NDE of Microelectronics by Real Time X-ray Imaging

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Summary:

Real time X-ray has been demonstrated as an effective nondestructive evaluation (NDE) tool for microelectronic components and assemblies. The effectiveness of a high-magnification, microfocus real-time x-ray system was illustrated. The system is specifically designed with large field-of-view, ideal for overall viewing of entire microelectronic package. Identifying and locating defects without destroying a microelectronic device can provide pertinent information for the analyst. This method also enabled analysts to section a specific area of the device containing the defect, rather than the entire component.

The acquisition of x-ray in real-time eliminates the trial and error method as compared to conventional film x-ray method. Instead of film, and image intensifier is used to capture and convert x-ray to a viewable video signal via CCD camera. This technique eliminates repeat parts exposure, film development, x-ray and part position adjustment.

The x-ray source used is of a point source type about 4 microns in focal spot size. This is done by focus the electron beams to a very small spot on the tungsten target. Because x-ray is emitted from a point source, a well-defined conical pattern is resulted with geometric sharpness, which is critical in detecting small anomalies in microelectronic packages. In addition, geometric magnification is achieved in real time, where the image is project into the image intensifier by the "shadowgraph" principal.

By changing the distance between microfocus x-ray point source and the part and vary the position of image intensifier, magnification of up to 1000x can be achieved with very low distortion and a final output resolution of 2.5 lp/mm (line pairs per millimeter).

As microelectronic packaging continue to decrease in size and assemblies become more complex, real time microfocus x-ray imaging system will become an ever-increasing important tool for the process control and quality verification.