Solutions for Adhesive Curing

An Application Case Summary

Flip Chip Underfill & Bump Cure **Ref: 02-302**

Topic Reference:
Flip chip assembly … bump reflow and underfill cure, on smart card packages

The Problem:
The use of flip chip packaging has become mainstream in smart card technology. Smart card growth recently has been significant. But the key element for continued success and reaching its potential is the ability to reduce cost. Cost drivers are manufacturing expense associated with product fixturing and process throughput cycles, plus the material cost of substrate and of course the silicon chip. The processes of die attach on flex, or bump reflow and underfill cure and use of the lowest cost substrate, are typically not compatible. In order to complete the reflow or underfill cure, the part temperatures reach levels not tolerated by low cost substrates. A compromise is either lower quality underfill material that cures at lower temperature or use of higher cost substrates. Even with medium cost substrates, expensive fixturing is usually required to support the substrate during the cure cycle. Furthermore, the cure cycle time usually prohibits a convenient continuous flow operation that is needed for manufacturing efficiencies.

Proposed Solution:
Variable Frequency Microwave (VFM) was proposed as a solution that would permit use of the lowest cost substrate material while reducing cycle time, minimizing fixture expense, and allowing a continuous process flow. Generally, microwave is well known for accelerating reaction rates such as needed to cure adhesives, by as much as 10 to 20 fold. VFM is a unique microwave technology that allows the benefit of microwave curing without the disadvantages associated with single frequency, conventional microwave. By rapid sweeping through a broad range of frequencies, VFM produces uniform energy distribution while eliminating the problem of arcing. This permits use of microwave (VFM) in the presence of metal, circuits, and high value semiconductor assemblies. Furthermore, VFM provides selective heating, permitting the heating of the die and underfill area only, without overheating the remainder of the substrate.

Realized Benefit:
A leading manufacturer of smart card assemblies adopted VFM for a die attach and bump reflow process as well as the underfill cure requirement. VFM's rapid cure allowed for a continuous process flow and a significant reduction in fixture expense. The selective heating feature permitted the use of lower cost substrates and hence reduced overall product cost.

Summary:

- **Reduced Process Cycle Time by More Than 95% (4 hrs to 4 min)**
- **Reduced Number of Expensive Pallets Required by 90%**
- **Enabled Use of Low Cost Substrate Material**
- **Permitted In-line Process Flow for Efficient Manufacturing Flow**

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