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Hermetic Sealing and Testing of Small Volume MEMS Packages

1/2 DAY

Reliable packaging of MEMS requires the ability to create and maintain a suitable inert atmosphere or vacuum inside the package cavity for the expected lifetime of the device. Traditional hermetic ceramic/metal packages are being replaced by wafer level packaging techniques, which present unique challenges from a hermeticity testing perspective. This course begins with an overview of traditional hermetic sealing processes along with wafer level MEMS packaging processes and methods. In some cases near-hermetic packages, such as LCP are suitable in some applications. Testing of small cavity MEMS packages according to the traditional Mil Spec TM 1014 requirements may not be sufficient to guarantee reliable operation. Difficulties and limitations in fine leak testing of small volume packages will be addressed. Recent advances in Optical Leak Testing (OLT), Cumulative Helium Leak Detection (CHLD) and Radioisotope KR 85 along with other hermeticity techniques are reviewed in light of the new, tighter leak rate hermeticity specifications. Moisture ingress is of primary concern for a small volume MEMS cavity packages. Moisture level vs. surface area to volume ratio is an important concept, along with material outgassing and the potential to mitigate these problems with getters. These along with other critical MEMS packaging issues are addressed in this course.

This PDC is intended as an introductory level course for process engineers, designers, quality engineers, and managers responsible for packaging and hermetic testing of cavity style MEMS.

Course Outline

MEMS Packaging Overview
- Traditional metal and ceramic seal processes
- Hermetic wafer level MEMS packaging processes
- “Near hermetic” package seal options

Review of Hermeticity Testing per MIL-STD-883 TM 1014 Seal
- Hermeticity leak rate specifications for MEMS
- OLT, CHLD and Kr-85 hermeticity testing methods

MEMS Hermeticity Testing Issues
- Moisture level vs. surface area to volume ratio
- Expected lifetimes in the field
- Use of getters as a mitigation strategy

Course Summary
Student Feedback and Course Critique