

June AREA Consortium Meeting In Review

We are happy to report a very successful June AREA Consortium meeting has concluded and copies of the presentations and Flash recordings of the presenter audio can be found on the website.

- <http://smtweb.uic.com/consortium/2012 AREA Consortium/June%20Meeting/2012%20June%20Meeting.htm>

We had several guest speakers ranging in topics from Eco-Compliance to HiP. New topics were discussed such as vibration testing and our New Project Proposal Process. PLEASE follow the link above to learn more of the topics presented and our future planning activities.

October AREA Consortium is being planned. We will have many topics to cover at that meeting so expect more updates on projects between now and then.

Pad Reliability at Various Loads

We started a systematic project to construct S/N curves using angled hot bump pull fatigue of individual joints.

- 3 different board materials (identical board design)
- 7 different NSMD pad sizes.
- At this stage, only non-functional pads (no traces) will be tested, but pads with one or two traces are available on the coupons.

The samples have been built and strength tests have started.

0.3mm Pitch Printing

The final PCB designs for our 0.3mm pitch WLCSP test vehicle have been submitted to Multek for fabrication. We hope to have the boards within four weeks. In addition to evaluating realistic paste printing processes we intend to perform reliability tests on the components which have been supplied by Maxim via our friends at Celestica. We are also including a test cell for the Amkor WLP which utilizes an encapsulated copper post as part of the redistribution configuration.

Website Updates

We have added many new files to the 2012 website. They include;

- June meeting slides and audio
- NEW PROJECT PROPOSAL PROCESS
- New Proposals

Effect of Repair of Thermally Cycled Parts on Pad Cratering

The samples that have been put in thermal cycling until they fail (so that their components will be removed and the site redressed and balled for pad strength and fatigue tests) still have not failed. Cycling continues.

Creep Corrosion by Humid Sulfur Test

A Pb-free HASL test board was found to develop localized creep corrosion without being reflowed. Ion chromatography measurement showed high levels of bromide and chloride levels, most likely from fluxing agent used in the HASL process. Received more Pb-free HASL boards from various suppliers. Ionic contamination characterization has been done and humid sulfur testing is ongoing. Boards with three new surface coatings are also under testing.

Filled vs. Unfilled Vias

We continue to evaluate open and copper filled PCB via-in-pad designs for fine pitch (0.3mm to 0.5mm) components. Many boards have already been drop tested and we are performing failure analysis on those samples. We also have samples in our -40/125C thermal cycle chamber and are eagerly awaiting those results.

Conformal Coating

We have recently begun, in conjunction with a consortium member, a reliability experiment designed to compare the effects of conformal coating on CSP reliability. Test boards with various conformal coat thickness as well as non-coated samples have been assembled and currently are in -40/125C thermal cycling. To date over 400 cycles have been completed and we are already starting to see failures.

Pad Cratering and Laminate Testing

Our introductory pad cratering analysis of six PCB laminate materials using cyclic 4-point bending has been completed and a brief report has been uploaded to our website. We have begun the second phase of the experiment which involves evaluating the effects of pre-damage (i.e. a single stress prior to cyclic bending), and creating S-N curves for the different materials by varying the cyclic amplitude.

High Temperature Pb-free Die Attach Solder

Received improved Bi-AG-X solder paste for dispensing. Experiment has been planned for die shear test before and after liquid-to-liquid thermal shock.

Designing Accelerated Tests and Interpreting Test Results:

1) We have identified, and developed an understanding of, the mechanisms governing damage evolution and failure in thermal cycling. The mechanisms require significant, repeated variations in temperature. We have shown service conditions involving mild cycling, say from room temperature to 60C, to be sufficient for the same mechanisms to control life. It is also obvious that current models, including those relying on scaling of damage with the work per cycle, cannot be true. We have designed a systematic matrix of unique thermal cycling tests that should allow us to finalize our quantitative model. The same model is expected to allow the prediction of the effects of so-called mini-cycles.

2) The mechanisms governing damage evolution and failure in isothermal cycling such as vibration and cyclic bending are completely different. In this case, we have shown life to scale with the work per cycle. This appears to be so even in cycling with varying amplitude. We have identified the reasons for breakdown of Miner's rule for lead free solder joints, and we have proposed an approach to predicting life. We propose validating this approach in carefully designed cyclic bending experiments first.

Properties of New Solder Alloys

Progress is being made on the effect of minor alloying on, Sn grain morphology, composition and morphology of Intermetallics on different pad finishes (Cu, ENIG, ENEPIG, etc.), evolution of microstructure and mechanical properties (shear strength, fatigue, etc.).