



Celebrating 125 Years
of Engineering the Future
IEEE Boston Reliability Chapter
Joint with New Hampshire and Providence
<http://www.ieee.org/bostonrel>



SMTA/IEEE Reliability Society Joint Meeting **Tuesday, July 14, 2009**

- + Benchmark Electronics Product Assurance and Failure Analysis Laboratory Tour**
- + Pb-free Rework Demonstration**
- + (2) Timely technical presentations by experts from U-Mass Lowell, Benchmark & EMC Corp.,**
- + Summer BBQ Dinner \$10.00! Registration is required, limited attendance, details below.**

Technical Presentations:

1.- "Long Term Reliability Analysis of Lead Free and Halogen Free Electronic Assemblies"

Greg Morose – New England Lead Free Electronics Consortium, University of Massachusetts Lowell

The New England Lead-free Electronics Consortium is a collaborative effort of New England companies spanning the electronics supply chain, sponsored by the Toxics Use Reduction Institute, the U.S. EPA, and the University of Massachusetts Lowell. The consortium has published the results of several phases of manufacturing and testing of lead-free Printed Wiring Boards (PWBs) with the goal of achieving lead-free soldering processes with comparable reliability to that of leaded solder processes.

Phase IV efforts of the Consortium began in 2008 and will be completed by third quarter 2009. The objective for Phase IV testing is to address the outstanding rework and reliability issues for lead-free electronics, and to evaluate halogen-free laminate materials. The Phase IV test vehicle is comprised of twenty layers, is 0.110" thick, and is densely populated with 900 components on each test vehicle. The research includes the evaluation of ENIG, OSP, HASL, and nano surface finishes, as well as SAC and Sn100C solders. Thirty-six test vehicles were built and inspected to IPC 610 D standards. The test vehicles have undergone vibration testing, IST testing, and thermal cycling. The failure analysis for these tests is still on-going. Greg will present the statistical analysis and overall results of the Phase IV efforts completed to date.

and

2.- "Evaluation of a RoHS Compliant Nanotechnology Printed Circuit Board Surface Finish"

Deb Fragoza – EMC Corporation, Hopkinton MA

Bob Farrell/Paul Bodmer – Benchmark Electronics, Hudson NH

The selection of the optimum printed circuit board surface finish is an important factor that can influence assembly yields and the reliability of Pb-free products. The underlying copper must be protected with an appropriate surface finish until surface mount and through hole soldering takes place.

There are many Pb-free surface finishes and each one has advantages and disadvantages. This presentation will compare a RoHS Compliant nanotechnology surface finish with OSP and Pb-free HASL surface finishes.

Comparison includes a real board that is .093” thick with multiple layers requiring double sided SMT and through hole soldering. Intentional time delays are added between bottom side reflow, top side reflow, and wave solder resulting in a total cycle time of 5 days. All reflow and wave soldering is done in air.

Data will include Ion Chromatography, Surface Topography, and Forced Aging prior to assembly, assembly yields, reliability testing, forced rework results, Sulfur Exposure, and Mixed Gas Test (Nitrous Oxide, Sulfur Dioxide, Hydrogen Sulfur, and Chlorine). Both gas tests will be conducted after assembly. Relative comparisons will be made due to limited sample sizes.

and

3.- Tour of the Benchmark Electronics Product Assurance and Failure Analysis Laboratory

Paul Bodmer and Bruce Tostevin

Tour will provide an overview of the following equipment and techniques in the Benchmark Product Assurance Laboratory that are used to validate the integrity of RoHS and non-RoHS compliant product. Topics of discussion will include:

- XRF Verification of RoHS Compliance
- Counterfeit Component Detection
- Ion Chromatography
- Surface Insulation Resistance
- Assessment of Pb-free solder joints per IPC 610, Class 2 and 3.
- BGA Ball Shear Testing
- Pull Testing
- Cross Sections
- Visual Reflow Chamber to Assess Solder Paste Characteristics and Wetting Characteristics of Solderable Surfaces
- Strain Gage Testing (prevent BGA fractures)
- Electrical Verification
- Presence of Pb Verification (Sn Whisker Mitigation)

and

4.- Demonstration of Through-hole Rework Technique Used in Phase IV to Minimize Copper Dissolution:

Bob Farrell

Demonstration of the use of forced convection to remove a 200 pin connector and vacuum clean the through holes which was one of the three rework techniques used in the Phase IV forced rework. Card thickness is .110” with 20 layers. The technique dramatically reduces solder fountain contact time which minimizes copper dissolution and the risk thermal damage to the printed circuit board.

Date: Tuesday, July 14th, 2009.

Location: [Benchmark Electronics, 65 River Road, Hudson NH, 03051](#) Tel.: 603-879-7000

Summer BBQ Dinner Cost: \$10.00 Cash or check made payable to SMTA at the event.

PLEASE NOTE:

- 1.) You must register on-line to attend. Attendance for this event is on a LIMITED first-come-first-serve. Registration will close when the meeting capacity (**65**) is met. Those registered for the event will be guaranteed a spot for the night of the event.
- 2.) The first 5 (five) IEEE Student members -with valid 2009 IEEE-Membership card- to register can attend free of charge (must be a US citizen & bring a US Passport or Birth Certificate, PLUS their 2009 IEEE- Membership card with them the night of the event to receive meal ticket).
- 3.) Company Regulations require that **ALL** attendees –including students- MUST be US Persons and MUST bring a US Passport, Birth Certificate, Certificate of Naturalization or Permanent Resident Card to attend this SMTA/IEEE Meeting on Tuesday, July 14th 2009 at Benchmark Electronics

*** Thanks in advance for your compliance! ***

Registration at: <http://ewh.ieee.org/r1/boston/rl/jul09form.html>

* Registered attendees will receive a registration confirmation & a meeting reminder e-notice prior to the meeting.

Agenda:

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| 4:30 – 6:00 PM | Sign in and Socializing |
| 4:45 – 6:30 PM | Tours of the Product Assurance and Failure Analysis Laboratory and Demonstration of Pb-free Through-hole Rework |
| 6:00 - 6:50 PM | Summer BBQ Dinner |
| 6:50 - 7:00 PM | SMTA / IEEE Chapter's Upcoming Meeting Announcements |
| 7:00 - 9:00 PM | Technical Presentations |
- **Long Term Reliability Analysis of Lead Free and Halogen Free Electronic Assemblies**
 - **Evaluation of RoHS compliant nanotechnology PCB finish**

About the speakers:

Paul Bodmer- Benchmark Electronics, Hudson NH

Paul has a Bachelors of Science in Electrical Engineering from the University of New Haven. He joined the Navy after college and was a US Naval Aviator / P3B pilot from 1965 to 1970. Paul is currently the Product Assurance Lab Manager at Benchmark Electronics, Hudson NH division, a contract manufacturer for commercial, military and aerospace products. He has 39 years of experience in semiconductor manufacturing and Mil/Commercial PC board assembly, testing and reliability. He has extensive experience in PCB process development and PC board construction/assembly and semiconductor failure analysis. He has provided lead free PCB assembly qualification and reliability analysis support over the past six years, including paste/solder studies, PCB surface finish studies, BGA strain analysis, ball shear/lead pull test, thermal cycle testing, SIR testing, Ion Chromatography testing and cross section analysis.

Bob Farrell – Benchmark Electronics, Hudson NH

Bob has a Bachelors of Science in Mechanical Engineering from Union College, a Masters of Science in Mechanical Engineering from Worcester Polytechnic Institute, and a graduate nanotechnology certificate from the University of Massachusetts Lowell. He is an advanced development engineer and has been on the Benchmark corporate Pb-free team from 2003 to the present and has provided on site support to a number of Benchmark manufacturing facilities as they convert to Pb-free manufacturing. He has extensive experience developing SnPb and Pb-free rework processes for through hole components and BGAs.

Deb Fragoza – EMC Corporation, Hopkinton MA

Deb is a Principal Hardware Engineer and a core member of the EMC technical team responsible for lead free solder joint reliability of advanced technology printed boards. With over eighteen years industry experience, she has worked for EMC Corporation in Hopkinton MA for 9 years and is currently the Lead Engineer for the PCB Group's Design of Experiments. She is a key link between design and manufacturing groups providing DFX consultation and advance packaging recommendations. Her research focuses on emerging Nano, Halogen free, and next generation lead free assembly technologies. Deb earned a Bachelor of Science in Engineering from the University of Massachusetts and a Master of Science in Business from Lesley College. She is Black Belt trained, Green Belt Certified and holds a US Patent for her PCB Micro-Cleaner Process Design.

Greg Morose – University of Massachusetts Lowell

Gregory is the Industry Research Project Manager for the Toxics Use Reduction Institute at the University of Massachusetts Lowell. For the past four years, Gregory has been the project manager for the New England Lead-free Electronics Consortium. Previously, Gregory had seven years of design, manufacturing, and sales engineering experience in the electronics industry; as well as eight years of management consulting experience. Gregory has published numerous lead-free electronics papers and has recently completed his doctoral degree in Cleaner Production. Gregory is also an ASQ certified Six Sigma Black Belt (SSBB).

Bruce Tostevin - Benchmark Electronics, Hudson NH

Bruce has a BSEE from San Diego State University and has been a Senior Component Engineer in the Benchmark Electronics Product Assurance Laboratory for 13 years. He performs failure analysis and process/product qualification, including Pb-free assembly, SIR analysis, and ion chromatography. He is particularly interested in counterfeit component detection. His previous experience has involved medical device R&D, manufacturing and testing of high resolution drum scanners and high-powered switchmode audio amplifiers, and R&D projects as an intern with the Power Systems Division at Naval Ocean Systems Command (NOSC), San Diego.

Directions to Benchmark Electronics in Hudson NH:

Benchmark Electronics

