm/**