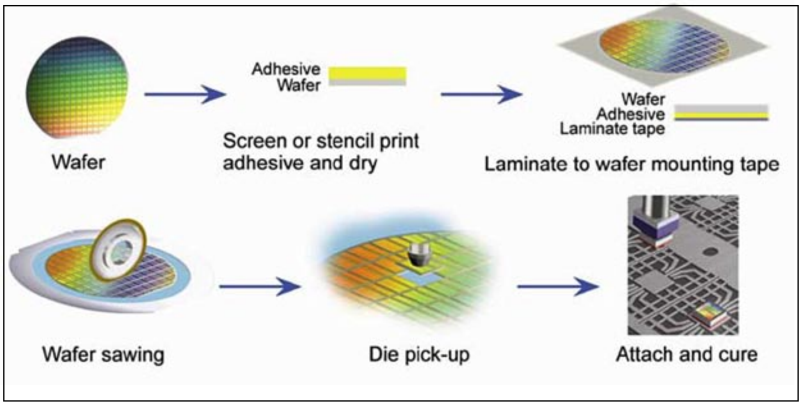
Wafer Backside Coating

Conventional die attach processes based on automated dispensing of pastes have some limitations in terms of speed, throughput and accuracy. A new approach, Wafer Backside Coating, can overcome many of these drawbacks and become the most cost-effective method for some applications.

Figure 1 – Wafer Backside Coating process flow



While many advances in die attach methods and materials have taken center stage in recent months, there is one novel technology that has quietly emerged on the scene as, perhaps, one of the most innovative breakthroughs in die attach technology. The process, termed Wafer Backside Coating, uses traditional materials deposition technologies – screen printing, stencil printing or spin coating – to efficiently coat the backside of wafers with die attach materials. The benefits of this technology include reduced costs, increased units per hour (UPH), tighter material control and the maximization of die footprint area through elimination of the fillet.

Traditional dispensing approach

With conventional die attach pastes, material is deposited using an automated dispensing machine. And, while this is certainly a viable and popular approach, there are inherent drawbacks to this technique. First, because dispensing is a serial process, deposits of material can only be put down one or two at a time, depending on the number of dispense nozzles employed. So, the only way to increase throughput is to add more dispensing systems, which requires a substantial investment. Set-up time is also a major concern, particularly with highly miniaturized die which require the utmost precision. In these situations, machine set-up can take many hours. A second challenge with dispensing methods is maintaining a high level of quality and reliability. Placing a die into a very small dot of material is a delicate procedure and must be performed with near perfect accuracy to ensure a high-yield result. If the die is placed with too little force, the adhesive may not cover all of the die area. Conversely, if the die is placed with too much force, material may pushed out from under the die and adversely affect the bondline or flow past the desired die pad area. Die placement must also be level to avoid die tilt, a condition which may make wirebonding problematic or severely reduce reliability. In addition, there are certain applications which are simply not manufacturable with traditional die attach pastes. Chip-on-lead devices, for example, have no pad on which the die sits so a controlled flow die attach material is the only solution.

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These devices which require an alternative to traditional die attach pastes in combination with the industry's relentless drive for highly miniaturized die, smaller footprint packages is what led to the development of Henkel's Ablestik 8000 series Wafer Backside Coating (WBC) materials. Working in close cooperation with printing leader, DEK, the Ablestik product development team engineered a series of materials that combine excellent die attach performance with the speed and ease-of-use provided by a screen or stencil printing platform. Offered in both conductive and non-conductive formulations, these Henkel die attach materials have effectively enabled applications such as chip-on-lead which were heretofore not cost-effectively manufacturable.

Characteristics and benefits

While film is also a controlled flow solution, the cost of film is as much as 30% higher than that of liquid die attach paste materials. So, for low-ticket products, film methodologies are cost-prohibitive. Not only are there cost saving benefits to WBC materials, but there are substantial throughput and material control advantages as well. Using a highly accurate printing platform in combination with a tool set that delivers handling stability for ultra thin wafers, the wafer coating process only takes between 10 and 15 seconds. With a printer, the entire backside of the wafer is coated with die attach materials in one single stroke, as opposed to individual dot deposition that occurs with a dispensing system. Bondline thickness can be controlled to customer specifications and material thickness is consistent across the entire wafer. This technique has effectively achieved coatings as thin as 20 microns on wafers as thin as 100 microns and up to 300mm in diameter. Once the wafer is coated, the material is then B-staged so that the wafers can be easily stored for use at a later date.

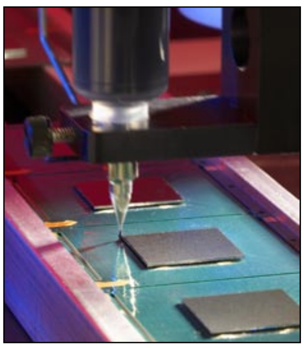
While many materials manufacturers offer what they call a B-staging dual cure mechanism, not many can truly deliver on the essential characteristics for robust performance. In the B-staging process, the die attach material is advanced to a secondary state that is, in essence, a partial cure and is generally achieved with either a thermal or UV process. Henkel's Ablestik 8000 series are thermal cure B-staged materials. In order for B-staging to be effective, it is imperative that the material becomes film-like but not tacky. If the material remains tacky, foreign material contamination is highly likely. When B-staged properly, the WBC material is designed to be tack free and ready for subsequent processing or stored until required at a later date.

Currently, WBC materials are used in production for single die configuration devices. The technology has not yet been adopted for stacked die applications. This is primarily due to the bondline limitations and wafer handling requirements with current application methods. However, development work is underway and <10μm thicknesses have been achieved with Ablestik WBC materials using novel application processes. It is certainly conceivable that WBC will replace film-based die attach materials in the not too distant future.

Fast Contact Drying Technology For Screen Printers

Spartanics and Systec have introduced their Sheet & Web Contact Drying System to eliminate expected bottlenecks in the drying stage after screen printing. The system dries both solvent and water-based inks in a fraction of the required drying times in conventional heated air ovens. The system uses a heated vacuum plate with transport belt on the bottom of the material being dried. An integrated heated air blower furthers the drying process and helps eliminate solvent fumes. According to Spartanics, screen printed materials that previously required 2 hours to dry are now fully dry within 30 seconds. The system typically uses 1/5 the energy or less than conventional drying systems. The Sheet & Web Contact Drying System is available as a standalone item or as a standard option for the Spartanics-Systec Fineprint Screen Printing Systems.

Thermally Conductive Flip Chip Underfill



Lord, a leading supplier of thermal management materials, adhesives, coatings and encapsulants to the electronics industry, has announced the launch of a thermally conductive flip chip underfill that offers an improved thermal path for heat reduction. Even though a typical thermal solution for a flip chip package uses thermal interface materials to drive the heat to the heat sink, some of today's complicated flip chip packaging constraints do not allow for dissipating the heat through the back side of the die. ME-542, a specifically formulated material designed to achieve high reliability for in-package or chip-on-board applications, was developed to increase thermal dissipation from the die into the substrate. The material is jettable with minimal wear to the jet nozzle, offering a fast flow without voiding under large die. ME-542 has a thermal conductivity of 0.8 W/mK, which represents a 500 percent increase over standard underfill products. The new underfill material is engineered to quickly flow into gaps less than 25 microns with minimal filler settling and no voiding, encapsulating the fully populated interconnect arrays with a reliable layer of protective polymer.