TECHtips

Electronics Manufacturing Insights from ACI Technologies, Inc.

Reflow Experiment

An experiment was recently performed ACI Technologies for a customer that was interested in comparing the wetting of lead-free solders with varying temperature profiles and atmospheric conditions. In order to deliver an objective measurement of solder wetting (in addition to subjective inspection analysis), a simple wetting indicator pattern was added to the solder stencil in an area on the test vehicle that had exposed and unused copper.

This pattern comprised two rows of 22 printed solder deposits. Each individual deposit is 0.64mm x 1.27mm (0.025" x 0.050"). The deposits are paired in sets of two with decreasing gaps among each pair. The gap between each pair is constant. Figure 1 shows the dimensions of the printed deposits. Two rows are included in the pattern to give two replications of the measurement on each test vehicle.

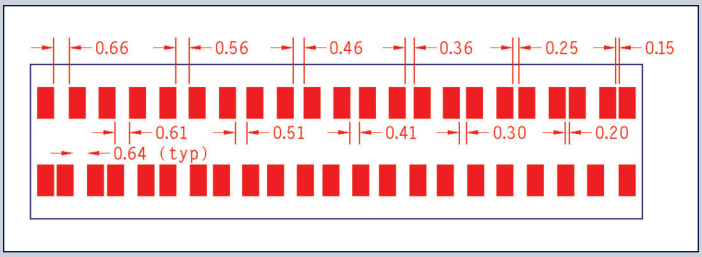

Figure 1: Wetting Test Pattern (dimensions in mm)

This pattern allows for two different measurements to be taken from the test vehicles after processing has been completed. The first evaluation is a count of the number of wetting pattern pairs that shorted together during reflow. As each pair of deposits is spaced further apart than the last, the number of pairs that bridge can be used to compare solder wetting under different conditions – an increasing number of bridged patterns indicates increasing wetting. Figure 2 shows an example of a wetting pattern after reflow, with four (4) shorted patterns.

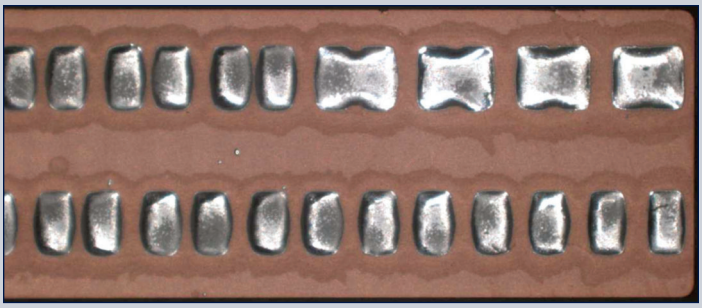

Figure 2: Post-Assembly Wetting Pattern

The second evaluation is a measurement of the gap between the paste deposit pair that is spaced furthest apart. This gap will decrease during reflow as the paste wets to the underlying copper and thus a smaller gap is an indication of greater solder wetting. Figure 3 shows an example of a paste deposit gap measurement.

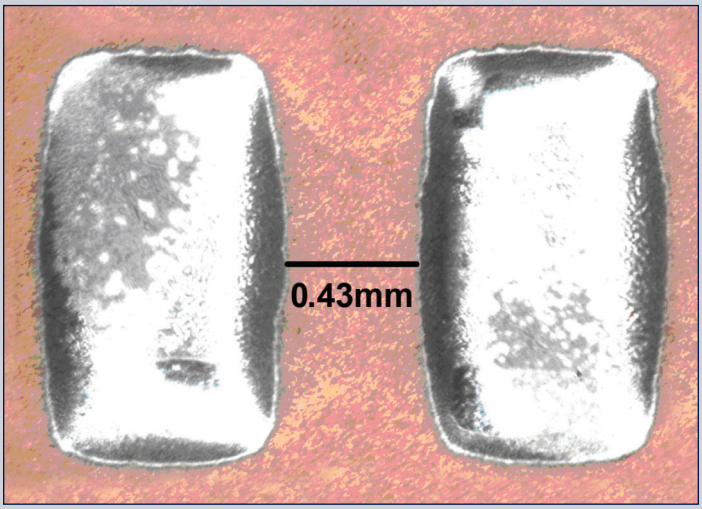

Figure 3: Wetting Pattern Gap Measurement

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It is important to note that the printed circuit board (PCB) test vehicle was finished with OSP (Organic Solder Preservative) over bare copper and the gaps were designed with that in mind. Other surface finishes would require gaps of different sizes due to the expected wetting and spread of solder on the particular surface finish. If all of the deposits bridge, the count of bridged deposit pairs is no longer valid as a measurement and there will be no gap to measure between the last pair. For example, an ENIG (Electroless Nickel/ Immersion Gold) finish allows solders to wet and spread to a much higher degree than bare copper and would require much larger gaps in order to produce useable measurements. The solder alloy can also affect that proper spacing of this type of pattern; tin-lead solders are generally expected to wet and spread to a greater degree than their lead-free counterparts.

However, when this type of pattern is properly designed for a specific combination of materials and processes, it can be a very useful tool for process engineers that are testing the general wetting properties under varying processing environments. This evaluation method can be used on both purpose-built test vehicles as well as incorporated into an unused area of a production assembly for an easy indicator of the degree of wetting occurring between the solder and the PCB surface.

ACI Technologies