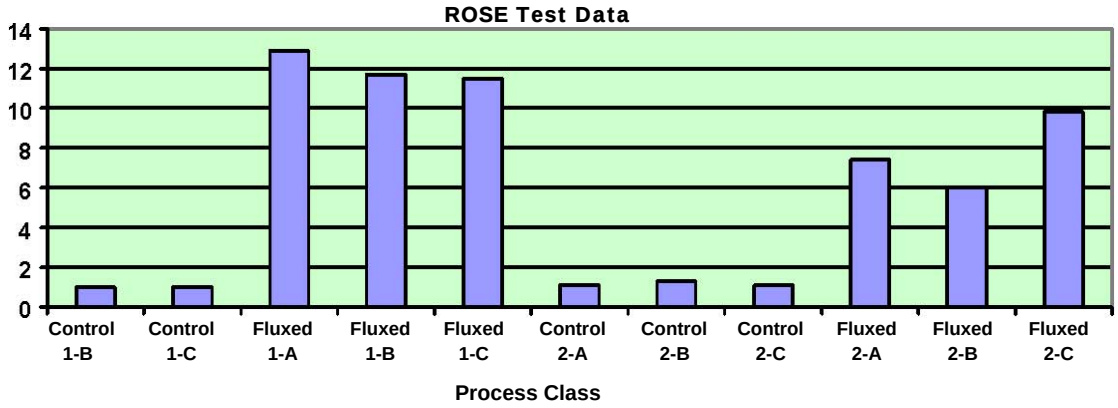
When A Cool Flux Should Be A Hot Item

Foresite Inc.

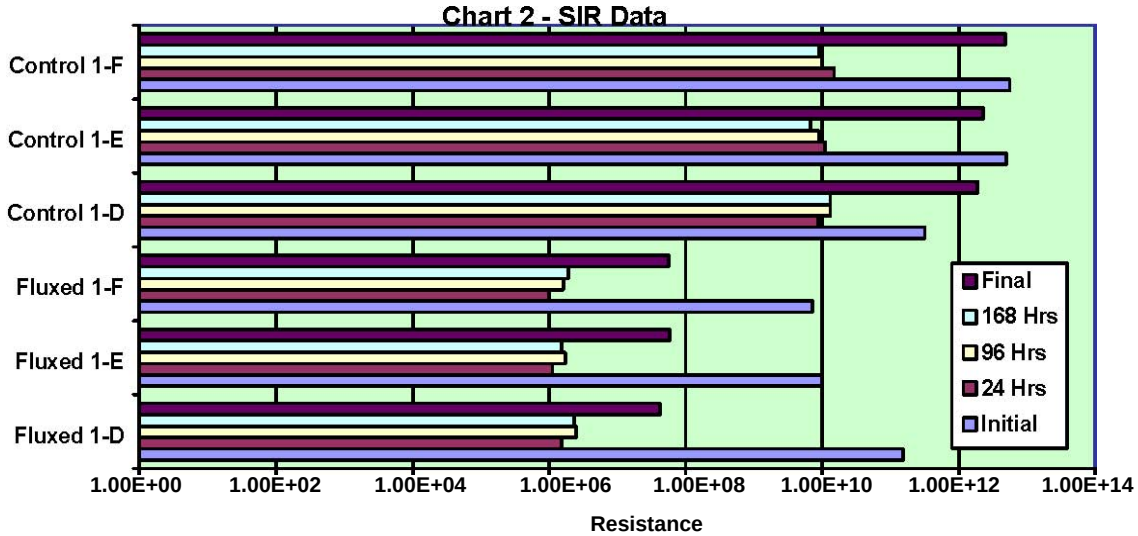
In this study, we were working with an assembler who was attempting to qualify a hand soldering process to J-STD-001A, Appendix D and F guidelines. It had been an accepted industry practice, when we were dealing with RMA fluxes, to add liquid RMA flux to a hand solder site with an RMA cored wire solder in order to improve solderability. Many assemblers have continued that practice with low solids (no-clean) fluxes. Because these fluxes are generally lower in activity, the additional liquid flux is often viewed as a necessity for adequate soldering.

Both of the low solids fluxes in the evaluation were mainstream, mature fluxes, which had been qualified for use in a number of facilities. The liquid flux was designed for wave solder applications, and the flux in the cored wire solder was a minor variation of that wave solder flux. Both fluxes were halide-free.

The test substrate was the IPC-B-36 test board with four leadless chip carriers (LCCs). The LCCs were hand soldered to the test boards using a combination of the cored wire solder and a liberal application of the liquid flux. The initial visual observations showed a nearly transparent residue around the LCCs, with good solder joints.



The qualification tests were resistivity of solvent extract (ROSE) and surface insulation resistance (SIR) testing. Chart 1 shows the ROSE results. Chart 2 shows the SIR results. Both are baselined against unprocessed controls.



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The historical limit for ROSE data was 14.00 micrograms of NaCl equivalence per square inch. The process usually qualified. The clear residues also turned white after exposure to the isopropanol / water solution, giving a good visual indication of the amount of flux applied and the extent to which the flux had spread.

The SIR requirement was 100 megohm minimum at all times and 500 megohm at a final measurement. Low resistances were found in a number of places, most notably in the areas where the liquid flux had been applied. As with the ROSE test, the flux residue turned white after exposure to high humidity. Minor levels of green residues were also noted. The low values and the corrosion were cause for failure of the test. We counseled the client to try the qualification again, but be more restrained in the flux application. The client did so. Chart 1 also shows the second attempt for ROSE testing. The white residue was limited, indicating a lesser degree of flux application, with a correspondingly lower ROSE level. Unfortunately, the SIR still exhibited low resistance levels and a greenish residue, possibly corrosion, under the LCCs.

After additional analysis, we concluded that the problem was a combination of unreacted flux and capillary action. The liquid flux was drawn under the low standoff LCC by capillary action and by the low surface tension inherent with an isopropanol carrier, carrying the flux far away from the hand solder site. Most of the flux never saw the heat necessary to bring it up to its activation temperature. Since no other thermal operation followed, the flux remained unreacted. The greenish product we noted was a reaction product between the weak organic acids in the flux and the copper of the test patterns. Unreacted fluxes are often marginally conductive, and so detrimentally affect SIR performance. We counseled the customer that it was likely to always be this way and that the liquid flux should not be used. We have found this to be the case in many applications, not just with the B-36 qualification testing.