ANALYTICAL ANSWERS

Real-Time High Resolution X-Ray Microscopy (XM)

High resolution X-ray Microscopy offers nondestructive real-time inspection with magnifications up to 1000X. Internal mechanisms of samples, not normally visible under any other means, may be observed while in operation. Another advantage of the real time radiography system over a static radiography system is that the sample under examination may be positioned in exactly the correct orientation to best depict the features of interest. The sample may be moved in the X, Y and Z directions and can be tilted and rotated as well. With suitable calibration, area and linear measurements can be made of internal components nondestructively.

XM Applications include:

Materials Evaluation

Dispersion of fillers
Delamination in thin films
Real-time evaluation of electrical and thermal devices
Real-time evaluation of micro-surgical implements

Failure Analysis

Opens/shorts in bond wires
Bond wire placement
Extraneous components
Construction details
Loose components
Deformed internal components
Micro-fracture detection in materials

Quality Control

Ball Grid Array (BGA) voiding in solder balls
Voids in welds
Clearance between embedded wires
Die attach voiding
Linear measurements

Principle of Operation:

The X-rays are generated by impinging a stream of electrons onto a target. The energy of an impinging electron is transferred to the orbital electrons of the atoms of the target. When the excited electrons jump to a lower energy level, photons are emitted. These photons have a frequency which places them into the range of electromagnetic radiation which we call X-rays. The energy of these X-rays is directly related to the energy of the impinging electrons. This electromagnetic radiation has the property of penetrating solid objects. The variable density of the object determines how many photons penetrate to the detector.

The magnification is achieved with an X-ray source designed to be practically a point-source. These X-rays extend out from the source in the shape of a cone. Geometric magnification is obtained by adjusting the distance between the source of the X-rays, the sample being irradiated and the detector. The closer the sample is to the source and the further the detector, the larger the image will be upon the detector.

The detector is an image intensification tube sensitive to X-rays. The multiplication of geometric and electronic magnification provides a practical limit of about 400 times.

Data Output:

The output is either as an image on the computer monitor or an electronic image. The system is capable of recording video if the sample under examination so that how the components work together is visible. This is provided as avi files.

Sample Constraints:

The sample size usually determined by the amount of translation needed. The maximum size is 14 by 15 inches (370 X 390 mm) and the sample can weigh no more than 10 lbs. These maximum constraints depend on the type of examination.