PWB Design and Procurement Support

PWB failures are costly because they are often apparent only after value is added after assembly, or after the hardware is fielded. Is it adequate when high reliability is essential to procure PWBs specifying only that the hardware meet IPC Class 3 requirements? What additional requirements should be considered? How will quality problems (and questions) be addressed when they occur?

SEM Lab, Inc. provides PWB design and procurement support services aimed at closing the gap between specification requirements and performance objectives. This is achieved through a combination of reliability modeling, stress testing, enhanced coupon analysis, and failure analysis.

Reliability Modeling

SEM Lab, Inc. can perform design assessment at the pre-release stage of the PWB development cycle based on IPC-D-279, Appendix B - "Design for Reliability of Plated-Through Via (PTV) Structures". The assessment includes,

- Prediction of expected life in the use environment
- Prediction of manufacturing process impacts on expected life
- Recommendations for extension of PWB life through enhanced design
- Model correlation through interconnect stress tests (see next section)

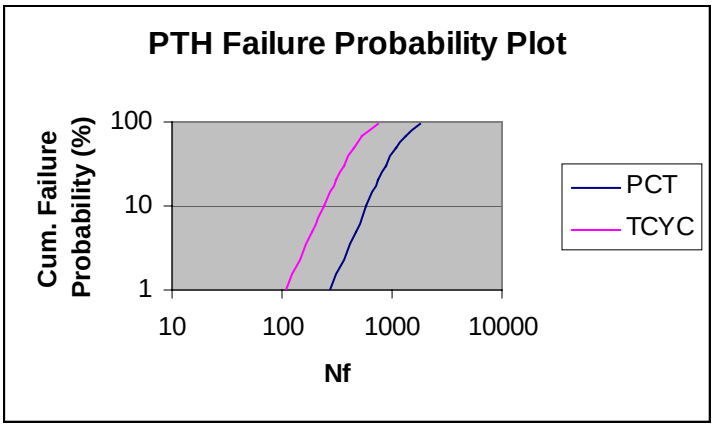

Fig. 1 – Calculated failure probability versus number of cycles for a 12-mil diameter PTH, 1.1-mil plated copper thickness, 0.125 inch thick PWB, Tg = 140ºC. PCT test is 25ºC to 130ºC at 96 cycles/day. TCYC test is –55ºC to 125ºC at 24 cycles/day.

Power Cycle Testing

SEM Lab, Inc. can perform power cycling tests (PCT) on custom PWB test coupons using our Power Cycle Test System. PCT enables performance of PWB life testing on a compressed time scale compared with conventional thermal cycling (TCYC) tests. The results can be correlated to predictions of the reliability model (see previous section) so that more confidence can be established for model results. Microsections analysis of the failed PTHs helps identify the weaknesses in the PWB design or fabrication. Furthermore, test results can be used to rank prospective suppliers, and to establish lot-to-lot performance variation for a given supplier.

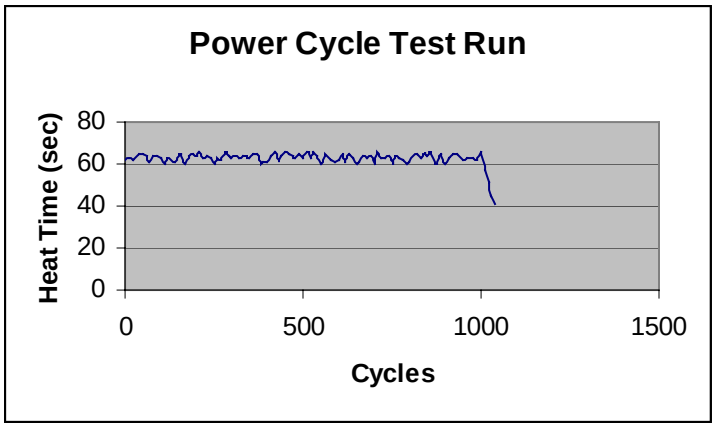

Fig. 2 – Power cycle test run showing heat-up time in seconds versus number of power cycles. The test circuit is typically heated from 25ºC to 130ºC and held at 130ºC for a total power-on-cycle of 3 minutes (power-off-cycle is 12 minutes).

Enhanced Coupon Analysis

SEM Lab, Inc. can perform enhanced coupon analysis that goes beyond accept/reject assessments performed in conventional coupon evaluations. The enhanced analysis would typically include,

- Review of coupon data from the PWB supplier
- Assessment of lot yield information
- SEM evaluation of selected coupons for incipient problems that can be missed during conventional optical evaluation of coupons

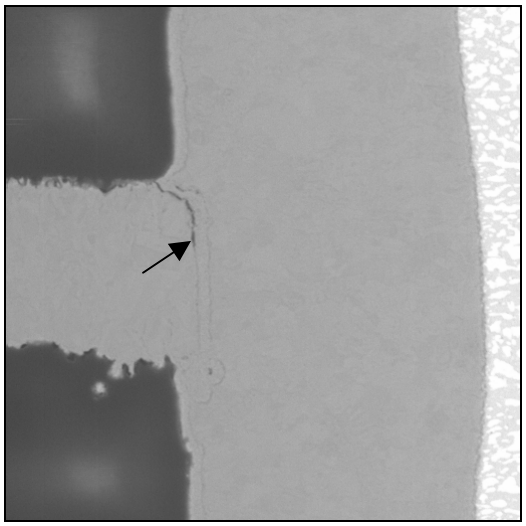

Fig. 3 – SEM image [810X] shows partial inner layer failure that was missed in conventional coupon evaluation (optical at 100X with 200X referee).

Failure Analysis

SEM Lab's staff has experience performing failure analysis of PWBs beginning in 1988. We have performed hundreds of individual failure analyses on PWBs and have

accumulated a significant database of the variety of failure modes and mechanisms involved in PWB failures.

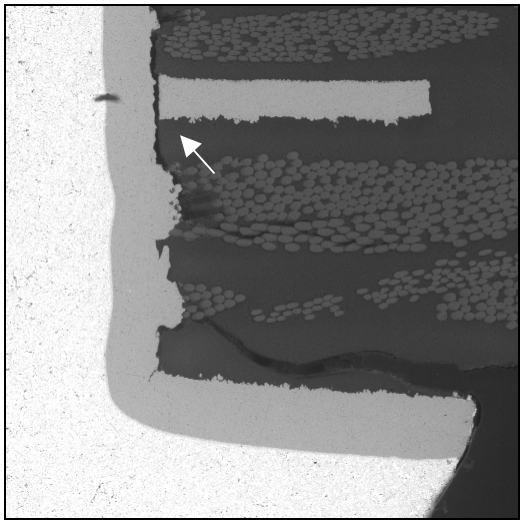

Fig. 4 – SEM image [162X] shows section of a failed PTH (field failure) due to inner layer separation.

Summary

SEM Lab, Inc. has the capabilities and expertise to provide PWB design and procurement support aimed at closing the gap between specification requirements and performance objectives. Contact Dr. Ed Hare for additional detail regarding these capabilities (Ph# 425-335-4400 or email ehare@sem-lab.com).