Leakage, Leakage Everywhere

Carlin Combustion
Foresite Inc.

In this case study, we examined the effects of surface and absorbed fabrication residues on an assembler. The products were electronic assemblies designed for an automotive "under the hood" application. The assembly process was no-clean. The assembler subjected units to burn-in testing before shipment of the assemblies. During this burn-in process, numerous assemblies exhibited unacceptable electrical leakage. After some investigation, we learned that the assemblies exhibiting the electrical leakage had used bare boards from a common fabricator. In several cases, the ionic cleanliness data (Omegameter) for the problem lots would have been acceptable by conventional standards. We examined the bare boards from this vendor, as well as other vendors as reference, to determine if the bare board cleanliness was the problem or if the assembly process was at fault.

Results

Chart 1-1 through 1-3 show the results of our IC (ion chromatography) analysis for the solder masked FR-4 laminate bare boards. Our study quantified the anion (negatively charged) and cation (positively charged) residues.

- For the bare copper boards (configuration 1), tin-lead coating had been used as an etch resist. Incomplete cleaning left high levels of chlorides, resulting in consistent failures at burn in testing.
- Board configuration 2 was from a known good vendor.
- Board configuration 3 was not consistent in chloride level between samples. This resulted in intermittent performance results in burn-in testing.
- Board configuration 4 was likewise inconsistent, but with bromide (from the HASL flux). High levels of bromide were found on assemblies having leakage problems.
- The cations noted were fairly common to printed assemblies and were not linked to the burn-in failures.

Similarly, Charts 1-4 through 1-6 show the results of the IC (ion chromatography) analysis for solder masked CEM-1 laminate bare boards.

- Board configurations 8, 9, 11, and 13, all had excessively high levels of bromide, resulting in leakage currents and corrosion.
- Board configurations 5 and 12 would be considered as clean and acceptable for a no-clean process.
- Board configurations 6, 7, and 10, had levels of bromide attributable to the fire retardant alone, but had marginal levels of chloride for a no-clean process.
- The cation levels for all boards, with the exception of board 11, were largely unremarkable.
- Board 11 had elevated ammonium levels, when considered together with the elevated halides, indicated virtually no cleaning on this board.

Conclusion

We advised the assembler to work with the fabricator to get the processes under control and assure better incoming cleanliness. We also recommended the assembler conduct remedial cleaning on all existing inventories using a special saponified water cleaning process until the fabricator's process is brought under control. The remedial cleaning process was successful, as illustrated by Charts 1-7 and 1-8. Once cleaned, the burn-in leakage problems ceased.

Specific Fabrication Impact

If the bare boards are dirty due to HASL flux residues during the fabrication process, the electrical failure and malfunction problems may occur quicker and more catastrophic than general analysis (Omegameter) could have foreseen.

Chart 1

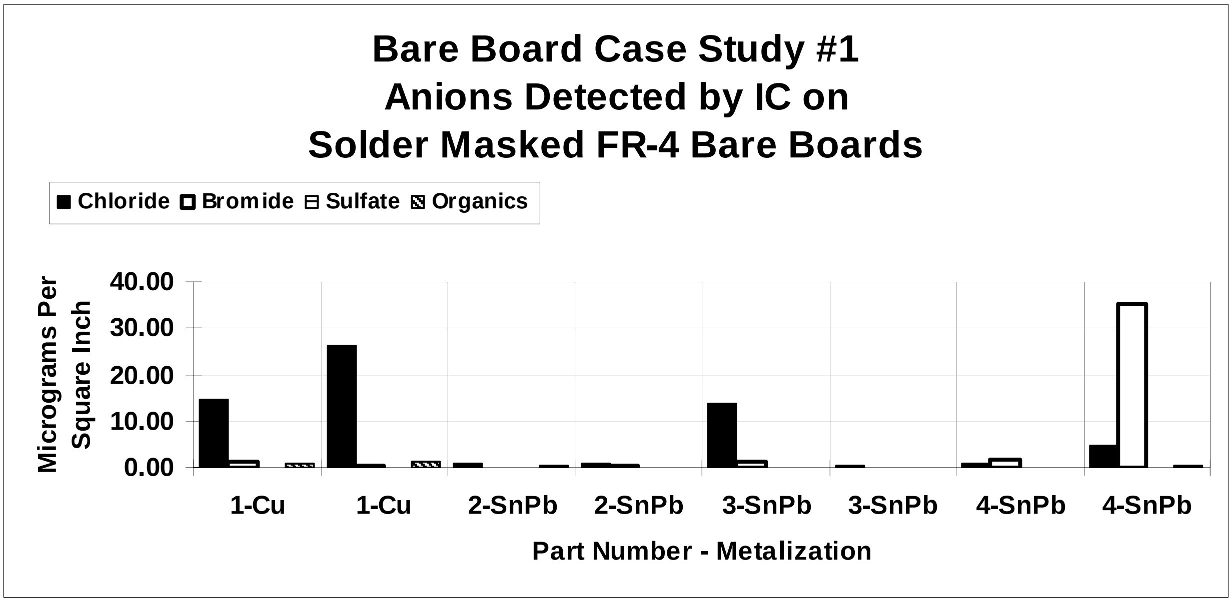


Chart 2

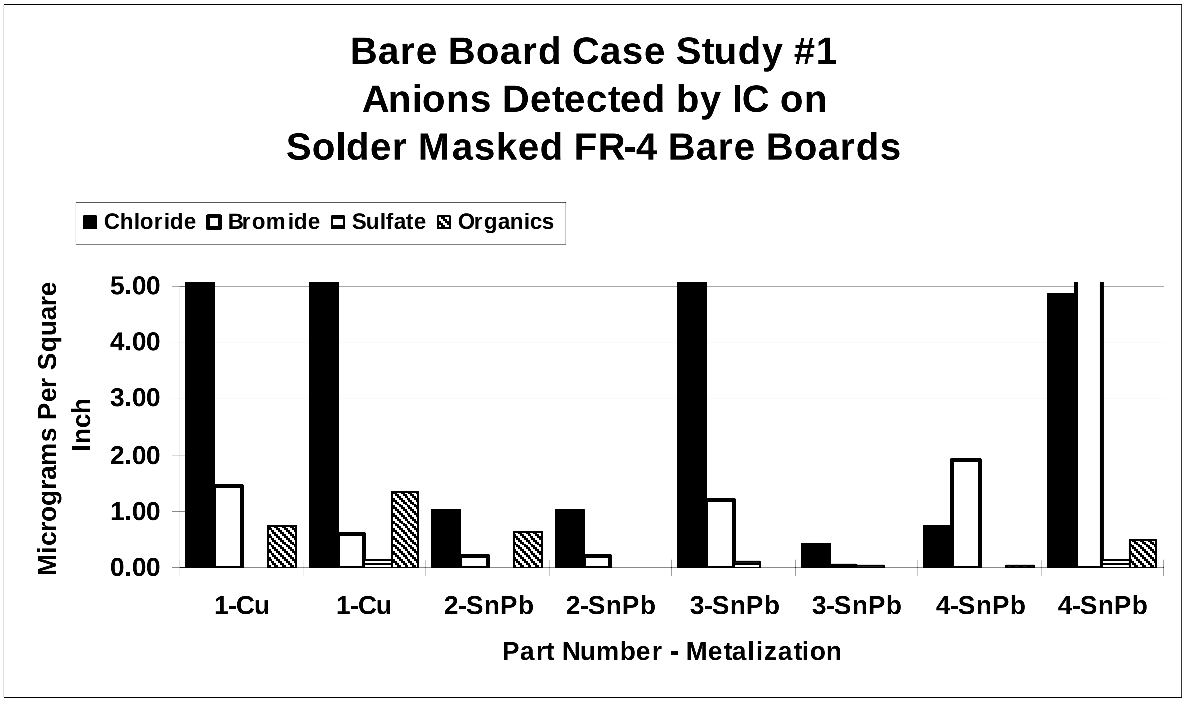
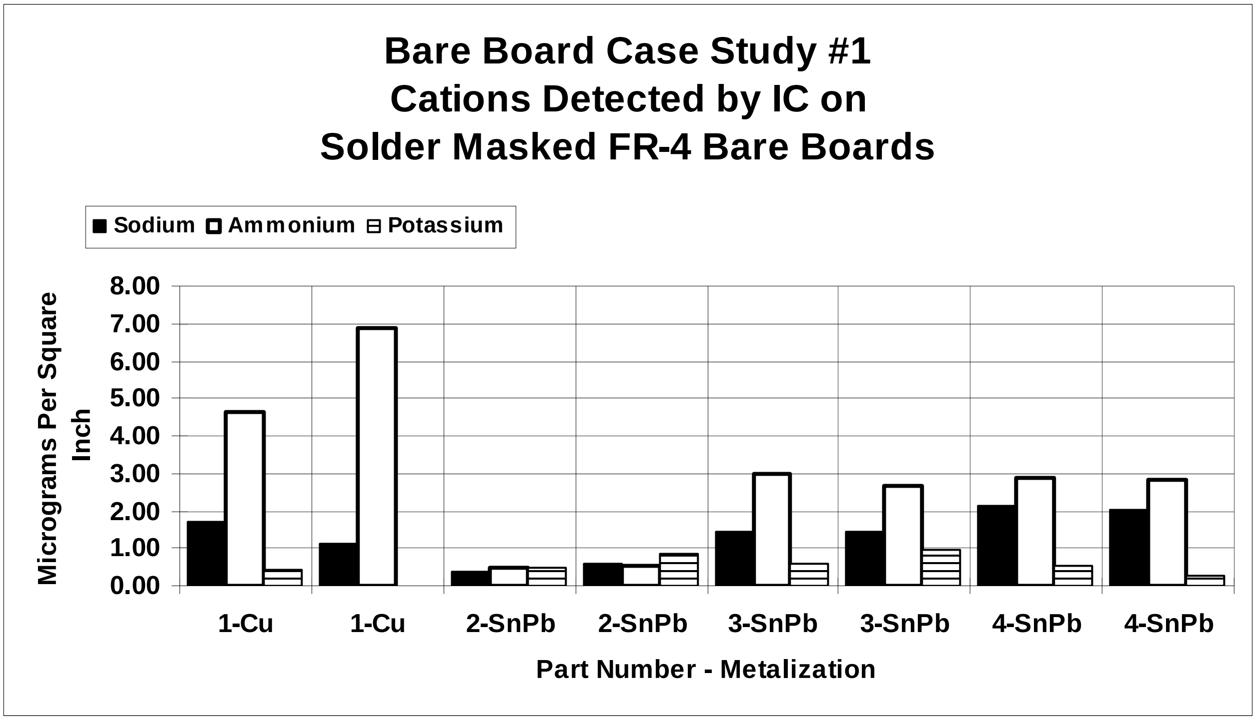


Chart 3



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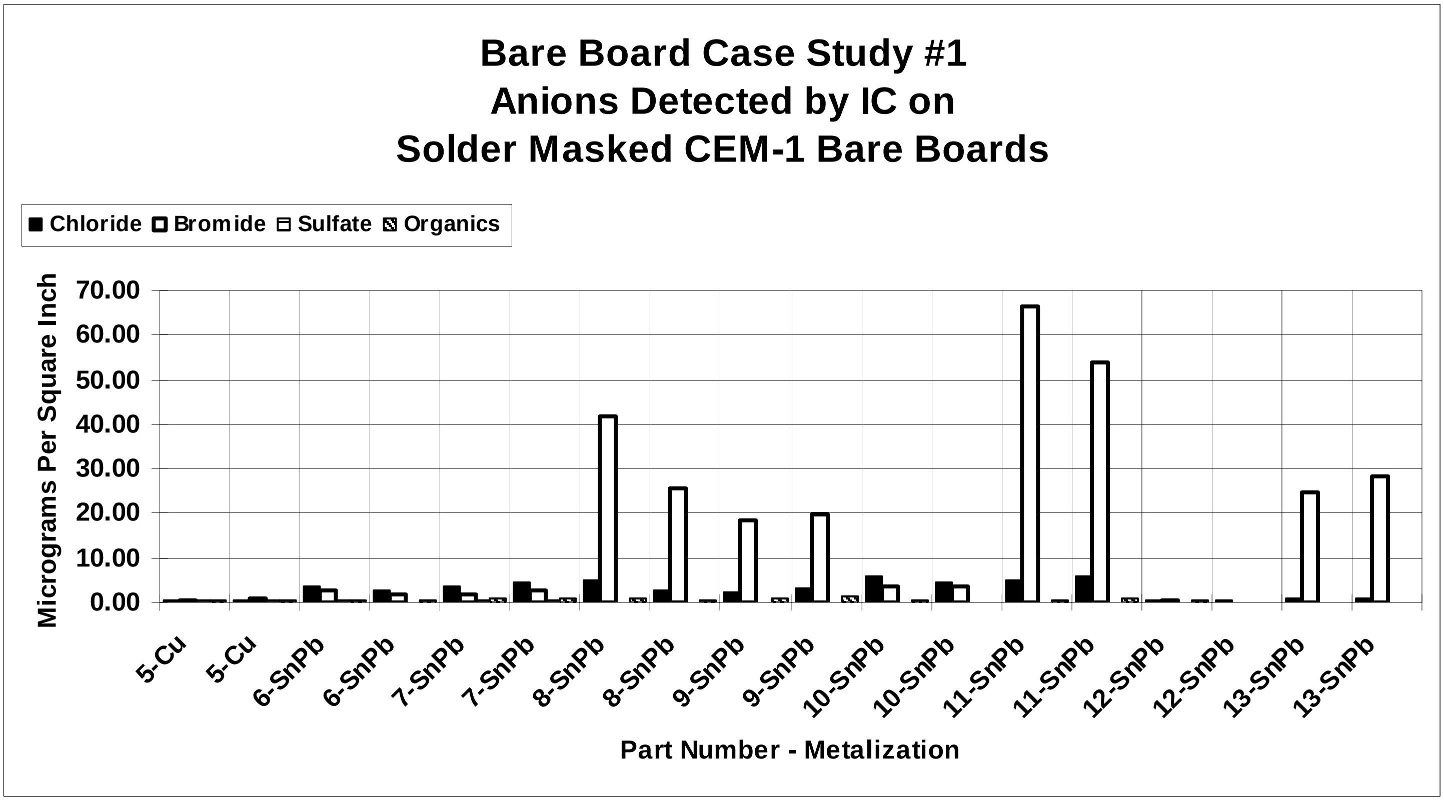
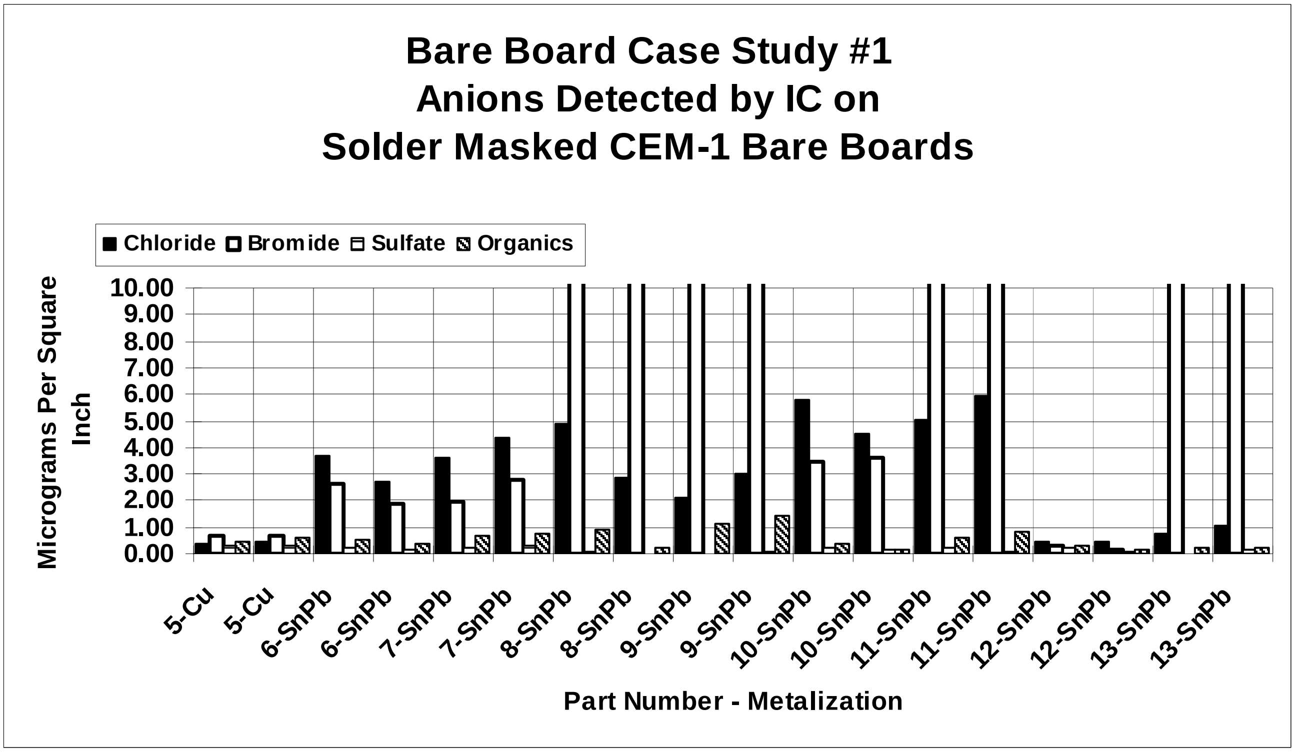


Chart 5



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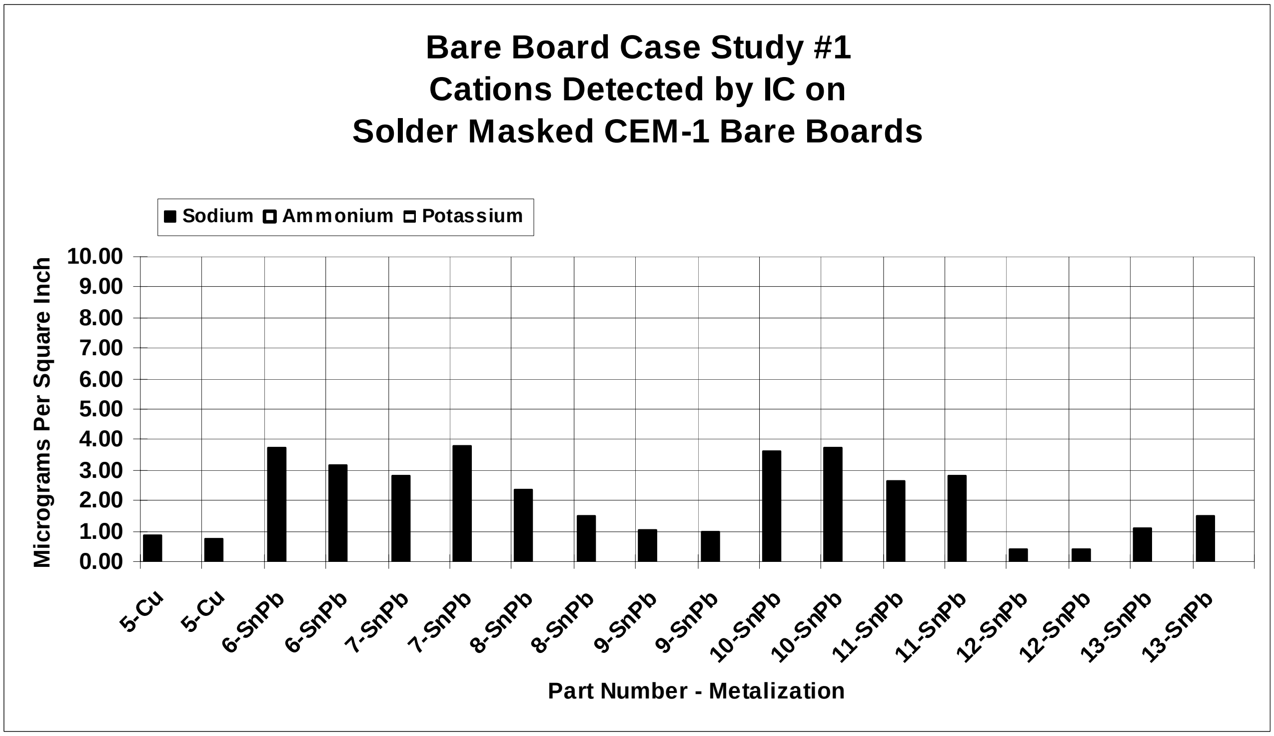

Chart 7

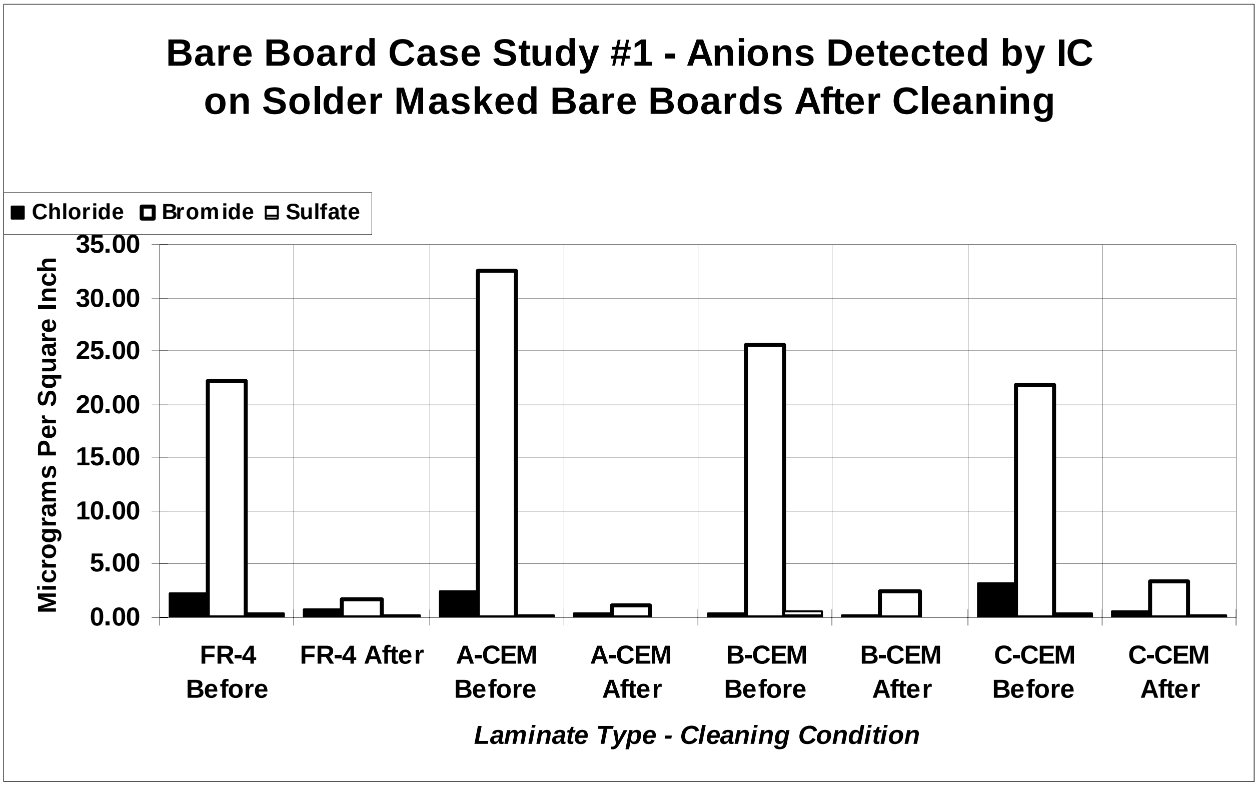

Chart 8