Tightening Up Type 4

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Though the majority of assemblers are using Type 3 solder paste for most of today's mainstream applications, the prevalence of finer-pitched devices is growing. With 01005s and 0.3mm CSPs showing up in more and more assemblies, use of Type 4 solder paste will soon rival that of Type 3. The thinner stencils and smaller aperture sizes required to address fine-pitch devices dictate the use of solder paste with finer powder particle sizes – without it, variable and decreasing print volumes in addition to poor release from the stencil will likely be the result.

But, what is the standard for particle size in Type 4 materials? When pitches were relatively generous by comparison to today's miniaturized components, a solder paste's particle range distribution and particle size wasn't as critical. Today, nothing could be further from the truth. Unfortunately, the current standard is a bit ambiguous as to what is or isn't allowed as far as size in the upper end of the particle range for Type 4 pastes. Though the current IPC standard J-STD-006A (2001) allows for a broad distribution range of particle sizes (**Figure 1**), Henkel has decided to push beyond that based on our belief that a tighter distribution range and a smaller upper limit particle size will prevent problems down the line.

Powder type	< 0.005wt% greater than	<1wt% greater than	80wt% between	90% between	< 10% smaller than
1	180 um	150 um	150-75 um		20 um
2	90 um	75 um	75-53 um		20 um
3	53 um	45 um	45-25 um		20 um
4	45 um	38 um		38-20 um	20 um
5	32 um	25 um		25-15 um	15 um
6	25 um	15 um		15-5 um	5 um

Figure 1: IPC Standard J-STD-006A, Particle Size Distribution Specifications

With the ability to control our own solder powder production and develop innovative techniques to maintain an excellent surface finish on the powder, Henkel has succeeded in significantly tightening the particle range distribution and reducing the size limit on the upper range particles without sacrificing yield rates. In fact, Henkel's Multicore® DAP Plus™ Type 4 solder powder improves performance, particularly for customers who are running high-speed printing operations. Our unique production method helps ensure this outstanding result. Generally speaking, alternative powder production techniques require sieving to control the particle size distribution of the powder. The more sieving that takes place, the more degraded the surface of the particles become. As you move to smaller and smaller particle sizes, the integrity of the surface finish becomes increasingly critical. With smaller particles comes a higher surface area to volume ratio, which introduces more opportunity for oxidation. Higher levels of oxidation can impact the life of the paste and, therefore, performance. So, keeping the surface of the particles

as pristine as possible is very important as smaller particle sizes are incorporated into paste materials. Henkel's powder production methodology allows for consistent, smooth particles – even at sub-35 micron sizes.

While the official standard for Type 4 particle sizes is currently being scrutinized, Henkel has developed our own criteria internally to address what we consider to be shortcomings of the current standard. Henkel believes that today's standard allows for too many oversized particles and too many undersized particles. By our estimates, the variance of particle sizes in a batch of today's standard Type 4 solder paste could range anywhere from 5 microns up to 50 microns. Henkel thinks that's not ideal. It is very easy for a single oversized particle to become trapped in an aperture, resulting in multiple insufficients for that particular pad type and quite a large defect rate. By tightening up the particle size limit and acceptable distribution, Henkel's Multicore DAP Plus has alleviated this problem and afforded robust, high-speed production for fine-pitch assemblies.

As the industry forges ahead with ever-smaller device designs and production, the need for capable solder paste materials will be even greater. For example, customers are already talking about 0.3mm CSPs, printing through 80 micron thick stencils with aperture sizes of 150 microns. With dimensions like this, it is easy to understand how a 50 micron powder particle could easily block an aperture and why Henkel is confident that a fine-tuning of the current specification is warranted. In fact, our own studies have proven as much. (**See Figure 2**).

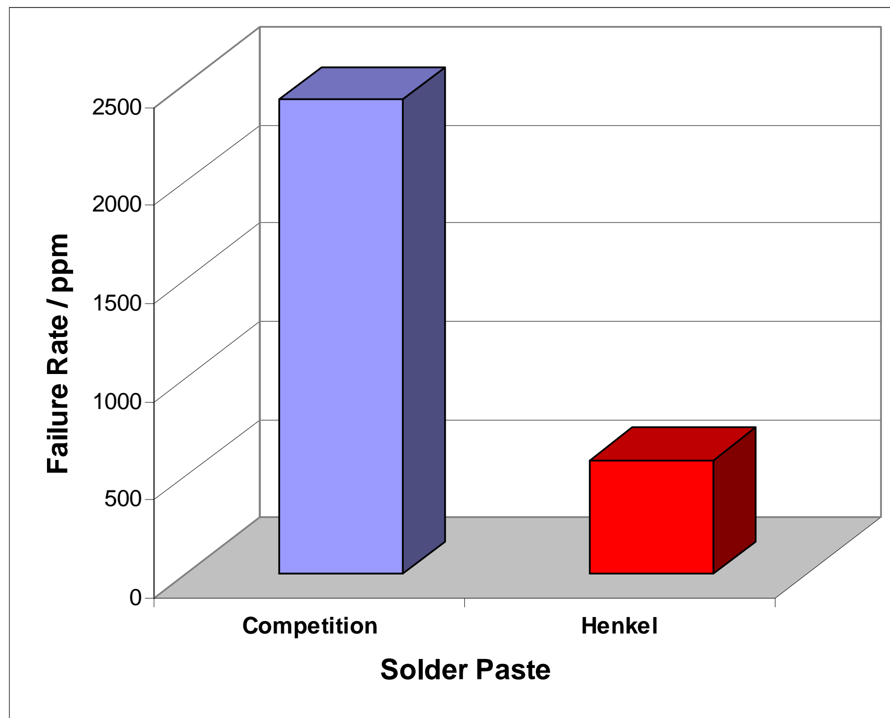

Figure 2: Solder paste formulated with Multicore DAP Plus Type 4 powder versus competitive Type 4 solder paste exhibits significantly lower failure rates.

The bottom line is that, just as with many other materials, all Type 4 solder pastes are not created equal and performance from one to another can vary wildly. Henkel considers it our responsibility to manufacture the most robust, highest performing materials available – ensuring excellent results and a low-risk partnership proposition for our customers. This has been and continues to drive our product development initiatives and, in the case of Type 4 solders, is why we have tightened up our own standards, regardless of what other suppliers are doing.

For more information on Multicore DAP Plus solder powder and our advanced line of lead-free solder pastes, please call the Henkel headquarters at 949-789-2500 or log onto www.henkel.com/electronics.