MicroCure™ – VFM
rapid cure processing

Application Note

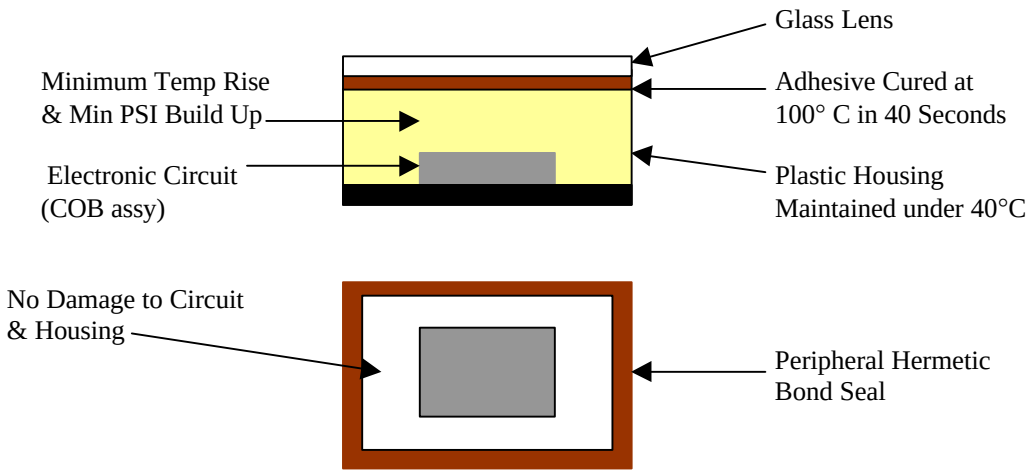
MC 98 – 204

Subject: **Structural Bonding –Optical Lens**
Glass to Plastic for Hermetic Seal

VFM Background: VFM processing is a controlled approach to uniform distribution and selective heating with microwave energy. The technique was developed for the purpose of processing many of today's advanced materials, with particular applications in the area of polymer adhesives and encapsulants used in electronic packaging. VFM provides rapid heating at the molecular level, hence is volumetric, and is distributed uniformly throughout the material by sweeping across a wide frequency spectrum. In addition, by sweeping through the complete variable frequency range in less than one second, the process eliminates any conditions that would create arcing or damage to metallic components or circuitry. Furthermore, VFM heating is inherently selective and, as a result, the heating of adhesives to bond two dissimilar materials is often accomplished rapidly without raising the temperature of the adjacent materials to anywhere near the same level as required for the adhesive.

Choices in the Bonding Process: The demand for lighter, faster, smaller and less expensive products has led the electronics manufacturing industry to the use of new packaging assemblies. These assemblies involve the use of chip-on-board electronic circuits contained in plastic housings or onto other low temperature materials. Many of these assemblies require the use of adhesives to bond the components or the use of encapsulants to protect the circuitry. The best adhesives for structural and hermetic seals often cure at temperatures higher than those tolerated by the plastic material. Furthermore, hermetic seals are often compromised by the build up of pressure within the housing during the adhesive curing process. VFM has been demonstrated as an alternative to conventional oven methods of curing adhesive bonds in these advanced applications.

Schematic of VFM Cure Of Structural Adhesive On Optical Lens Assembly



VFM Results of Curing Structural Adhesives: VFM process applications for structural bonding in the presence of electronic circuitry have been performed primarily using a Loctite adhesive tailored for interaction with microwave energy. The Loctite adhesive combined with the uniform heating of VFM permits the positive and rapid cure of a thin adhesive bond line between two adjacent surfaces. Simultaneously, the microwave energy does not directly heat the glass or plastic components, allowing them to remain a much lower temperatures then the cure temperature required for the adhesive. In addition, the short cure cycle combined with the selective heating does not create the same pressure build up within package as occurs with conventional heating methods. Extent of cure of the adhesive was determined to be identical when using the faster VFM cure and the integrity of the bond was evaluated by pull tests and pressure soak testing. A summary of the application results from the bonding trials is outlined below.

	Conventional	**VFM**
Cure cycle time/temp	4-5 minutes @ 100ºC	40 seconds @ 100ºC
Extent of cure for Adhesive	100%	100%
Condition of Bond Joint	Occasional voids or leaks	No voids or leaks

Functionality & Reliability Testing: Components processed by the VFM cured adhesive were tested for functionality of the circuitry and reliability of the bonded joint. While specific details of the packages tested are not available, all parts processed showed no change in electrical functionality and/or performance. Testing of the bond line was accomplished by pull tests and via boil and soak testing. Results in all cases showed VFM cured joints were equal to or better than the conventionally processed joints. No signs of leakage due to excessive pressure or improper cure were evident as a result of VFM processing.

VFM System Configuration: The VFM system used for the above trials was a standard MicroCure™ 2100, development system, 700 watt model. This system is a fully automatically controlled, batch load system with closed loop temperature cycle operation. A similar cycle time of 40-45 seconds was demonstrated on up to 36 package assemblies at once, housed in a common carrier. The MicroCure™ 5100 is an in-line system designed to accommodate up to 4 similar carriers and operates in the same VFM control mode to project viable production processing of up to 144 parts in the same 45 second cycle.