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Knowledge Sharing

The Now You Know, aka **NYK**, series is written to help spread the collective knowledge that has been accumulating on subjects that today's process engineers need to know.

Fluxless Vacuum Reflow

Abstract

Today's high reliability (HiRel) electronics are getting more and more functional and are running at ever higher speeds and powers. This has mandated that the solder reflow process become a more integral part of the system architecture and the manufacturing processes use the best available technologies. These drivers have caused the industry to take a second look at the use of resin, organic and inorganics fluxes. The concern has become the residue left by each type and if it can be cleaned from the device.

When the answer is fluxless reflow, a process must be found that allows the effective reflow with good wetting and little or no voiding. Vacuum reflow could be a good option to attain the solder reflow results that are needed.

Problem

Most metals oxidize in the presence of oxygen. Oxide inhibits the wetting of filler materials to metal surfaces causing poor reflow and possible voiding.

Traditionally, solder reflow was done using some kind of flux agent to eliminate the oxides that are present on metallic surfaces. Most of the fluxes had a resin or rosin base that needed to be cleaned off after reflow to avoid possible damage over the life of the components. Then there are "no clean" fluxes that report to not leave sufficient residue to be cleaned off. However, in many instances, these devices still needed post reflow cleaning. Additionally, many fluxes contained agents that could actually out-gas at reflow temperatures and cause voiding.

Solution

One solution to consider would be vacuum reflow. In its simplest form this is accomplished in a sealed vessel with the ability to control the atmospheric pressure with a combination of vacuum and noble gas flow and heat components to the desired temperature.

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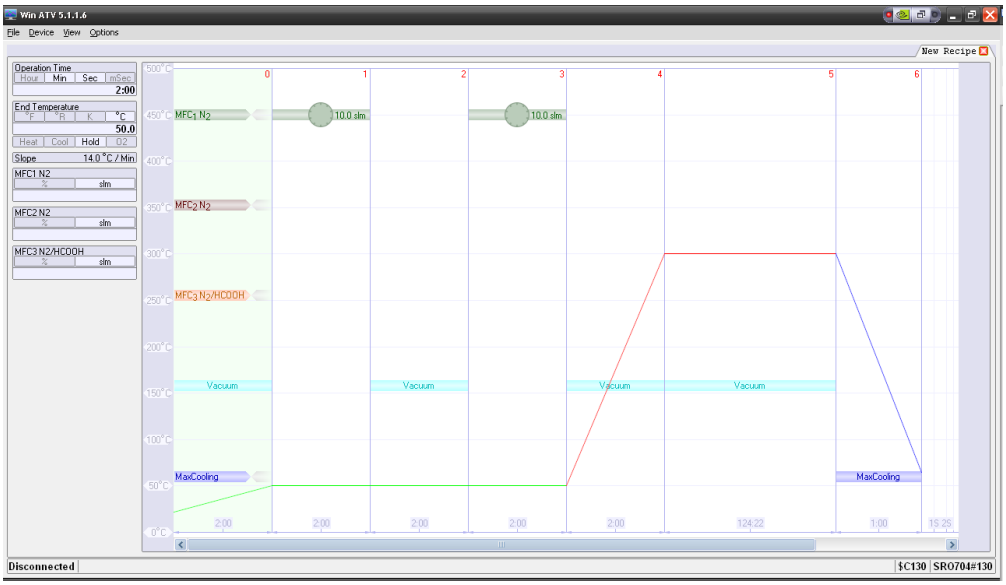
How does it work?

First it must be understood that oxides have a chemical bond to the base material that it is on. Secondly, all chemical reactions are reversible. The goal is to break the bond that oxides have of the metal.

To break the oxide bonds requires being able to reduce the stability of the oxide by elevated temperature and decrease oxygen partial pressure. Fortunately, the reflow temperature, of many metals is high enough to destabilize these oxides when the oxygen partial pressure is lowered with vacuum.

By using a series of vacuum purges and nitrogen backfills the oxygen levels in a sealed vacuum chamber can be reduced to < 2ppm. This will help with the oxide reduction and inhibit oxidation at the elevated reflow temperature.

What is the process?



Using the ATV SRO-7xx series vacuum furnace, you would first place the devices into the chamber a close the lid, insuring an airtight seal. Then the system would be programmed to run a series of two vacuum/purge cycles, which would reduce the oxygen to < 2ppm in the chamber. The next step would be to turn on the vacuum while heating the devices to the desired temperature. Once the reflow has been completed the system would then turn off the vacuum and introduce nitrogen to finish the cool down cycle.

More Information

Contact Sales@BSETPLASMAS.com

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