

Suggestions for Monitoring a Flux Cleaning Line

This application note outlines the principle elements of a flux cleaning line to determine an acceptable level of cleanliness. It will also help to establish process control parameters to maintain that desired level of cleanliness.

Introduction

When determining cleanliness levels, it is important to set a level ensuring that a reliable product leaves the factory at an economic cost. Flux removal after soldering is only necessary if it has been demonstrated that the residues will affect the reliability of a subsequent process. If removal is to be done, it must be done in such a way as not to reduce in-service reliability. Partial removal can leave active chemicals on work surfaces, which can reduce SIR and lead to corrosion. Conversely, an over-specified cleaning process adds nothing to an assembly except expense.

Solder paste residues are actually a resin slag consisting of activator reaction products, possibly unspent activator, and heavier molecular weight remnants of the viscosity control package. The resins are essentially inert and encapsulate the other products, some of which are likely to be ionisable. The latter property can be utilized to assess the overall effectiveness of a cleaning regime by carrying out ROSE testing (Resistance of Solvent Extract).

Theory

First, make a dual series of test pieces and reflow them in exact production conditions. Next, clean the test pieces with varying degrees of efficiency, for example, 0% to 110%. Test one piece from each pair and subject the other to an ALT (Accelerated Life Testing) regime and determine time to fail. Time to fail can then be graphed against ROSE results. The correlation is usually good.

Practice

ROSE testing can be done classically in a laboratory in glass, but is quite difficult and tedious to carry out effectively. It is simpler to use specialized equipment designed for the purpose, such as the Alpha Ionograph or Omegameter. In these, the work is put in to a test tank and rinsed with an alcohol-water solution. The solution is flowed over the test piece reading to a conductivity cell, and then to a resin column before being returned to the test tank. In the Ionograph, the solution is circulated until all ionisables have been extracted from the test piece. In the Omegameter, the amount of solution used is related to the size of work, and the amount of ionics extracted in a given time is measured. In either case, the test takes a few minutes, and the results should show the amount of sodium chloride that would produce the same reading. This amount is then presented as a measure per unit area of

substrate. The ALT regime is usually done again in special equipment such as the Auto-SIR from Concoat. However, it takes days to produce results.

It can be seen that time to fail can be related to the amount of NaCl per cm². Optimum process parameters can then be determined in near real time using the NaCl per cm² reading. This is likely to be <0.1 μ gram/cm², where epoxy encapsulation is required.

Comments/Amplification

This method is good for conventional assemblies using recognized flux types and cleaning processes. Although the correlation between ionics and reliability is good and represents a good pragmatic assessment method, it is not absolute. Occasionally, certain species or residues can be generated, which although not impacting on overall reliability in service, can affect some processes. This is because non-ionic residues can remain on the surface. These are not detected by the test method, but can interfere with some process steps. For example, insoluble tin salts generated by high activity fluxes can impede curing of silicone encapsulants, therefore leading to soft spots and degrading the wire bond quality. If this is found to be the case, then more sophisticated investigatory tests need to be done, such as ion chromatography.

This outlined procedure is best practice. Many companies actually work to an established in-house number or perceived industry standard. These should be treated with caution, or at least investigated.

Once process parameters have been determined, a continuous test regime is probably not required. Instead, the process itself is monitored and occasional test pieces are sent for calibration/verification.

Purchase of an Ionograph or Omegameter is usually not necessary. In most countries, these are available on a rental basis or a test house can be contracted to carry out the procedures.

The number generated above is process unique. It follows that if any part of the process is changed (flux, cleaner, board finish, etc.), then this procedure should be repeated to ascertain the new acceptable level of ionics.

In an aqueous or semi-aqueous process, the resistivity of the final rinse water can also be monitored as a continue/stop/caution procedure. In this context, pH meters in the final rinse are useless, as most process chemicals are buffered.

It is important that test assemblies are reflowed in exactly the same way as production items. This is because the fluxing activity and residuals are profile dependent.

This application note is provided for general information only. It is not intended, and shall not be construed, to warrant or guarantee the performance of the products described which are sold subject exclusively to written warranties and limitations thereon included in product packaging and invoices. All Indium Corporation's products and solutions are designed to be commercially available unless specifically stated otherwise.

Form No. 97772 R2

www.indium.com

askus@indium.com

ASIA: Singapore, Cheongju, Malaysia: +65 6268 8678
 CHINA: Suzhou, Shenzhen: +86 (0)512 628 34900
 EUROPE: Milton Keynes, Torino: +44 (0) 1908 580400
 USA: Utica, Clinton, Chicago, Rome: +1 315 853 4900



©2016 Indium Corporation

ISO 9001
REGISTERED