

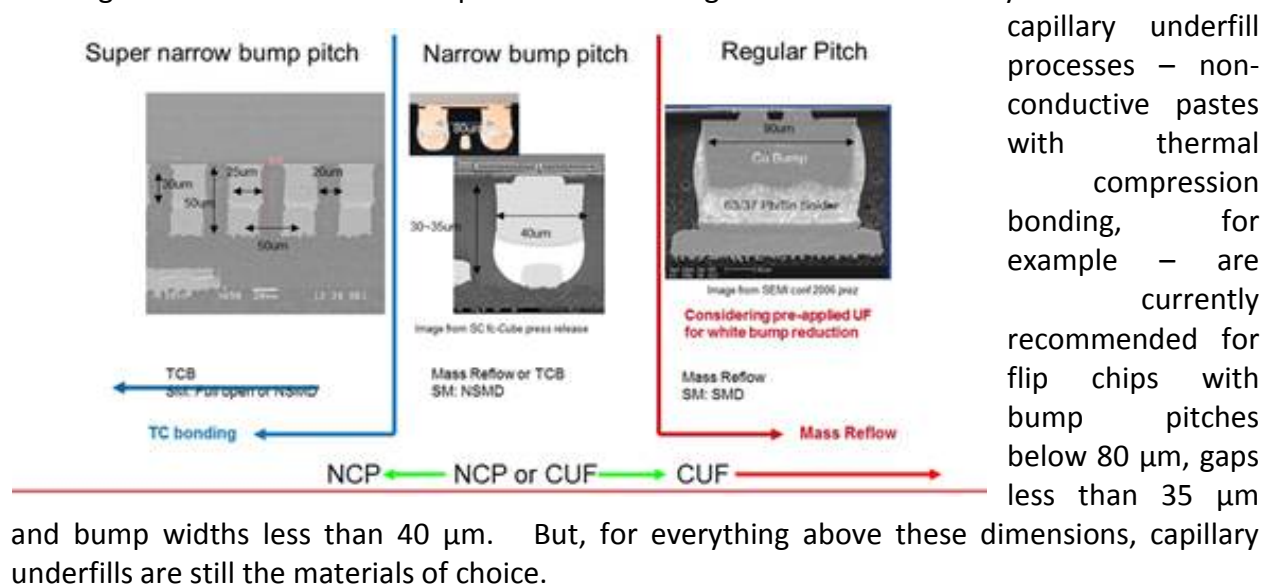
Enhancing Reliability of Fine-Pitch Flip Chip Devices

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With unyielding consumer demand for higher functioning products in ever-smaller footprints, the electronics packaging industry is witnessing an accelerated shift from traditional wirebonded devices to flip chip technology. Flip chips have many advantages including the ability to incorporate higher I/O counts, facilitate package integration and allow for tighter bump pitches. Increasingly found in consumer, mobile/handheld, high power computing, as well as Internet of Things (IOT) applications, flip chips offer broad appeal because of their compact form and high function. In addition to flip chip proliferation in general, there has also been significant growth in copper pillar flip chip technology, which is a key enabler of finer bumps and tighter pitches.

The decreasing bump pitches, gaps and widths inherent with copper pillar technology have made robust flip chip device protection more challenging than ever before. Most packaging specialists prefer the use of capillary underfill systems, but the higher density dimensions of emerging flip chip architectures place new demands on these materials to deliver complete coverage for robust interconnect protection and long-term device reliability. Alternatives to



capillary underfill processes – non-conductive pastes with thermal compression bonding, for example – are currently recommended for flip chips with bump pitches below 80 µm, gaps less than 35 µm

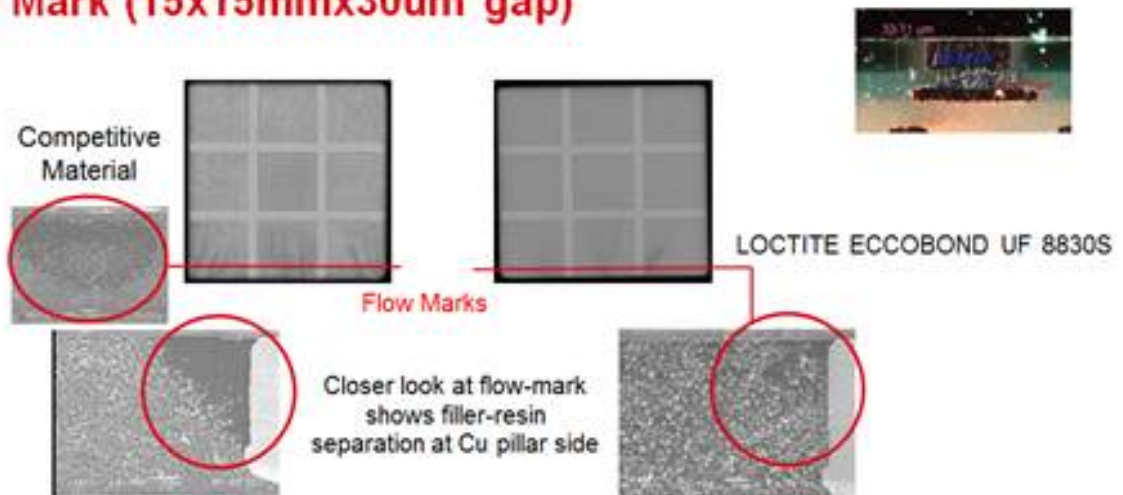
and bump widths less than 40 µm. But, for everything above these dimensions, capillary underfills are still the materials of choice.

Designing a high-performance capillary underfill system capable of providing all of the flip chip processability benefits required, while delivering on the increasingly demanding performance needs is no small feat. Improving on its well-known LOCTITE ECCOBOND UF 8830 material, Henkel has developed a completely new underfill system designed for emerging copper pillar flip chip designs. The new material, LOCTITE ECCOBOND UF 8830S, is a fast flow material with a brand new resin system and filler package formulated to accommodate the challenging dimensions of today's flip chip designs.

As compared to one of the more popular Japanese underfill materials, LOCTITE ECCOBOND UF 8830S delivers better performance in several areas. The Henkel underfill system offers users a much longer work life, with minimal viscosity increase after 72 hours. This is in comparison to other materials that ranged from a 45% to a 108% increase in viscosity during the same time period. In terms of reliability, LOCTITE ECCOBOND UF 8830S also outperforms other package-level underfill materials. With a higher, more stable glass transition temperature (Tg), the Henkel material provides a higher reliability option. When tested against competitive systems, LOCTITE ECCOBOND UF 8830S maintained very stable Tg levels even after exposure to high temperature for extended periods of time. Competitive materials, however, have wide swings in Tg as temperature exposure increases, leading to instability and potential device warpage.

As package dimensions decrease, the keep out zone – or footprint of the package and surrounding material – becomes increasingly important. Here, too, LOCTITE ECCOBOND UF 8830S outperforms other underfill products. With a shorter dispensing tongue and less resin bleed out than competitive underfills, LOCTITE ECCOBOND UF 8830S gives manufacturers little concern about material moving beyond the defined area. Likewise, the integrity of the material is superb, with no filler/resin separation whatsoever, which is in stark contrast to other materials where x-ray analysis very clearly shows areas where resin-only protection is observed (see images below). This can lead to differing coefficient of thermal expansion (CTE) rates, which can create high stress areas and potential failures.

Flow Mark (15x15mmx30um gap)



Priced competitively, LOCTITE ECCOBOND UF 8830S offers packaging specialists an exceptional underfill material with notable gains over competitive products. And, Henkel isn't stopping here; the development of next generation of capillary underfill materials for ultra-fine-pitch flip chips is already underway. The ambitious Henkel underfill technology roadmap, in combination with a well-trained global team to facilitate world-class support and process integration, provides customers with a solid materials partner to progress flip chip technology well into the future.

For more information, visit www.henkel.com/electronics or call +1-714-368-8000.