One Ion Can Ruin Everything

They can be the destruction of thousands of dollars' worth of equipment within seconds. Ions, the bane of the electronics industry, can be as small as 0.0001 µm (sodium ion) in size – approximately one thousandth the size of the smallest detectable particles — invisible to the naked eye and to the most advanced scanning electron microscope.

In the microelectronics industry, ionic contaminants usually include flux residues or harmful materials picked up or left behind during the process. Generally, they are water-soluble organic or inorganic acids or salts and contain molecules or atoms that are conductive when in solution which can disassociate into either positively or negatively charged species and increase the overall conductivity of the solution.

These ionic contaminants can degrade the reliability of the electronic components and assemblies as they contribute to current leakage between the circuitry, promote dendrite growth (multi-branching tree-like crystals), and increase the risk of corrosion.

More specifically, these nano-sized contaminants can travel through electronic transistor devices and naturally gravitate to areas where they can do the most damage, despite operations occurring in highly efficient cleanrooms. Furthermore, the trouble doubles because positively charged ions (cations) must be accompanied by an equal number of negatively charged ones (anions) to maintain electrical neutrality resulting in an ability to wheedle their way into separate areas.

Example: A single sodium ion (positive) along with a single chloride ion (negative) work their way into a semiconductor device. The sodium ion penetrates the transistor gate, where the flow of electricity is controlled, while the chloride ion can worm its way onto electrical wiring that connects various layers in the device. The result, corrosion.

Many other ion problems exist and therefore, microelectronics manufacturers relentlessly specify that chemicals and consumables used in their processes be at extremely low levels, sometimes in the low ppb (parts per billion) range.

Clean Room Wipers

Used continuously in the microelectronics manufacturing industry, clean room wipers do for surfaces what HEPA filters do for air – they keep the clean room clean and must have an extremely low ion profile since they come into contact with environmental and production surfaces. Standardized protocols for analyzing ions in wipers have been established over many years.

Widely used in the cleaning and maintenance of clean rooms, as well as, production and test equipment, the ideal wiper should not only start out clean but be able to capture and hold contaminants until taken out of the clean environment and discarded.

Summary

Electronic device failures directly link to the presence of trace levels of ions. Ion contamination during electronics manufacturing processes is of critical importance and manufacturers must continually detect and minimize ionic contamination. Wiper improvements have been introduced throughout history to produce lower levels of releasable particles, micro-metals, anions and cations and nonvolatile residues released from wipers through unique wiper constructions, edge sealing and laundering processes.