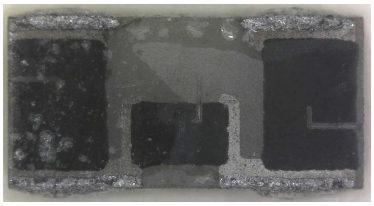
Tech Note

Non-Aqueous Flux Removers and Aluminum Nitride



Introduction
The electronic industry uses batch cleaning systems to clean printed circuit boards (PCBs) containing electronic components, including passive surface mount resistors and attenuators. The cleaning process is necessary to remove contaminants and flux residues that can affect the performance and reliability of the electronic components. The choice of cleaning agent and the cleaning profile used by the batch cleaning system can have an impact on the surface of the components, particularly those produced on Aluminum Nitride (AlN) ceramic substrates.

Differences in Bonding Chemistry of Glass and Alumina vs. Glass and Aluminum Nitride
Thick film components have long used glass as a passivation layer to protect and stabilize components from physical or environmental damage. The bonding chemistry at risk for damage when exposed to such cleaners is typically that of the bond between glass and conductor or glass and substrate materials. The chemical bonds between glass and Alumina are covalent in nature, while the chemical bonds between glass and Aluminum Nitride are ionic and van der Waals in nature. This difference in bonding chemistry makes the passivation glass for Aluminum Nitride ceramic parts more susceptible to being affected by acidic or alkaline solutions often found as the active saponifier of non-aqueous solutions including cleaning agents used in batch cleaning systems.

Risk of Damaging Bonding Chemistry on Aluminum Nitride Ceramic Parts
Common non-aqueous cleaning agents, such rely on an operator to supply the appropriate concentration of cleaning agent and to configure the cleaning profile used by batch cleaning systems (such as the Aquastorm 50 or Trident ZDO). The resulting solution can have a pH range from 9.5 to 10.5, which can increase the risk of etching or damaging the surface of Aluminum Nitride component films.

The factors known to contribute to the risk of damaging passivation glass on Aluminum Nitride parts can be summarized as follows:
1. pH of cleaning Solution >9.8
2. Using repeated cycles of wash and drying
3. Cleaning and drying temperature
4. PCB orientation resulting in high and direct pressure on sensitive components from spray nozzles
5. Use of aggressive ultrasonic energy during exposure to cleaning agents

Reducing the Risk of Damaging Bonding Chemistry on Aluminum Nitride Ceramic Parts
For inline cleaning systems that have adjustable direct inject pressure nozzles, consider decreasing pressure for nozzles responsible for regions of the board where AlN parts reside. For smaller batch systems with little or no nozzle adjustment features, consider orienting board assemblies so that affected parts avoid the path of fixed nozzles mounted on oscillating spray manifolds. In general, following the manufacturer recommendations for setting up the cleaning chemistries is first priority. In some cases, when cleaning efficiency must be increased, it may be tempting to introduce a higher concentration of cleaning agent. Unless carefully controlled, or unless accompanied by other changes in the profile (decreased clean temp/time, more wash time) the solution can stray out of specification and cause damage to components.

Conclusion
The risk of damaging the bonding chemistry of passivation glass on Aluminum Nitride components is increased and compounded on the basis of pH alkaline strength, time, temperature, direct spray, and ultrasonic energy. Management of these parameters is required in order to control cleaning efficiency. Risk factors should be optimized by being kept at the lowest level possible for a desirable result of cleanliness.