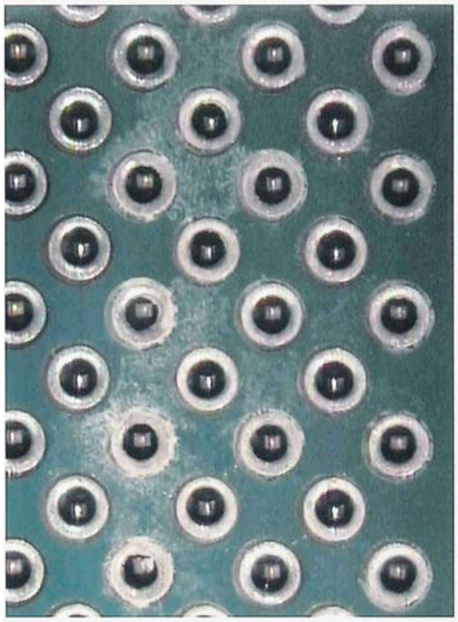
ISO 9001:2000 Certified

Ventilation Condensation

The Cleanliness of Environmental Chambers
has a Direct Impact Product Performance
Foresite Inc.



Close up of Drip Trail around VHDM connector

Sometimes the reason for a cleanliness related reliability concern comes not from the assembly process and handling, but instead from actual quality and reliability testing. Environmental chamber cleanliness has created substantial problems for several of Foresite's customers. The waters and cleaners used in environmental chambers can possess ionic residues that condense and deposit on boards. It is of great importance to monitor these chambers for cleanliness in order to prevent harmful contaminants being introduced onto finished assemblies and causing field failures.

Recently, Foresite has been involved in ongoing process monitoring and failure analysis for a customer manufacturing high density assemblies. You may remember them from our April column about localized residues causing big problems for an assembler. In this case, the manufacturer was seeing dendrites and a visible white residue that appeared to be in a drip pattern around a VHDM connector. These boards were double sided no-clean assemblies utilizing SMT and through-hole technologies on FR-4 laminate. FTIR analysis only showed flux residues. SEM/EDX showed a concentration of tin, lead, oxygen and copper, which was indicative of electromigration related failures. We analyzed the localized connector and housing areas where the white residue and dendrites appeared by extracting a sample with the C3 localized ionic cleanliness tester, and examining the samples with ion chromatography. Our findings showed high levels of chloride and sulfate residues, which are often found together in tap water, but we had yet to diagnose the root cause of the failures.

After examining all of the steps in this assemblers' process, we decided to analyze the cleanliness of an ESS chamber used after assembly in a Malaysian plant. We analyzed the cleanliness of the filter and desiccant, both used and unused. We also took wiping samples and foil samples from inside the chamber. All samples were analyzed using ion chromatography per IPC TM 650-2.3.28. There was a lot of variability amongst the foil and wiping samples, but many of the samples showed high levels of chloride residues. Examination of the filter and desiccant showed astronomically high levels of chloride residues, while unused samples and foil blanks showed low levels of residues.

Our findings indicated that chloride residues were being deposited on the boards during ESS/Burn-in testing. Contaminated tap water was allowed to condense and drip down onto the sensitive VHDM connector, thus causing the electromigration to propagate and cause field reliability concerns. To eliminate the introduction of this contamination, we set up a cleaning protocol for the ESS chamber involving Scotch Brite pads and 10MΩ deionized water working from the top to the bottom of the chamber. The chamber should be scrubbed at least 3 times using this method, and then thoroughly wiped with a lint free cloth and deionized water making sure to clean all vents and air inlet openings. Then, the chamber should be wiped down 3 times with isopropyl alcohol using non-polyester critical contact wipes. The filter and desiccant will need to be replaced, and clean deionized water should be used when testing in the chamber is resumed.

This case is one of several we have encountered that exemplify how critical that chamber cleanliness can be to long-term field performance. We were able to develop a cleaning program and rescue clean these no-clean assemblies for this manufacturer, but all of these frustrating problems could have been prevented by ensuring that the chamber equipment and disposables were free of harmful ionic contaminants.

Ion chromatography Data

	Ion Chromatography				
Sample Description	Cl^-	NO_3^-	SO_4^{2-}	Na	NH_4
Wiping Samples from inside the Chamber					
Left Side Wiping Sample	7.44	1.76	1.62	1.30	0.36
Window Wiping Sample	8.32	1.59	1.03	1.77	0.61
Back Wiping Sample	0.11	1.00	0.24	0.24	0.27
Back Wiping Sample	0.27	0.36	0.33	0.41	0.22
Back Wiping Sample	0.08	0.48	0.22	0.23	0.26
Back Wiping Sample	0.32	0.54	0.26	0.69	0.27
Top Wiping Sample	8.41	1.64	1.20	1.21	0.61
Window Wiping Sample	5.76	1.99	1.22	1.33	0.36
Top Wiping Sample	11.76	1.06	1.49	1.29	0.69
Right Side Wiping Sample	7.46	1.58	1.47	1.24	0.65
Top Wiping Sample	7.39	1.25	1.33	1.27	0.98
Left Side Wiping Sample	8.19	1.36	1.14	1.72	0.68
Right Side Wiping Sample	5.62	1.92	1.71	1.28	0.54
Right Side Wiping Sample	6.97	1.88	1.48	1.35	0.36
Control Wiping sample	0.02	0.22	0.15	0.17	0.05
Left Side Wiping Sample	5.52	0.97	1.71	1.10	0.74
Window Wiping Sample	8.26	0.94	1.32	1.43	0.26
Foil Samples from inside the Chamber					
Foil 1	2.36	0.04	0.02	0.18	0.06
Foil 2	2.54	0.02	0.15	0.24	0.23
Foil 3	0.21	0.05	0.23	0.39	0.36
Foil 4	0.29	0.17	0.44	0.29	0.29
Foil Control 3-1-C	0.04	0.05	0.00	0.12	0.01
Standard Extraction of materials					
Filter	206.73	24.45	1024.15	4011.34	1762.06
Dessicant-old	54.69	21.23	127.84	16.37	9.87
Dessicant-new	2.19	0.39	33.53	12.98	9.20

NOTE: All values in $\mu g/in^2$, unless otherwise noted.