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An In-Depth Look At Ionic Cleanliness Testing

Reprinted with the direction of the Ionic Conductivity/Ion Chromatography Test Task Group (5-32a) of the Cleaning and Coating Committee (5-30) of IPC

Users of this standard are encouraged to participate in the development of future revisions.

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Thank You.

Tim Crawford
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EXECUTIVE SUMMARY

Testing performed at the Electronics Manufacturing Productivity Facility has shown that as technology advances and printed wiring assembly (PWA) surface areas get smaller, surface residues will become harder to measure accurately. On small surface areas, variables such as probe limitations, solvent volume, and even carbon dioxide from the air will influence ionic contamination measurements.

Most systems have what is termed a "deadband". The resistivity probe used in each system has a maximum measurement capability. For example, if the maximum capability of the probe is 100 megohm-cm and the resistivity of the solvent is actually 150 megohm-cm, the display will continue to read 100 megohm-cm. Any ionic residues that lower the resistance of the solvent from 150 to 100 megohms-cm will not be measured. Resistivity, however, is not linear, and the amount of residue it takes to drop the resistivity from 150 megohm-cm to 140 megohm-cm is much less than the amount of residue it takes to drop the resistivity from 50 megohm-cm to 40 megohm-cm. It has been argued that the amount of ionic residue it takes to drop the resistivity from the deadband to the visible range is insignificant in most cases. This argument would depend on surface area as well as the need for accuracy. To maintain accuracy, it is important that the operator of the cleanliness test equipment not leave the system in a clean/filter mode for an extended period of time. If the operator inadvertently deionized the solvent to a higher than normal level, the solvent should be artificially contaminated and then recleaned to an acceptable level.

Carbon dioxide can dissolve in water to form carbonic acid. This can weakly ionize into H^+ and HCO_3^- ions which can/will then affect ionic readings. The presence of this ionic build-up during a static extraction will contribute to the overall ionic reading. In most instances, such contributions will be small, representing only a relatively small error in the measured results. If, however, we are measuring a small sample in a large volume of extracting solution, the effective total micrograms of NaCl represented by the CO_2 build-up in solution will be divided by the smaller surface area of the sample giving rise to a larger relative error in the reading expressed as $\mu g/in^2$. Extractions which are made for longer times will also show higher CO_2 errors, since more CO_2 will dissolve in the longer period of exposure to the atmosphere. Testing indicated that the problem was not detectable for all of the static systems; and there did not appear to be any correlation for spray versus no spray, or spray