

Terry Munson and Joe Swartz

# Finding Residue Sources, Part II

## Use the Six Sigma inter-ocular test to find residue sources in PCB fabrication

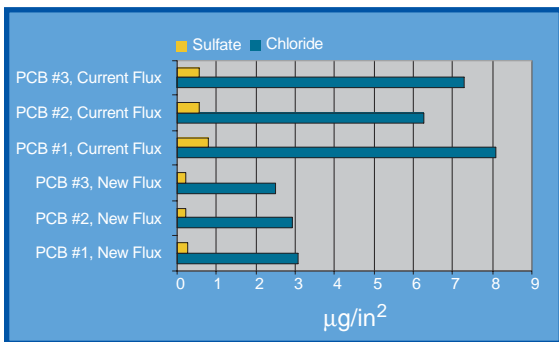
One of the first tests used to analyze data from a residue experiment is the inter-ocular test. The inter-ocular reticular formation stimulation test, or inter-ocular test, is well known among statisticians for the test's ability to aid users in making clear, and powerful, decisions. The test may seem obscure to most engineers, but we feel engineers, rather than the best statisticians, more efficiently use the test.

### A Case Study

After isolating the source of corrosive residues to the hot-air solder leveling (HASL) flux, a client wanted to compare the HASL flux currently used with a new HASL flux of future interest.

### Analysis

Several printed circuit boards (PCBs) were produced using each type of HASL flux and then analyzed using ion chromatography (per IPC-TM-650, method 2.3.28). The boards produced with the new flux had less than half the average chloride level (current  $7.22\mu\text{g}/\text{in}^2$  versus new  $2.82\mu\text{g}/\text{in}^2$ ), and less than half the average sulfate level (current  $0.64\mu\text{g}/\text{in}^2$  versus new  $0.24\mu\text{g}/\text{in}^2$ ) as the boards produced with the current flux. We concluded, with a good degree of confidence, that the new flux left significantly lower levels of both residues—at least for the boards used in this sample.



**FIGURE 1:** Ion chromatography results determined chloride and sulfate levels found on boards processed for the case study.

### Corrective Actions

The client performed additional product reliability tests to confirm the findings above, then switched to the new flux and is now producing a more reliable product. In this case, the data didn't require extensive analysis—the data passed the inter-ocular test of significance.

### The Inter-Ocular Test

To fully understand the test, the name of the test should be dissected. *Inter* means “between”, and *ocular* means “to be perceived by the eye.” *Reticular formation* is the web-like part of the brain that runs up the brain stem, from the medulla oblongata, through the pons and to the mid-brain. This part of the brain determines what information is truly important, within the constant barrage of sensory information traveling from the body, and what information should be transmitted to the cerebrum for attention.

When the reticular formation is stimulated, the information is called to the attention of the brain. Therefore, when data passes the inter-ocular test, the data so effectively grabs the brain's attention that the result could be equated to a light bulb appearing over the head—just like we've all seen in popular cartoons. In legalese, the information adduces the allegation prima facie. In simpler terms, it means what the data is relating should be taken at face value—the information and conformation is evident to most rational people.

### Conclusion

Ion chromatography analysis allows the use of analytical techniques, such as the inter-ocular test, with confidence. The tool identifies and objectively quantifies individual species of detrimental process residues. Occasionally, the conclusions drawn from certain data is so obvious, that the inter-ocular test is passed. ■

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