



# Soldering Technology International News

Volume 3, Issue 2

February 2004

www.solderingtech.com

## Dave's World

By David Raby



The most difficult part of writing this column each issue is choosing a subject. Luckily, I have some very smart people working for me and, like they do in other things, they've always been able to bail me out when I couldn't think of a subject.

The first thing they suggested this month was to write about our new e-commerce site. I've talked about it in the past and the features it was going to have. Beta site testing began in January and hopefully will be successfully completed by the time you read this. After the completion of the testing, our e-commerce site will be available at [www.solderingtech.com](http://www.solderingtech.com) and will allow you to easily shop and purchase items from your computer. It will also allow you to check the status of your account, view old invoices & statements, repeat past orders, and do all kinds of other nifty things. Due to publishing lead times by the time you receive this newsletter the site will be completed and you can go to our web site and see what it will really do. As a result, that's not what I want to write about this month, but I would like you to take a look at the e-commerce site and let me know what you think and how we can make it better.

It was also suggested that I write about the new online version of Jim's Corner. Also on our web site, Jim's Corner will be a chance for you to ask Jim Raby questions via e-mail and tap his almost 50 years of experience in soldering and electronic assembly. Ideas on the exact format are still being kicked around at the moment but, like e-commerce, it will be there by the time you read this. If you take a look at our web site, you'll see the final (or at least current) version. Again, you've got the advantage of time on me so try out the new Jim's Corner and let me know what you think.

I've also been asked to write about our planned Soldering Technology International Technical Seminar. The seminar is planned for November in Huntsville, Alabama and will feature technical presentations by our R&D and Training personnel. Presentations will include some papers that we have presented recently at other seminars around the world but will also feature some new information on independent studies being conducted in our lab on diverse topics such as Lead Free, Tin Whiskers, and Embedded Technology. Training presentations will include updates on specifications and training issues. Planning is still in the early stages for this event so I've given you about all of the details I have. Look for information in upcoming issues.

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## Trade Show

**Pan Pacific**  
Kahuku, Oahu, HI  
February 10-12, 2004

**Apex**  
Anaheim, CA  
February 24-26, 2004

**Atlanta SMTA Expo**  
Gwinnett Civic Center  
April 22, 2004

**Assembly Technology Expo**  
Rosemont, IL  
September 28-30, 2004

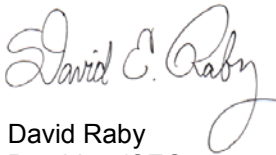
**STI Technical Expo \***  
Huntsville, AL  
November 2004

\* More details to follow.  
See you there!

## Dave's World (Cont.)

I still don't have a subject and my deadline is this afternoon but at least I'm out of space now. Please take a look at the new features on our web site and plan on visiting Huntsville in November.

Speaking of visiting, if you are attending APEX in Anaheim, please stop by and visit us at Booth 1101.



David Raby  
President/CEO

PS. Now that I'm out of space, something important just came up. **STI is now a distributor for Kester Solder.** Call us for more details but we're excited that you can now get the best solder and the best service in one place.

## 2004 Training-At-A-Glance Schedule

### February 2004

Sun	Mon	Tue	Wed	Thu	Fri	Sat
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29						

- **February 02-06** - IPC Rework and Repair Registered Instructor Certification
- **February 02-06** - STI MSFC/NASA Cable Harness Certification
- **February 09-12** - IPC/WHMA-A-620 Registered Instructor Certification
- **February 09-17** - IPC Rework and Repair Operator Certification
- **February 16-17** - IPC-A-610 Class "A" Instructor Recertification
- **February 18-19** - IPC J-STD-001 Registered Instructor Recertification
- **February 18-20** - IPC-A-610 Class "A" Worker Proficiency Certification

### March 2004

Sun	Mon	Tue	Wed	Thu	Fri	Sat
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	31			

- **March 01-04** - MSFC/NASA Staking and Conformal Coating Certification
- **March 08-12** - IPC J-STD-001 Registered Instructor Certification
- **March 15-19** - IPC-A-610 Class "A" Instructor Certification
- **March 22-23** - IPC Rework and Repair Registered Instructor Recertification
- **March 24-26** - IPC-A-600 Instructor/Inspector Certification

Register for Classes On-line at [www.solderingtech.com](http://www.solderingtech.com)

(256) 705-5512 or (800) 767-4919

Classes are conducted at our facility in Madison, AL unless otherwise noted.



## STI<sup>2</sup> Plating Organics: Hidden Defects

*By: Jason Gjesvold*

Recently we received some hardware that exhibited failures at a specific multi-use socket. The socket originally came under scrutiny because of weak solder connections that were cracking during final integration resulting in electrical failure of the product. Real time x-ray analysis (RTX) performed on the connections confirmed the presence of significant voiding as illustrated in Figure 1. Upon studying the reflow profile used in the board assembly and after numerous teleconferences discussing factors related to the reflow, it was unclear as to the source of the voiding. We were assured that the humidity at the time of paste and reflow was maintained at or below 25-30%. Additionally, the process time had been minimized to ensure the flux in the paste did not dry out too soon. What was the root cause of the massive voiding? Why didn't other leaded devices exhibit similar voiding?

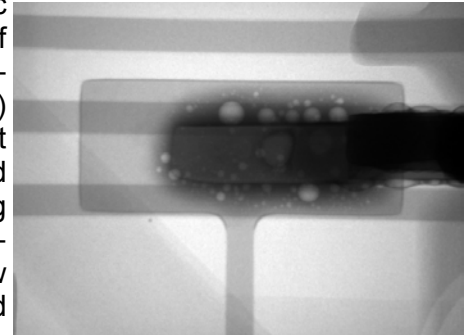


Figure 1. RTX Image of Socket Lead

To further investigate the phenomenon, a socket that failed due to fractured solder connections was analyzed in our scanning electron microscope (SEM). Energy dispersive x-ray spectrometer (EDS) analysis of the lead indicated the fracture occurred very close to a Nickel (Ni) diffusion boundary layer since Ni was detected in the EDS spectrum. Cross sectional analysis of good connections indicated Ni plating was not present on the surface of the board, therefore the fracture location was confirmed as occurring at the lead interface. Also discovered was the appearance of voids in the upper portions of the socket leads as illustrated by Figure 2. The location of the voids was not consistent with voiding that would be initiated by binders in the solder determined to be caused by occluded organic impurities or contamination in the plating process of the leads.

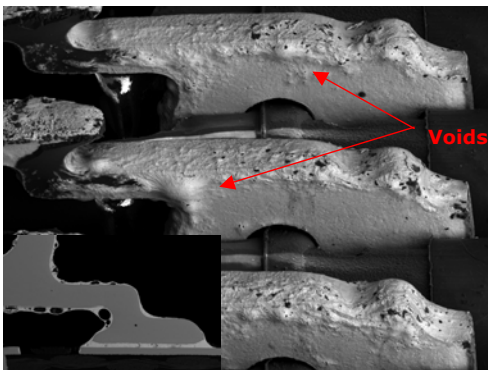


Figure 2. SEM Analysis of Lead (Microsection inset)

In implementing a corrective action to address the problem, the plating process must be understood. The plating material was measured as Tin (Sn) / Lead (Pb) in composition at a ratio of 93/7 respectively, common for Sn/Pb plating. While several types of solutions can be used to plate Sn/Pb, flouborate and organic sulfonate solutions are the most commercially accepted. Both processes require the use of organic additives to ensure a smooth, fine grain plating deposit and to increase throwing power. Invariably, some of the organics are co-deposited onto the target surface during plating. These organics, if present in high enough concentrations, will outgas at reflow temperatures and cause the voiding that was discovered on this hardware.

Unfortunately, voids caused by plating organics are perhaps more detrimental to the mechanical integrity of a solder connection than voids caused by the binders in solder paste outgassing. In general, voids caused by the solder paste will be randomly distributed in the solder joint. Due to the nature of plating voids initiating from the plated lead surface, they normally remain very close to the lead surface upon reflow and solidification. All other factors remaining equal (intermetallic compound formation and grain structure), the strength of the solder connection is directly proportional to the attachment surface area.

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## STI<sup>2</sup> Plating Organics: Hidden Defects (cont.)

By: Jason Gjesvold

As plating voids accumulate at the lead surface, the attachment surface area to the lead is reduced, thereby reducing the mechanical strength of the connection. Solder, by nature, is very weak compared to other engineering materials so, when plating voids reduce the attachment area, and applied mechanical or thermal stress is present, the risk of failure is higher than for normal solder paste voids.

Another critical factor is the screening process for determining whether leadframes are susceptible. Incoming visual inspection will not accurately diagnose the failure mechanism since the voids are not produced until the leadframe is heated. Cleanliness testing to identify organic contamination presence is also ineffective since the contamination is under the plating material and undetectable without altering the components. Therefore, some type of reflow simulation appears to be the best method for creating the phenomenon.

If reflow simulation is not possible, remember to look for telltale signs during visual inspection. Affected connections may appear cold due to their rough surface appearance. Furthermore RTX inspection of the in question may reveal voids on the lead that are well above the top of the solder paste. The location of these voids is a good indication that you have outgassing of contamination in the plating. While you would like to confirm this with 3D x-ray, it is not required. Take another look at Figure 1 at the right side of the lead as it extends up the socket. While it is subtle, voids are discernable in that 2D image that are well above the termination of the solder paste, leading to the conclusion that the voids present in the solder connection are most likely the cause of plating outgassing as well. Therefore, be suspicious of voids that do not occur uniformly across the circuit board and seem concentrated at a particular component. They may be the result of something outside of your manufacturing process.

Please contact Jason Gjesvold at (256) 705-5531 or email at [jgjesvold@solderingtech.com](mailto:jgjesvold@solderingtech.com) if you have any questions regarding this article.

<p><b>Training Resources Offers 10% off Gift Certificate!</b></p>	<p>SOLDERING TECHNOLOGY INTERNATIONAL, INC. <b>10%</b></p>  <p><b>Gift Certificate</b></p> <p><i>This certificate entitles you to 10% off your next enrollment in a course conducted at the STI Training Facility in Madison, AL or 10% off your next purchase of any Soldering Skills Kits, Process Development Kits, and Dummy Components purchased directly from STI. This certificate cannot be used in conjunction with any other discount or special offer.</i></p> <p><b>10%</b> EFFECTIVE IMMEDIATELY THROUGH JUNE 2004 Ref. NL0204</p>
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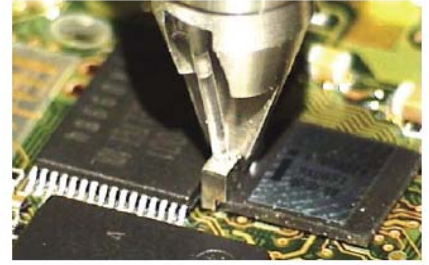


### NEWS FLASH! ..... NEWS FLASH! .....NEWS FLASH! .....NEWS FLASH!

STI is proud to announce that we are now a stocking distributor for **Kester Solder**. **Kester** has been and continues to be the leader in the soldering arena. We are excited about working with a world-class organization. This change without a doubt will greatly benefit our current and future customers. Please call one of our customer service representatives at (800) 858-0604 to discuss your needs for wire, bar, or paste solders as well as your chemical needs.

## sti STI's Sales Department Announces the Arrival of the Ersascope 2

Most everyone in the electronics world has either seen, heard about, or owns an Ersascope. The Ersascope opened many new doors in the way of inspecting, especially for the Ball Grid Array. The Ersascope was the first of its kind and now Ersa has introduced its successor, Ersascope 2. You may ask how this engineering marvel could be improved upon? Take a look at the added features.



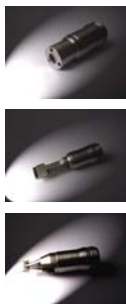
The revolutionary ERSASCOPE 2 Flip Chip head - designed for densely populated PCBs

### Ersascope 2 – The next generation

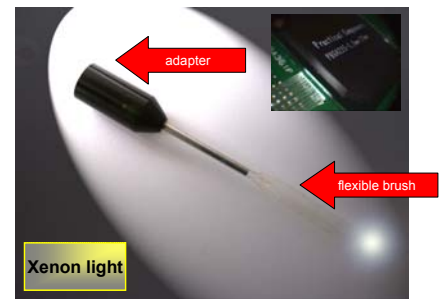
- New, stable Ersascope stand with improved z axis
- Ersa CCD color camera
- TV zoom adapter (F20 – F40)
- New ES 2 optical carrier with three exchangeable heads
  - BGA inspection head
  - Flip chip inspection head
  - 0 degree inspection head
- Front & backlight separately controllable
- Controllable Ersa Mini-Xenon light source
- Integrated coaxial light fiber
- Additional gooseneck with flexible adapter and light brush
- X-Y Theta rotation table
- Glass calibration scale & new Auto Cal function
- Optic case, cleaning kit, dustcover



Exchangeable Optical Heads



BGA Inspection Head



Xenon Light Source

As always, please contact one of our friendly Customer Service Representatives for additional information at (800) 858-0604.

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### New Toll Free Number

We have added a new toll free number to make it easier for our customers to reach us and get information or place an order. For general information please call (800) 767-4919. If you would like to place an order, please call (800) 858-0604 and one of our customer service representatives will help you.

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### Surplus Inventory Sale

STI, as one of the largest distributors of electronic assembly and solder supplies, occasionally has overstock on some items. We have created a surplus inventory list with prices drastically reduced. The surplus inventory list is available at our website, [www.solderingtech.com](http://www.solderingtech.com), and is updated monthly. Please call (256) 461-9191 and ask for Sales or (800) 858-0604. Quantities are limited so don't delay.

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*(STI)*

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## Jim’s Corner

*By: Jim D. Raby, PE*



For the past two years I have been communicating with you through Jim’s Corner in Soldering Technology’s bi-monthly newsletter. Now I would like to give you the opportunity to communicate with me through Jim’s On-Line Corner via our website. I have tried over the years to make my more than 50 years of experience in the electronics industry available to our colleagues and customers around the world and now perhaps through this on line service we can share our experiences together. Simply go to our web site, [www.solderingtech.com](http://www.solderingtech.com) and then open the Engineering Services Home Page. Under this Home Page there will be a link to “Jim’s Online Corner.” There one can ask any question dealing with the subject matter of soldering technology, any problem one may have in the field and expect to receive an answer very quickly. You will

also be able to attach drawings, photos, etc. to clarify the question or problem. I will personally respond to each question with an experience-based answer. If it requires test or laboratory attention, we will address that with you before it is done. This service will be available to you by the time you read this article, so get on line and let’s give it a try. See you there.....

