AREA Consortium

Dear Members;

Our October Meeting has been scheduled for the 3rd and 4th. I hope all of you can attend since it is the last meeting of the year. On the agenda will be discussions regarding next years research plans. We hope that all of you can attend such that we can provide the most value for each of you.

George Westby, 25-year Director of Universal's Advanced Process Laboratory, has been appointed the Chief Technical Advisor. George's new position will provide him the opportunity to manage innovation projects, continue to track technology evolution in electronics manufacturing, and identify new process options and opportunities for the Lab's customers. George started the Laboratory in 1987, set the course for its unique role in our industry, and has grown it to the globally-recognized organization it is today.

All the Best,
Martin Anselm, Manager AREA Consortium

0.3mm Rework

We've started work on the 0.3mm pitch BGA reball project. This project will develop a rework process for 0.3mm pitch BGAs and compare the reliability of virgin and reworked components. As received balled components will be assembled on test boards using a paste process. The components will then be removed, re-balled, and re-assembled. Accelerated thermal cycling and drop/shock testing will be used to compare the reliability of virgin and reworked components. The test boards are scheduled to be built the first week of August.

TIM

We have started work on the thermal interface material (TIM) characterization project. This study seeks to characterize the thermal performance of several TIMs on Intel Thermal Test Vehicles (TTV) as a function of pressure and after thermal degradation. Initial testing with a TTV has begun. We are currently developing a fixture that will apply a known pressure on the TTV-TIM-heat sink assembly.

Website Updates

- **Martin Anselm recorded his own perspective on the vibration work planned with Binghamton University – can be found in the June meeting link**
- **Martin Anselm recorded his own perspective on Down Hole research – can be found in the June meeting link**
- **Two new Reports have been placed on the Website regarding Peter's LF research**

Fine Pitch Assembly and Reliability

Our evaluation comparing open and copper filled PCB via-in-pad designs for fine pitch (0.3mm to 0.5mm) components continues. Samples subjected to test in our -40/125C thermal chamber have surpassed 500 cycles and many devices have recently failed and are now being prepared for failure analysis. Drop testing (1500g impulse, 0.5ms duration) also continues as we are finding that it takes nearly 600 drops per board to get meaningful data.

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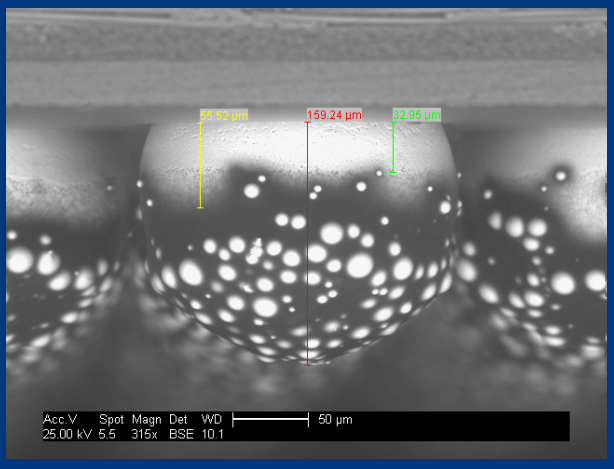
Conformal Coating

The CSP conformal coat reliability project is still in the -40/125C thermal chamber with about 1000 cycles completed. The member supplied test boards containing various conformal coat thickness as well as non-coated samples have already produced a significant number of failures and many samples have been prepared for failure analysis already. Temperature cycling will probably be completed within the next few weeks and we hope to have a report available in mid September.

0.3mm WLCSP Assembly

As mentioned in our last newsletter, the final PCB designs for our 0.3mm pitch WLCSP test vehicle have been submitted to Multek for fabrication. Due to production delays we now expect the boards in the third week of August. However, we have already begun some preliminary 0.3mm pitch CSP analysis using member supplied components and boards. We have completed some solder paste and flux dipping assembly processes and have begun drop, bend and temperature cycling tests on those samples. We also plan to build more samples using a paste printing process with a 3 mil thick screen when the stencil arrives.



Thin Die

We have completed a build utilizing small, thin, WLCSP components in which we varied PCB pad size, stencil thickness, and solder paste (type 3 vs. type 4). The samples are already in our -40/125C test chamber and our goal is to determine which design and assembly variables may improve the reliability of these very fragile devices.

ATC Scaling Factors

We have also begun a new phase in our long-term program to better understand the effects of thermal cycling temperatures and the scaling factors between them on BGA and CSP assemblies. Under the direction of Dr. Peter Borgesen we have built model components with 1.27, 1.0, 0.8, and 0.5mm pitches using 30, 20, 16, and 12mil solder balls respectively. Three thermal cycles have already been started: 0/100C with 15 minute dwells, -40/125C with 10 minute dwells, and -40/125C with 15 minutes at cold and 60 minutes at hot. A fourth cycle is set to begin shortly and four additional cycles are planned in total.

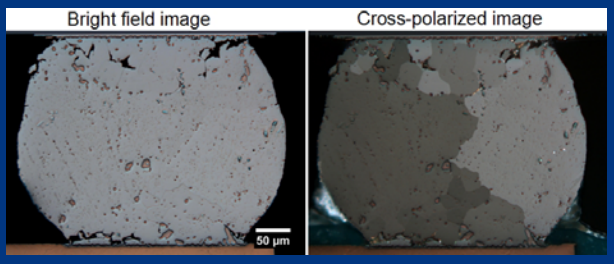
- Systematic studies of the effects of varying amplitudes on the life of SnAgCu solder joints in cycling are ongoing. Indications are that these effects vary significantly with strain rate.

The Failure Mechanism of Solder Joints with Various Geometries in ATC

Understanding the recrystallization in BGA and LGA joints is on going with careful attention to the crack propagation as a function of thermal cycles. The effect of strain on coarsening of precipitates and Sn grains is also being evaluated.

Microstructure of Mildly Cycled PCB Assemblies

Failure analysis was conducted on PCB assemblies previously cycled by a comparatively mild accelerated thermal cycle condition of 20-80C. After about 10,000 cycles various surface mount components, including wafer level CSP and QFN(MLF), showed that solder fatigue cracks were accompanied by Sn grain recrystallization and coarsening of intermetallic precipitates. The failure mode is similar to what has been observed for standard thermal cycling tests, such as 0/100C or -40/125C.



A 14 mil SAC305 solder joint in a WSCSP component after ~10,000 cycles between 20C and 80C. Sn grain recrystallization and precipitate coarsening are clearly visible.

Creep Corrosion: Evaluation of Various Surface Finishes

Test vehicles from various suppliers were tested by FoS (flower-of-sulfur) test for their propensities for creep corrosion. The finishes were Pb-free HASL, Cu-OSP, ImmSn, plasma coating, nano coating and direct Pd coating. As-received test vehicles showed some levels of surface corrosion and edge corrosion. However, the level of creep corrosion was found to be minimal. The effect of free chloride ions is currently being evaluated for those surface finishes. The chloride ion levels were chosen to be 0.7 and 7 ug/in2.

Edge corrosion was seen on a test vehicle with Pb-free HASL finish after 20-day FoS testing

A Letter from the Associate Director

Dear Advanced Research on Electronics Assembly Members,

We are pleased that we are able to deliver valuable and relevant information for you, our members. In our efforts to provide this information in a timely and transparent manner, I am available to visit you to provide information on a given project or projects. In addition, we have recently developed and delivered a dedicated full day seminar focusing on failure analysis, lessons learned in manufacturing, and emerging technologies. This program was very well received at the various locations that Martin and I have presented it. If you have an interest in a visit in either of these opportunities, please contact me.

Best Regards,

Denis

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