PCB Epoxy Pad Repair Thermal Shock Study

Background

The repair method used for this study is referenced in the IPC 7721 4.1.1 lifted conductor repair, epoxy seal method section.

Repair Method

Both the microetching of the repair circuit pad and its proper cleaning prior to attachment were steps taken in order to prepare the pads for attachment on the FR4 substrate. This microetching of the circuit frame replacement pads is part of the manufacturing process used by BEST, the vendor of the repair frame. Furthermore, any coatings or organic materials are removed (done with a "soft" eraser by the repair technician) in order to maximize the bond strength of the repair pad to the FR4 substrate.

Testing Method

The materials used as part of this test consisted of standard materials including Sn63Pb no clean solder wire and capacitors. These capacitors were manually soldered to both the control and test circuit boards.

Repair samples all used microetched copper replacement pads as supplied by BEST Inc.. The pads were tacked into place using a lap joint that held the replacement pad to the original trace prior to the application of the adhesive.

Thermal shock testing was done by exposing the samples to the air-air shock temperature cycles between –-50ºC to +85ºC at a 30-minute dwell at each of the extremes for a total of 200 cycles.

Results

All of the repair sample failures showed a failure mode indicative of an epoxy adhesion break down on the microetched Cu pad. It was shown that a combination of proper surface preparation as well as a given resin/hardener epoxy produces sufficient bond strength with good reliability. The shear strength of the epoxy bond replacement pads were shown to be better than the virgin reflowed solder joints.

End user comments and conclusion

"In conclusion, the PCB repair BEST epoxy and brushed pads showed the best and adequately reliable results".

Test Results

Pre Thermal Cycling-Repaired Pads		Post Thermal Cycling	
Sample Designator	**Shear Strength (kG)**	**Sample Designator**	**Shear Strength (kG)**
H15	11.1	H1	7.7
H16	10.8	H2	7.7
H17	8.4	H3	8.7
H18	13	H4	8.4
H19	13.6	H5	7.9
H20	8.3	H6	7.9
H21	14.7	H7	8.3
H21	8.8	H8	8.8
H22	5.3	H9	9.7
H23	12	H10	10.2
Average	**10.6**	**Average**	**8.5**
Std Dev	**2.74**	**Std Dev**	**0.81**

Pre Thermal Cycling-Control		Post Thermal Cycling	
Sample Designator	**Shear Strength (kG)**	**Sample Designator**	**Shear Strength (kG)**
H12	8.3	T1	9.1
H13	8.1	T2	7.6
H14	8.8	T3	7.5
H15	7.3	T4	7.4
H16	9.4	T5	5.7
H17	8.4	T6	5.9
H18	8.5	T7	6.4
H19	8.7	T8	7.3
H20	8	T9	7
H20	8.1	T10	7.7
Average	**8.4**	**Average**	**7.2**
Std Dev	**0.53**	**Std Dev**	**0.94**

Table #1- Comparison of Shear Strengths, Control Samples vs Repaired Pads