Without question, adhesive materials make electronics production possible, particularly when it comes to semiconductor packaging. Of all of the adhesive technologies employed in the market, epoxy adhesives are likely the most common material for die to substrate or die to die bonding. As devices have become more miniaturized with higher functionality, however, the corresponding requirement for larger, thinner die has challenged older-generation die attach adhesive materials, forcing packaging specialists to seek alternatives.

In addition to size and thickness modifications, die are also now routinely being stacked in order to address the demand for miniature profiles and multi-functionality. The die attach process and material selection are crucial to ensure high reliability stacked die packages and have necessitated new materials development. Flow control issues, incomplete wetting, non-uniform bondlines and die cracking from the requisite placement pressure needed to push the material across the die have all been well-documented challenges associated with traditional die attach adhesives used for die stacking. To address these issues, many manufacturers have turned to Die Attach Film (DAF) as an alternative to conventional pastes. With die attach film, bondline thicknesses are uniform, process stability of the die is enhanced through support provided by the film and processing is fairly simple. The drawback to films, however, is cost. Without question, die attach films are the more costly option, requiring a larger up-front investment (by as much as 30% in some cases) as compared to traditional die attach pastes. What the marketplace really wants is a die attach paste that offers many of the same advantages of film – but at a paste price.

Henkel and ASE recently participated in a joint effort to evaluate a novel controlled flow epoxy system introduced by Henkel, called Ablestik® Self-Filleting® die attach. Results show that the material exhibited good process control as compared to traditional dispensing die attach pastes, with excellent workability, good flow control and high reliability for large die stacked packages.

One of the biggest issues with older generation die attach epoxies is limited flow control, as insufficient or uneven flow and poor wetting can result in reliability failures. The Henkel – ASE work focused on understanding the viscosity to develop good, controlled flow while also limiting die bond force requirements and bleed out. By lowering the viscosity of the Ablestik Self-Filleting material, dispensability was improved and the material flowed easily to fill the gaps between the die and substrate without requiring excessive force during die placement. The capillary force and controlled flow of the material ensures that the Ablestik Self-Filleting paste is drawn to the edge of the die where it stops, forming a bondline but not a bulky fillet.

A series of experiments were designed to test the performance of the Ablestik Self-Filleting materials. In the first, epoxy wetting capability on a large, thin die (9 x 13 x 0.15 mm) was evaluated; the second test centered on package reliability; and the third experiment analyzed the Ablestik Self-Filleting epoxy in terms of its wire coverage.
capability. In all three experiments, the Ablestik Self-Filleting materials performed better than the alternatives. (See figures 1, 2 below.) The tested material showed excellent wetting performance with no voids, passed all reliability tests including TCT and HAST, and showed perfect wire coverage with no under-wire caves (often caused by DAF materials).

Figure 1: Wetting performance of Ablestik Self-Filleting (right hand side) and a traditional epoxy: the Ablestik material has excellent wetting performance as compared to the older-generation die attach material.

Figure 2: Ablestik Self-Filleting wire coverage as compared to DAF wire coverage. Films often cause under-wire caves, which can lead to reliability issues. Excellent wire coverage was observed with the Self-Filleting materials.

Clearly, this novel material is a breakthrough for the semiconductor packaging industry. For cost-sensitive die stacking applications, Henkel’s Ablestik Self-Filleting materials with controlled flow offer a cost-effective alternative to higher-priced die attach films and alleviate the issues associated with traditional epoxies, all while delivering excellent
performance. These new epoxies provide excellent wetting control, uniform bondlines, and good reliability with the convenience and value of a paste material.

For more information on Henkel's Ablestik Self-Filleting die attach materials or any of the company’s advanced semiconductor packaging products, call 949-789-2500 or log onto www.henkel.com/electronics.