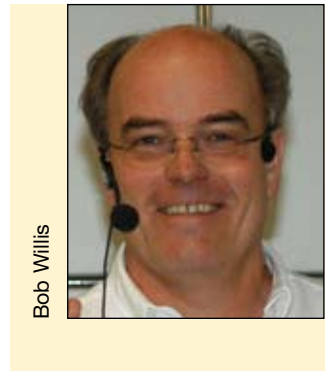


PCB Solderability Assessment – The Industry Standard



Bob Willis

Solderability testing has become more common in the industry, particularly to assess components and printed board surface finishes during the transition to lead-free manufacture. The wetting balance is the standard method of test and provides the repeatability that other methods do not. The wetting balance is the more professional way of assessing the performance of printed boards finishes, but has not been used that extensively in the assembly or fabrication industry due to the cost of the system.

The tests conducted in printed board manufacturing facilities are well documented in international standards but are not really representative of the requirements of modern assembly. Rotary dip and solder float solderability test methods are used by the printed board industry but are very limited and basically the same as the dip and inspect test used for surface mount components. It is very difficult to demonstrate the subtle changes that take place on boards and components when they are subjected to multiple heating operations during the manufacture or during assembly. The test and criteria used by the supplier should be reviewed to determine what methods are used and what criteria are applied when specifying new finishes for lead-free. The ageing methods and criteria should also be considered so that confidence can be achieved in the supplier's ability to control his process and his consistency of products supplied to the end user.

A wetting balance can be used in two modes for testing printed board test coupons, either a solder bath or the preferred method, which is the solder globule. In the test coupons shown below, either individual test pads or oblong pads shown on the bottom of the sample are tested with the globule. Alternatively, the seven pads should be tested simultaneously with a solder bath, which was the method used during the Lead Free Hands On Experience 3.



Figure 2: Printed board samples after testing with the wetting balance: top left Sn (tin), top right Au (gold/nickel), bottom left Cu (copper OSP), bottom right Ag (silver).

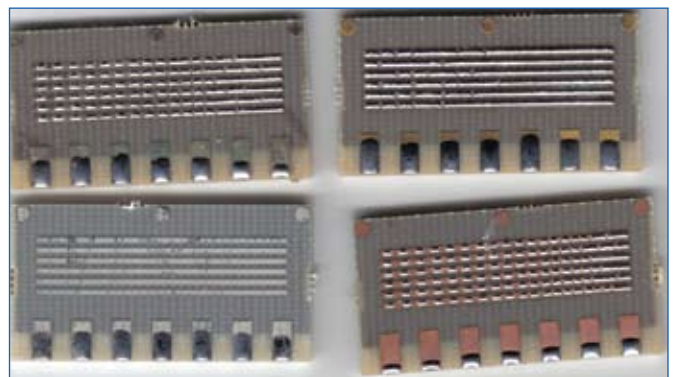


Figure 3: Printed circuit board samples after convection reflow: top left Ag (silver), top right Au (gold/nickel), bottom left Sn (tin), bottom right Cu (copper OSP).



Figures 1: Testing chip components for solderability. Images taken from a video provided courtesy Gen3 Systems.

To provide repeatable results, the wetting balance may be used to assess changes in solderability on test pads, audit panels or even pre-production boards. Test pads can typically be 2mm x 3.5mm (0.080" x 0.138"). Smaller pads can be used with smaller solder globules to better reflect what is used in the industry, but alignment of the sample, in my experience of many hours

doing testing of this type, is more demanding on the operator.

With modern assembly processes, the boards are often subjected to pre-baking, adhesive curing and wave soldering; each will affect solderability to some degree. The board may also have been subjected to a reflow soldering process for topside mounted components. In the

case of double sided products, one or two high-temperature reflow processes may also be experienced. The hold time between side one and side two reflow or wave soldering can be assessed. Other process stages known to affect solder finishes include board washing, adhesive curing and handling. In each case the test pads can be used to assess the impact of the previous process stages. It is a useful technique to assess the benefits of nitrogen reflow against running in air; the impact of different levels of nitrogen on solderability performance can also be gauged to reduce costs.

During the Lead-Free Experience 3, samples were removed from the circuit board featuring a series of seven pads, the edge of each of the pads extended to the edge of the board, which is important in order to avoid the buoyancy effect that would result if the laminate contacted the solder before wetting the pad. The pre-routed test coupons also featured mouse-bit breakout tabs to make removal easier. The board sample is then placed in a modified holder to allow the board sample to be lowered at an angle of 45°C. During the Experience, the testing was conducted on a solder bath rather than a solder globule with the Menisco solderability system provided by SEHO.

The following parameters were used:

- Solder: 60/40
- Flux: Pure non-activated flux

When a solder pellet is used for tests, it is conducted at 235°C for tin/lead using a 200-250mg solder globule on a 2mm globule block with an immersion depth of 0.1mm. The immersion speed for the tests is typically 1mm/s with a dwell time of five seconds. In the case of lead-free, a higher temperature is used. A further benefit of the globule approach is that the alloy used for test can be the same as that used

in the assembly process. The difference found in wetting between tin/lead and lead-free materials has been highlighted many times.

The 200-250mg globule may be used on each pad to be tested without contacting the adjacent pad. Due to the size of the pad under test, a new pellet is applied to the block after each test. This is due to the amount of solder removed on each test site. It is also necessary to remove the occasional solder spike from the pads to avoid them touching the globule block, affecting the next test result. Spikes can be caused by poor solderability but are more often caused by the cooling effect of the board and its mass. The tests can be conducted using both pure rosin and activated rosin flux to assist repeatability of assessment.

Wetting Balance Solderability Testing Experience 4

Although the solder spot



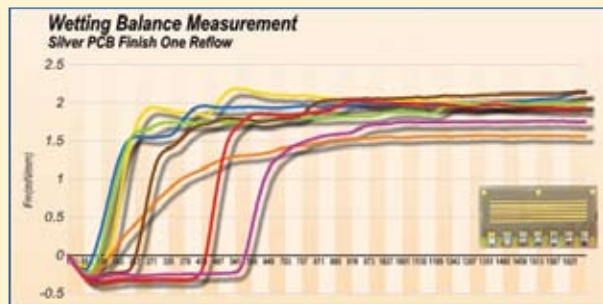
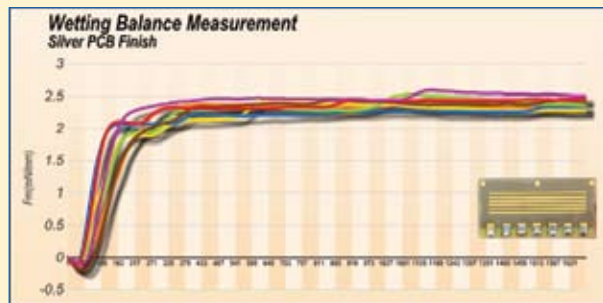
Figure 4: PCB test coupons for wetting balance evaluation

test pattern has been used for four years in the Lead-Free Experience, the wetting balance is the standard industry test method and has been developed over the years for PCB assessment using a test coupon with seven test sites shown in Figure 4.

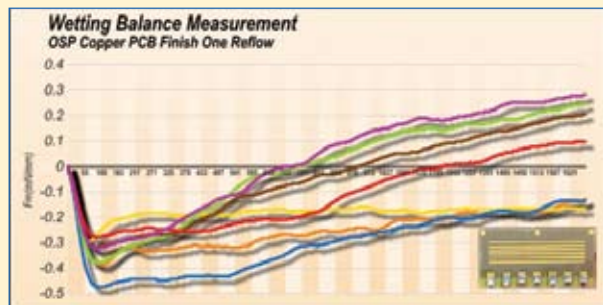
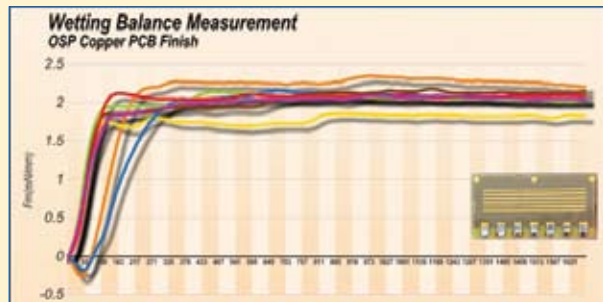
Sample boards from the

Experience previously subjected to one or two reflow cycles were tested 10 days after the first reflow by Gen3 Systems. Graphs 1 through 4 show the changes in solderability after one reflow operation; the results are exaggerated due to the hold time prior to testing.

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Graphs 1 and 2: Wetting balance measurements using a silver PCB finish.



Graphs 3 and 4: Wetting balance measurements using an OSP copper PCB finish.

Industry News



Kester acquired by Illinois Tool Works Inc.

Illinois Tool Works Inc. of Glenview, Ill. has acquired all of the shares of Kester. Terms of the transaction were not disclosed.

Roger Savage, Kester's President, believes the acquisition of Kester by ITW will significantly improve customer satisfaction. "ITW has a great foundation in engineered products-based business units, which is a great fit for the Kester portfolio of products. With strong market position and great brand name recognition, Kester increases the overall shareholder value. Applying ITW's business strategies, which are centered upon 80/20 methodologies, Kester will become a stronger, more focused business unit. The business systems and infrastructure that ITW brings to Kester will keep Kester one generation ahead of its competitors."

Cookson Electronics lead-free wave solder alloy receives approval

Cookson Electronics Assembly



Materials (CEAM)'s high-reliability ALPHA® Vaculoy® SACX™ lead-free wave solder alloy has been approved by LG Electronics DS Division (CD-ROM).

ALPHA® Vaculoy® SACX™ delivers wave soldering process value by providing SAC305 performance at 30% lower cost. Its fast wetting speed offers improved solderability that outperforms all Sn/Cu based alloys. It provides excellent drainage and minimizes bridging defects. ALPHA® Vaculoy® SACX™ creates strong, mechanically sound joints with excellent long-term reliability. It also minimizes dross generation, resulting in low process maintenance and reduced product waste. Its process window supports the use of a wide range of flux technologies.

www.cooksonelectronics.com

Everett Charles Technologies announces consolidation of atgTest Systems and Luther Maelzer

Everett Charles Technologies announced plans for two of its Capital Equipment Group's wholly owned business units, atgTest Systems (Wertheim, Germany) and Luther Maelzer GmbH (Wunstorf, Germany), to consolidate operations into a single new business unit. The reorganization is anticipated to be completed by year end. In the meantime, both existing operations will continue to service their respective customers as in the past. Subsequent announcements will be issued providing transitional details. Both companies have a notable history and extensive experience manufacturing

electrical test systems and related products for the bare printed circuit board industry. www.ectinfo.com

COMET Expands Service Department

COMET announced the appointment of Jochen Dietel as technical services team leader. With more than eleven years of experience as a service manager in the field of micro- and nanofocus x-ray inspection, Mr. Dietel is uniquely qualified for his new position with COMET. The appointment is indicative of COMET's commitment to provide superior customer service and applications support to its global customer base.

Flip chip substrate supply may be tight through end of 2006

As TechSearch International predicted last year, increased demand in 2005 resulted in longer delivery times and price increases for laminate flip chip build-up substrates. While several companies have added capacity since 2005, the situation is expected to remain much the same through the

Continued from page 5.

It is well known that some alternative surface finishes do not hold up to one reflow cycle and extended hold time before the second soldering operation. This is a critical issue when selecting surface finishes. Some companies build their products or contract out the assembly and only complete the final assembly when orders are received. This situation is often not considered during the evaluation phase.

Test conditions used on the wetting balance Solderability testing conducted with 200mg SAC pellet One pellet per test site Temperature set point 260oC No hold for pre-heat Speed 0.1mm/second Flux ACTIEC5

Using these techniques, assembly companies and printed board manufacturers can use the wetting balance to guarantee the solderability of boards and components in their drive for zero defect

manufacture. I have often used the test myself for material evaluations, evaluating the impact on assembly process stages, and evaluating the change in flux activity and supplier audits. It is also a useful technique as part of product development or to provide customers with technical support. Use of this test method eliminates the arguments that often arise when the soldering quality does not provide the expected soldering yields in production.

Bob Willis is a process engineer providing engineering support in conventional and surface mount assembly processes. He runs production lines for suppliers at exhibitions and also provides seminar and workshops world wide. Bob has one of the largest collection of training videos, interactive CD-ROMs and training material in the industry.

For further information on how Bob may be able to support your staff contact him via his web site www.ASKbobwillis.com