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acoustical imaging. recommended components miscellaneous stereophilecom, naw, just haughty, arrogant and disrespectful they reviewed various products for the magazine, and this is the list they came up with the classes are explained in full, in.

If both materials are typical solids, the degree of reflection will be moderate, and a significant portion of the pulse will travel deeper into the sample, where it may be in part reflected by deeper material interfaces. Gating of the return echoes[edit] A pulse of ultrasound from the transducer might travel nanoseconds or microseconds to reach an internal interface and be reflected back to the transducer. If there are several internal interfaces at different depths, the echoes will arrive at the transducer at different times. Planar acoustic images do not often use all return echoes from all depths to make the visible acoustic image. Instead, a time window is created that accepts only those return echoes from the depth of interest. In the image of the plastic-encapsulated IC above, gating was on a depth that included the silicon die, the die paddle and the lead frame. Still scanning the top of the sample, the gating of the return echoes was then changed to include only the plastic encapsulant mold compound above the die. The resulting acoustic image is shown above. It shows the structure of the particle-filled plastic mold compound, as well as the circular mold marks at the top surface of the component. The small white features are voids trapped bubbles in the mold compound. These voids are also visible in the previous image as dark acoustic shadows. Gating was then changed to include only depth of the die attach material that attaches the silicon die to the die paddle. The die, the die paddle, and other features above and below the die attach depth are ignored. In the resulting acoustic image, shown above slightly magnified, the red areas are voids defects in the die attach material. Finally, the plastic-encapsulated IC was flipped over and imaged from the back side. The return echoes were gated on the depth where the backside mold compound interfaces with the back side of the die paddle. The small black dots in the acoustic image above are small voids trapped bubbles in the mold compound. Other image types[edit] The acoustic images shown above are all planar images, so named because they make visible a horizontal plane within the sample. The acoustic data received in the return echo signals can also be used to make other types of images, including three-dimensional images, cross-sectional images, and thru-scan images. Some of these types are illustrated in the Photo Gallery. History[edit] The notion of acoustic microscopy dates back to when S. Sokolov [2] proposed a device for producing magnified views of structure with 3-GHz sound waves. However, due to technological limitations at the time, no such instrument could be constructed, and it was not until that Dunn and Fry [3] performed the first acoustic microscopy experiments, though not at very high frequencies. The scientific literature shows very little progress toward an acoustic microscope following the Dunn and Fry experiments up until about when two groups of activity emerged, one headed by C. Quate Stanford University and the other by A. Kessler Zenith Radio Research Labs. The first efforts to develop an operational acoustic microscope concentrated upon high-frequency adaptations of low-frequency ultrasonic visualization methods. One early system employed Bragg diffraction imaging , [4] which is based upon direct interaction between an acoustic-wave field and a laser light beam. Another example was based on variations of the Pohlman cell. Cunningham and Quate [6] modified this by suspending tiny latex spheres in a fluid. Acoustic pressure caused population shifts which were visually detectable. Kessler and Sawyer [7] developed a liquid crystal cell that enabled sound to be detected by hydrodynamic orientation of the fluid. In , the Quate group began the development of a concept, [8] which utilized a confocal pair of acoustic lenses for focusing and detecting the ultrasonic energy. Advancements of this instrument, a scanning acoustic microscope, have to do with achieving very high resolution, novel modes of imaging, and applications. In , the Korpel and Kessler group began to pursue a scanning laser detection system for acoustic microscopy. This instrument, the scanning laser acoustic microscope SLAM , was made commercial available in Using the same transducer to pulse ultrasound and receive the return echoes meant that the acoustic image could easily be constrained to a depth of interest. This design was the precursor of essentially all of the acoustic microscopes in use today, and was the development that made possible numerous later advances such as cross-sectional acoustic imaging, three-dimensional acoustic imaging, and others. Range of applications[edit] The samples imaged by acoustic microscopes are typically assemblies of one or more solid materials that have at least one surface that is either flat or regularly curved. The depth of interest may involve an internal bond between materials, or a depth at which a defect may occur in a homogeneous material. In addition, samples may be characterized without imaging to determine, e. Because of their ability to find visualize features non-destructively, acoustic microscopes are widely used in the production of electronic components and assemblies for quality control, reliability and failure analysis. Usually the interest is in finding and analyzing internal defects such as delaminations, cracks and voids, although an acoustic microscope may also be used simply to verify by material characterization or imaging, or both that a given part or a given material meets specifications or, in some instances, is not counterfeit. There are in addition numerous applications outside of electronics. The assembly of numerous medical products uses acoustic microscopes to investigate internal bonds and features. For example, a polymer film may be imaged to examine its bond to a multi-channel plastic plate used in blood analysis. In many industries, products that involve tubing, ceramic materials, composite materials or some types of welds may be imaged acoustically. A more recent application is the use of acoustic microscopy to the diagnosis of the paint layers of painted art and other objects.

Chapter 2 : Acoustic microscopy - Wikipedia

The contents of this volume are the proceedings of the 23'd International Symposium on Acoustical Imaging which took place April, , in Boston, Massachusetts. The first Symposium met 25 years ago.

Chapter 3 : UC Irvine - Faculty Profile System

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