

Ceramics

Application Overview:

A variety of ceramic materials are used as substrate or lid for microelectronic devices. Acoustic microscopes have the ability to nondestructively look for air within these ceramic materials. Either caused during the manufacturing process or the result of over-stress, acoustic inspection can help determine the “root-cause” and location of the defect. Inspections can be performed on just bare pieces of ceramic or ceramics inside devices.

Package Types:

Aluminum Oxide, Beryllium Oxide, LTCC, PZT

Inspection Standards:

- none -

Failure Types Commonly Detected:

Bubbling

Cracking

Non-bonded layers

Sonix Systems Recommended:

HS1000 system ([link to spec sheet](#)) for general, small volume inspection

UHR2001 system ([link to spec sheet](#)) for general, small volume inspection where high-resolution imaging are needed.

Quantum 350 system ([link to spec sheet](#)) for large or high-resolution imaging. Also works in a semi-automatic mode.

Please contact Sonix for high-volume inspections.

Technical Papers:

([link to tech paper section of hybrids, MCMs and power devices](#))

Images:

This is a schematic of a typical hybrid devices. The blue areas are solder interfaces. The primary function of these interfaces are to dissipate heat away from the die. The bond quality of these interfaces are critical to insure adequate device reliability. Although the materials and structural from design to design can vary, acoustically, most devices are very similar.

This is a pulse-echo (reflected) mode image of bond quality between a solder preform pre-preg and a copper-tungsten base plate. A red arrow points to voiding in the solder bond. Studies have shown that die temperature becomes critically high when solder layers become greater than 25% disbonded. In addition, disbonds and voids have been shown to expand upon stressing, thereby affecting long term reliability. A yellow area points to a void in the lid seal of the device. If the void propagates across the entire lid seal, the hermetic nature of the device is destroyed. Typically, leak tests can determine if the seal has been compromised, however acoustics has the ability to find voids that don't quite open the seal, but upon thermal stressing can later cause failure.

This is a pulse-echo (reflected) mode image of bond quality between a die and the substrate. A red arrow points to voiding in the solder bond. This device also suffers from insufficient solder coverage over the intended bond area. This lack of coverage will cause the die to heat up to intolerable levels, causing future device failure.

This is a pulse-echo (reflected) mode image of bond quality between TEC cooler and copper base. A red arrow points to voiding in the solder bond. Voids in this layer will impact the thermal properties of the device.