AREA Consortium

Dear Members;

We had a very successful meeting in June with significant audience and WebEx participation. I was happy to see many Members were in attendance despite travel restrictions and the WebEx option. Although all the staff here is looking forward to summer vacations we still have considerable work to do in order to prepare for our September 25th meeting. As I announced on June 12th we will be hosting a reunion meeting in September, inviting our former students and former members to the event. Our end of the year meeting is a perfect venue since we will have additional break-out time to discuss emerging technology trends and research needs. We are actively soliciting Keynote speakers for the event so look out for the formal invitation letter soon.

I would also like to remind everyone that the www.uic-apl.com website contains all the June meeting presentations (many "On Demand") and has been updated with all the UIC Consortium Reports back to 1994. I have been using the search function myself to find papers and it seem to be VERY useful. There are over 1000 reports with abstracts and hundreds of presentations that can be accessed through that search option.

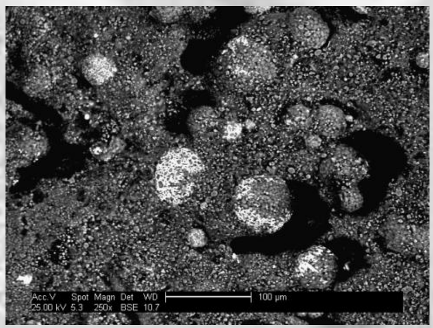
Martin Anselm, Manager AREA Consortium

MAT8A: Conformal Coating

We completed the 90 board build of TB2013 on June 21st with VERY few print issues and zero fallout. Dyne pen measurement of the boards prior to assembly was 38 which was considered acceptable for assembly. Boards were shipped to a Consortium Member for cleaning and coating using Humiseal 1A33 and 1B73. Boards have been cleaned and returned for coating of the Arathane 5750. We plan on starting thermal cycling testing at the end of July which should give us enough time to have some failures prior to the September meeting.

MAT4A: TIM, Component Level Gap-Pad Characterization

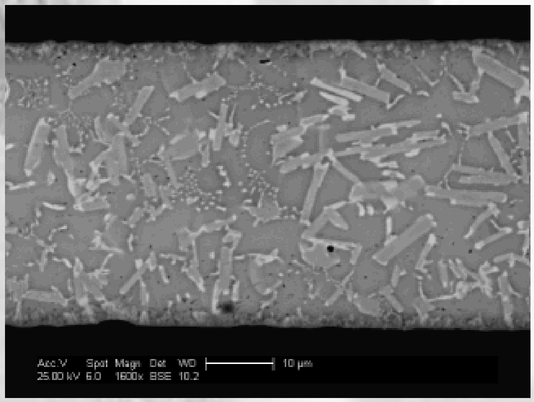
At the June meeting results were presented on the time zero testing of thirteen commercially available gap pad materials. The thermal resistance of the gap pads was measured at 10%, 30%, and 50% compression. Additionally, the microstructure of the gap pads was characterized using SEM. An image of one of the gap pads is shown below. Currently gaps are being aged at 125°C under 30% compression for 1000 hours. The thermal resistance will be measured after high temperature storage.



advanced process lab

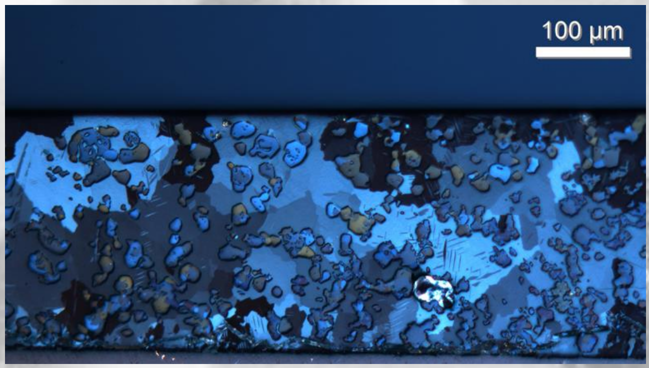
MAT3A: Pad Finish Studies

The study of the pad finishes continued with detailed examination of cross-sections, both of assembled parts (a BGA and an LGA) and of reflowed paste deposits on large square areas. The difference in solder volume between the BGA and its identical-footprint LGA often led to dramatic differences in intermetallics, both in composition and structure.



ENEPIG LGA where Pd particles dominant

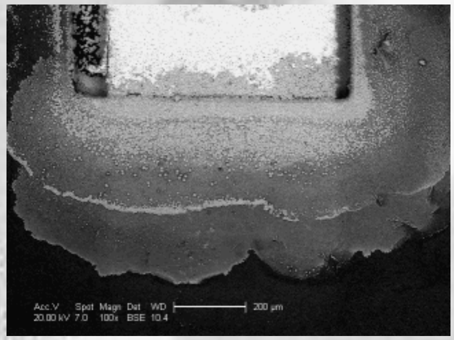
MAT6B: New High Temperature LF Die Attach Alloy Characterization



We presented an update on the Pb-free die attach project at the June meeting. Our work on BiAgXTM was presented along with the introduction of two new Pb-free die attach materials, Bi-14Cu-8Sn and Bi-20Sb-10Cu, developed at Binghamton University. An image of a Bi-14Cu-8Sn solder joint is shown. The microstructure of the joint is highly desirable of increased thermal conductivity. These new alloys along with die attach materials from Henkel and Nihon Superior will be characterized this summer.

REL4A: Creep Corrosion

The samples in the corrosion chamber mentioned in our April newsletter were taken out and examined in detail with optical and electronic microscopes for corrosion, Special attention was given to creep corrosion. Based on the extent and severity of it, preliminary rankings of the 6 pad finishes were made for each of the corrosion conditions



BRD711720 Cu OSP: 10 g/liter creep corrosion of 533um

MAT6B: HMP Materials and Manufacturing

We are designing a high temperature polyimide test board for down-hole, high temperature automotive and aviation applications. We will study process, materials, and reliability of high temperature electronics. If you are interested in participating in this project please contact Harry Schoeller (Harry.Schoeller@uic.com) or Martin Anselm (Anselm@uic.com).

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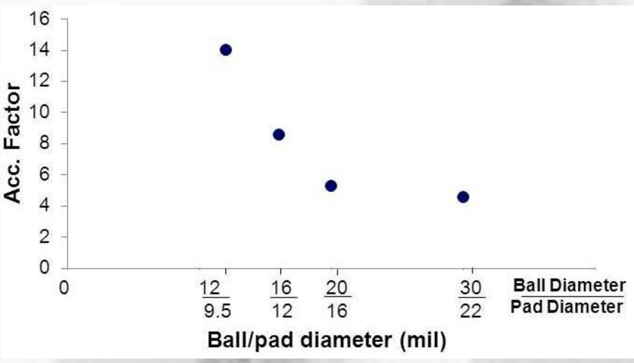
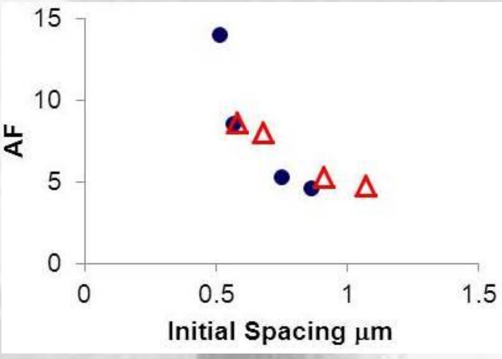
REL2A: Lead-Free Solder Fatigue Phenomenological Models

The usefulness of accelerated testing relies on our ability to generalize results and interpret them in terms of performance in service. Recent results show the comparison of assemblies with different size solder joints in thermal cycling to require careful judgment. This may be particularly true in the many cases where cross sectioning and cross polarizer microscopy is not practical.

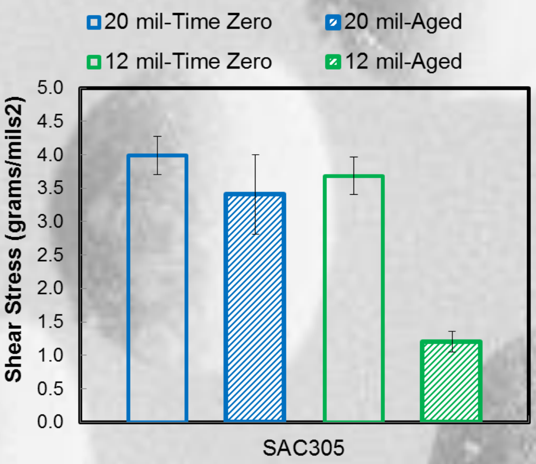


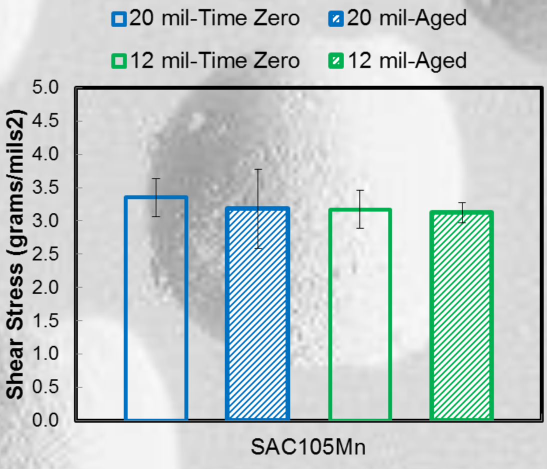


We have shown an 'acceleration factor' for SAC305 joints in thermal cycling (life in 0/80C divided by life in -40/125C) to vary strongly with solder joint dimensions. This would imply for example that even if fine pitch CSP assemblies fail faster than larger pitch BGAs in accelerated thermal cycling, they may still last considerably longer in service. The question remains whether this is likely to be true and, if so, how general the trend is.

MAT7A: New Alloy Research

We have performed mechanical testing (low speed and high speed shear test) on 10 different solder alloys with various sizes (ranging from 8 to 20 mils) both on Cu and ENIG surface finishes. Effect of aging was also investigated. Our results show that solder volume, surface finish and aging can affect the strength and failure modes in shear strength test. Some of the minor alloyed solder joints show less sensitivity to surface finish for long time of aging compared to common SAC 305. SnPb shows the least sensitivity of mechanical behavior to various surface finishes and following aging.





Effect of solder volume and aging on shear strength of SAC 305 and SAC105+Mn reflowed on Cu-OSP substrates.

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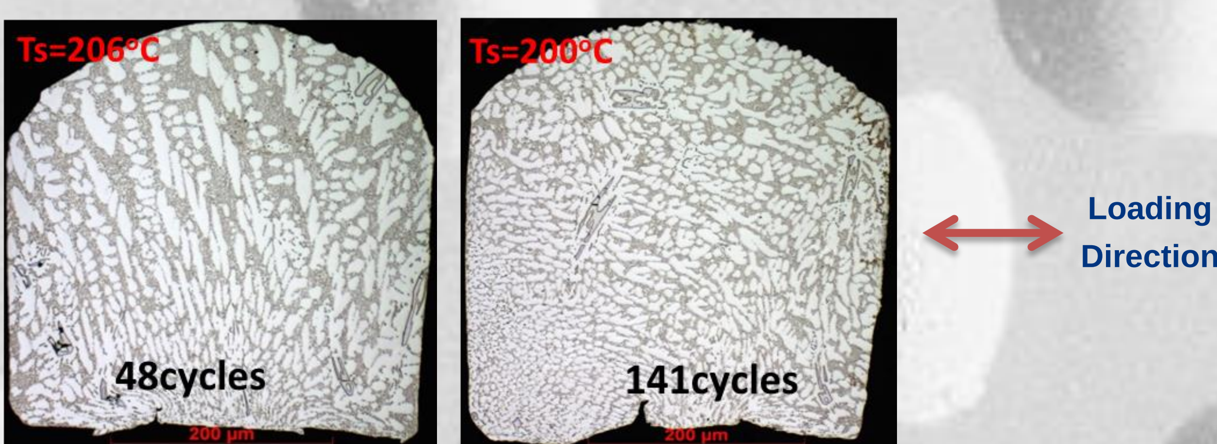
REL3A: Vibration testing

A comparison of two vibration methods for testing electronics reliability was presented at the June meeting. These include the sine dwell method with resonance tracking, which adjusts the excitation frequency to follow the changing resonant frequency of the system, and the sine dwell test with fixed excitation frequency. Six boards were tested with the resonance tracking method and six with the fixed frequency method. We found more consistent failure times using resonance tracking, with five of the six boards failing after approximately six hours at 2 g input vibration amplitude. Results using the fixed frequency dwells varied greatly, with two of the fixed frequency dwell tests not yielding electrical failures after 51 hours and 45 hours. Preliminary failure analysis for both test methods show the primary failure mode is trace failure with evidence of solder fatigue as shown above. We are in the process of using finite element analysis to obtain stresses at the failure locations for creating S-N curves.

B7: corner joint at Q4

MAT7A: Effect of Microstructure on Shear Fatigue

We have started our careful shear fatigue study on new alloys. Each individual solder bump is reflowed in the DSC and then subjected to shear fatigue test. The cooling rate, peak temperature, time above liquidus and aging will be systematically varied for each composition. Solidification temperature and microstructure at various conditions will be examined and correlated to mechanical properties.



Failed samples of 20 mil SAC 305 failed after shear fatigue test. The samples solidified at two different temperature (206 and 200 °C) and failed at different fatigue cycles.