Not-So-Fine Debris

Left uncleaned, even staging racks can be a source of failures.

This is a short excerpt of a patient visit with the Process Doctor. This is a fictional depiction of an industry problem and customer communication and any similarities to any actual conversations are purely coincidental.

Client: We are seeing a high number of field complaints regarding drained battery issues on one specific design. This Class 2, handheld device is seeing good performance with the exception of the drained batteries.

Foresite: Are you still using the no-clean solder paste you qualified?

Client: Yes, and we have qualified a new assembler and they are using the same materials as the previous assembler did during the four years they had the product. We have seen the issue with three different battery suppliers. Units returned from the field will drain a battery within three weeks in the OFF position.

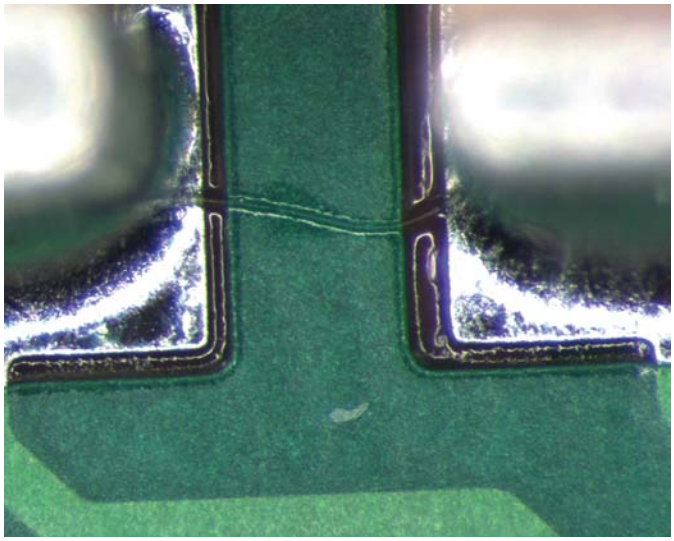

Figure 1. The battery circuit (shown at 150X magnification) revealed a debris pattern that was permitting flux to wick along the fiber surface, facilitating leakage.

Foresite: Are you seeing any dendrites or other corrosion issues?

Client: No corrosion or electrochemical migration issues were noted. And the power consumption has been optimized on this software revision.

Foresite: Let's run a couple of tests and investigate the assembly to see the circuits associated with the battery connections.

Two days later in the Process Doctor's office.

Foresite: How are things? Still the same?

Client: Yes, we are adding staff to our battery replacement program.

Foresite: The good news is that the incoming bare boards are clean and your suppliers are meeting the cleanliness specifications that you put in place. The assembler is showing a marginal to high level of weak organic acid (WOA) residues from the no-clean solder paste. They are using the same approved paste, but the stencil is 0.008" versus the 0.006" used previously and we see more visible flux residue in a number of critical areas on both sides of the SMT assembly. But the most interesting observation was that all nine of the failures provided for testing showed a fine debris pattern in critical areas of the battery circuit. This photo (**Figure 1**) represents much of what we were able to see on the assemblies themselves. These photos taken at 150X show that this debris was present primarily on the second side. You can see from the photo that the fiber was present at the time of reflow for the flux to wick along the fiber surface.

We were able to measure leakage across this fiber and flux location. When we analyzed the residue from this 0.1" area of the assembly we found high levels of WOA residues.

Since we see the fiber debris on all nine failures, primarily on the second side, we tested the transfer racks from the process and found these microfibers in the racks and ESD tubs. Each rack and tub showed a dust and debris buildup that had never been cleaned, according to the floor operators. We recommend a thorough cleaning and plastic cover system of these racks. We also recommend investigating the use of a thinner stencil to reduce the flux amount, but only if a design of experiments shows the thinner stencil will achieve the same solder joint quality required for your product.

On another issue, have you seen missing segments on your display?

Client: Yes, on a small scale but is has been an intermittent problem and concern as well. Why?

Foresite: We found that that the display showed high ionic residues on the surface of the ITO interface to the carbon connection strip.

Client: Thanks, we will investigate these issues as well.

Sixteen months after implementing the recommended corrective actions, the ESS-biased humidity test samples passed and the product from the improved process exhibits rare battery problems and lost display segment problems. ■

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