Predicted Cleanliness Defluxing

By Michael Konrad, Aqueous Technologies

Predicted Cleanliness Defluxing for High-yield Applications

The overused phrase, "How clean is clean?" most frequently refers to cleanliness in the past tense. Literally, it would be more accurate to ask "How clean was clean?" In the world of surface mount assembly, cleanliness normally is determined after the cleaning process has been completed. Like many things, we exert effort, hope for the best, then, when the work is complete, we validate the process.

In other segments of surface mount assembly, process validation is accomplished in real time. Pick-and place machines, for example, are equipped with vision technology, ensuring that the component is placed correctly, reducing the need to inspect the assembly for accuracy.

When it comes to defluxing circuit assemblies, many assemblers rely solely on post-process cleanliness testing. Surface insulation resistance (SIR), ionic contamination (resistivity of solvent extract), and ion chromatography (IC) are respectable and common methods to determine the cleanliness after the defluxing process. If the cleanliness testing procedures determine inadequate levels of cleanliness, then one or more processes are modified. Failed boards are re-cleaned, while new boards are subjected to modified or corrected cleaning processes, the results of which are re-verified by more cleanliness testing. In some situations, process modifications solve cleanliness issues, while, often, additional modifications and verifications are required. More hits and misses.

There are two conventional methods associated with defluxing: inline (conveyorized) and batch. With both methods, high pressure sprays direct wash solution onto a board's surface and under its components to solublize flux and other contamination. Wash chemistry and the flux it contains are left on the board's surface and are removed during the rinse process. As with many technologies, the two primary defluxing methods provide both benefits and disadvantages. Inline format defluxing systems normally are selected when high production rates are required. Although conveyorized defluxing machines consume considerable operating expenses, they can produce high levels of throughput. Modern batch technology (Figure 1), on the other hand, produces equal levels of cleanliness, but has historically suffered from a substantially reduced product-throughput capability.

Batch-format technology does offer one advantage over other defluxing technologies. Many batch format defluxing systems feature real-time cleanliness control, allowing an operator to program a desired level of cleanliness prior to the defluxing process, a process called "predictive cleanliness." On defluxing systems with predictive cleanliness capabilities, the cycle time required to rinse the assemblies is adjusted based upon the actual (real-time) cleanliness of the assemblies, as determined by the ionic reading

Mike Konrad
President/CEO

The leading manufacturer of cleaning and cleanliness testing products.

Aqueous Technologies
1678 N. Maple Street
Corona, CA 92880

Phone
(951) 298-8800

Fax
(951) 298-8850

E-mail
sales@aqueoustech.com

We're on the Web!
See us at:
www.aqueoustech.com

(resistance) of the rinse water. This technology forces the rinsing cycle to lengthen until programmed cleanliness is achieved. The result is a predicted cleanliness level that eliminates the element of surprise.

Batch-format defluxing methods are uniquely adaptable to predictive cleanliness technologies as they do not rely on a fixed-length conveyor. Inline defluxing processes, by design, do not allow for on-the-fly adjustments to rinse-nozzle contact times, a fact that precludes them from real-time cleanliness testing, mandating instead on the reliance on post-defluxing cleanliness verifications.

The advent of lead-free technologies has created two challenges. The need for cleanliness testing has been increased due to hotter reflow profiles frequently required by many lead-free solder pastes, and the resulting rise of post-reflow flux residue. This, in turn, increases the quantity of assemblies requiring defluxing. The increase in the quantity of assemblies being subjected to thorough defluxing processes, and the simultaneous increase in the need for cleanliness testing, creates a paradox. Does one increase throughput capability by using high-throughput inline-defluxing technology, thereby losing real-time cleanliness testing abilities? Or does one suffer the bottlenecks afforded by conventional batch technology, but retain the advantage of predicted cleanliness?

Recent advances in defluxing technology have produced defluxing systems capable of providing both high product yields and predicted cleanliness technology. High-yield defluxing systems use multiple process chambers, each of which subjects assemblies to wash, rinse, cleanliness test, and dry functions. Each of the multiple process chambers can accommodate multiple post-reflow assemblies. Multiple process chambers may be operated simultaneously or autonomously to suit the user's specific throughput requirements. Regardless of the chosen operational configuration, each process chamber provides individual cleanliness testing, resulting in individual automatic process modifications to ensure predictive cleanliness results.

Conclusion

While the need for independent cleanliness verifications can never, nor should ever be completely eliminated, high-yield, predictive cleanliness-enabled defluxing systems can reduce the reliance on such testers and the frequency of negative results. This combination of high throughput and predictive cleanliness provide a viable solution for environmentally responsible electronics assemblies. SMT

Michael Konrad is an SMT Advisory Board member and president of Aqueous Technologies Corporation. Konrad also is an IPC SMEMA Council APEX Tradeshow Committee Member. Contact him at (909) 291-1141; e-mail: konrad@aqueoustech.com.

Published in SMT Magazine