No Need for Sour Grapes

New Solder Paste Formulation Technology Resolves Graping Problems

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The electronics industry's never-ending miniaturization quest has constantly challenged conventional processes, forcing solutions to problems that are a direct result of the move to such tight geometries. At the board level, it's safe to say that a large majority of these issues have to do with the deposit volumes required to achieve high-integrity solder joints for such small components. So, the soldering process – from print through reflow – is front and center. Arguably, however, the move from 0402s to 0201s (with 01005s soon to follow) and from 0.4mm CSPs to 0.3mm CSPs into more mainstream production has made some issues even more severe. In fact, this downward trend in pitch dimension has even revealed a new phenomenon not seen before and one that is directly attributable to severe miniaturization: graping.

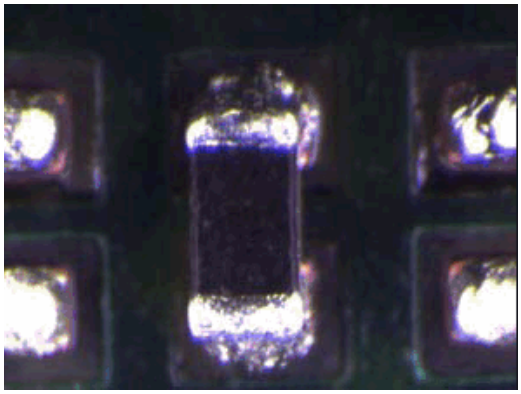
Graping, as the name implies, is a grape-like cluster formation of partially coalesced solder spheres that make up the solder joint after reflow. So, why does this occur? Well, not only do smaller solder paste deposit volumes call for thinner stencils, more thorough release and smaller solder spheres within the paste material, these necessary miniaturization conditions are also pushing the solder particle surface area to flux ratio to a breaking point. In addition, the surface area to volume ratio of the smaller deposit increases the relative level of surface oxidation.

The primary function of the flux is to allow soldering by removing any surface oxides that may be present on metals – including the solder spheres within the paste. The flux will also protect those spheres from re-oxidizing during the reflow process. As we move to smaller particle sizes, the total metal surface of the solder increases rapidly, requiring more activity. Likewise, smaller deposits will have a higher surface area to volume ratio as compared to larger solder deposits. Since the majority of the powder oxidation is on the particles on the surface of the deposit, increasing the relative amount of deposit surface increases further the demands on the flux. When the flux can no longer remove the surface oxide, which melts at a higher temperature, then flux exhaustion happens and graping occurs.

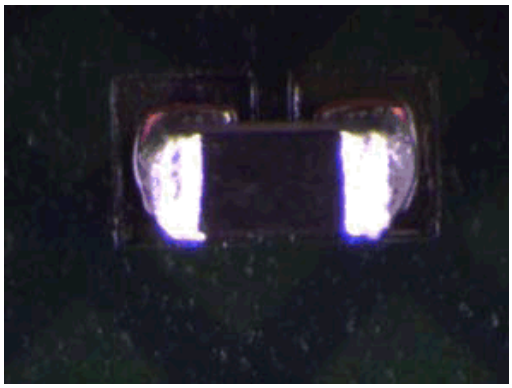
A solder material that may reflow very well on 0402s or a .5mm CSP can be significantly challenged on small deposits because there is so much additional powder oxidation due to the increased deposit surface to volume ratio that the flux activity becomes depleted. In these situations, full coalescence does not occur and graping is the result.

Fortunately, there are a number of ways to help alleviate the problem. First is ensuring better release from the stencil and more even deposits, thus minimizing the surface area to volume ratio of the deposit. Second is controlling the powder particle size distribution by designing a solder paste that incorporates advanced powder technology, such as Henkel's Multicore DAP Plus Type 4 powder. Improved particle size distribution delivers both a reduced metal surface and an optimal deposit surface area to volume ratio. Third is formulating the flux so that it has both sufficient activity and the ability to minimize re-oxidation of the powder, thus overcoming the graping as it occurs. In other words, the flux not only has to reflow nicely on the large deposits, but it also has to be able to remove existing oxides *and* protect all of the metals from re-oxidizing. Of course, all this added activity can not compromise the reliability required of no-clean soldering materials or affect the SIR and ECM performance either.

By marrying these solutions, the materials scientists at Henkel have developed their latest innovation, Multicore LF620. The new lead-free, halide-free, no-clean solder paste is formulated with a breakthrough activator flux chemistry that is designed to overcome graping while also delivering on a host of other process requirements. Multicore LF620 has excellent printability, brick-like print definition, outstanding stencil release and has been proven to overcome the possibility of graping.



0201 showing graping on the filets



0201 with Multicore LF620 and no graping

In addition, Multicore LF620's unique formulation exhibits extremely low voiding in CSP via-in-pad joints and has shown excellent solderability over a wide range of surfaces including Ni/Au, Immersion Sn, Immersion Ag and OSP copper. This is significant in relation to graping as well, as some surface finishes have been shown to elicit more graping occurrences than others. Process flexibility is also superb with Multicore LF620, which delivers a high tack force for component stability during high speed placement, an abandon time of up to four hours and a market-leading print work-life of up to 24 hours with no degradation in print quality.

What's more, multi-national manufacturers can deploy Multicore LF620 with confidence, as the solder paste ensures a consistent print performance with minimal impact from

process conditions even in regions with temperatures of 30°C (86°F) or more and relative humidity (RH) upwards of 80%.

In short, Multicore LF620 is the solution for today's most challenging soldering processes. From large solder deposits to the extremely small volumes needed for highly miniaturized components, Multicore LF620 offers consistent and robust performance – even overcoming emerging process challenges like graping.

For more information on Henkel's Multicore LF620 and our complete range of solder solutions, log onto www.henkel.com/electronics or call 949-789-2500.