

Terry Munson

Low Battery?

Localized screening tests help pinpoint the cause of battery leakage failures.

We were recently presented with the following problem: A company's batteries on its new product were draining while sitting in the storage box. As it turned out, dirty 0805 chip capacitors on the battery circuit were causing the three-volt battery to drain in less than two weeks. A high humidity screening test was developed to separate the good units from the bad until a root cause and corrective action plan could be developed. The assemblies were failing approximately 3 to 5% of the screening tests.

We originally thought that the capacitors were cracked; however, multiple cross sectioning tests proved this idea wrong. Standard cleanliness testing showed that the assemblies from the no-clean process were in fact clean. The total board extraction showed an acceptable level of residues, indicating that cleanliness was not a problem (Table 1).

Since we knew there was no problem with the capacitors, we believed that cleanliness in the critical area of the board was the problem. Further testing with a localized extraction system in the area of the capacitor on the failing units allowed us to better understand the pockets of contamination. Our testing revealed a high level of sulfate residue on the capacitors of the failed assemblies (Table 2). The sulfate was not present in high quantities on the units that passed the screening test. Additional areas on both groups were also tested, and all areas showed similar acceptable results. The localized extraction allowed us to see the pockets of chloride, sulfate and weak organic acid (WOA) residues that were located on the specific area of the board.

Conclusion

When examining the cause of the residues on the capacitors, we found that the post-plating rinses after the barrel

plating process using methane sulfonic acid (MSA) as the primary plating chemistry were not neutralized or uniformly rinsed. The residues allowed a percentage of dirty capacitors into the total population.

Localized pockets of contamination were not identified when analyzing the whole board using standard extraction techniques. The localized conductive plating residue (sulfate) left on the capacitor surface created an invisible conductive pathway, causing the failure of the battery circuit while sitting in the box on the shelf waiting for shipment. ■

Ion Chromatography				
(All values are $\mu\text{g/in}^2$)	Cl	Br	SO4	WOA
Boards That Passed				
Assembly #1 - Total board extraction	0.99	0.68	0.00	7.95
Assembly #2 - Total board extraction	0.70	0.72	0.00	15.78
Assembly #3 - Total board extraction	0.51	0.47	0.00	9.48
Assembly #4 - Total board extraction	0.68	0.58	0.00	7.93
Assembly #5 - Total board extraction	0.55	0.59	0.00	16.69
Failed Boards				
Assembly #6 - Total board extraction	0.93	0.32	0.00	14.93
Assembly #7 - Total board extraction	1.05	0.57	0.00	14.41
Assembly #8 - Total board extraction	0.83	0.33	0.00	11.92
Assembly #9 - Total board extraction	1.18	0.46	0.00	8.38
Assembly #10 - Total board extraction	0.99	0.68	0.00	11.05

TABLE 1: Total board extraction results of the high humidity screening test.

Ion Chromatography				
(All values are $\mu\text{g/in}^2$)	Cl	Br	SO4	WOA
Boards That Passed				
Assembly #1 - Localized extraction	1.11	0.57	0.13	11.62
Assembly #2 - Localized extraction	2.25	0.54	0.24	9.36
Assembly #3 - Localized extraction	1.54	0.60	0.16	10.92
Assembly #4 - Localized extraction	1.06	0.58	0.17	10.36
Assembly #5 - Localized extraction	2.04	0.48	0.21	11.52
Failed Boards				
Assembly #1 - Localized extraction	2.36	0.43	20.36	12.57
Assembly #2 - Localized extraction	2.15	0.53	28.26	10.14
Assembly #3 - Localized extraction	2.28	0.54	24.12	10.95
Assembly #4 - Localized extraction	2.06	0.34	29.36	11.41
Assembly #5 - Localized extraction	2.03	0.55	27.15	10.65

TABLE 2: Localized extraction results of the high humidity screening test.

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