The Information You Need...When You Need It.

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

Through high-resolution X-ray microscopy, we are able to non-destructively examine the internal structure of samples in real-time, at magnifications up to 1000X. While the internal mechanisms of these samples are usually not visible under other means, XM offers us a tool to watch them in operation.

Unlike static radiography systems, XM allows the sample under examination to be positioned in a direction that permits the best view of a feature of interest. The sample is able to be move in the X, Y and Z directions and can also be tilted and rotated. When images are calibrated, radiopacity (ASTM F640) and linear measurements can be made.

Video recordings of switches, relays, and other mechanical or electromechanical devices can be made to understand their inner workings or perform failure analysis.

How it Works:

We begin by generating X-rays by impinging a beam of electrons onto a metal target. The energy of an impinging electron is transferred to the orbital electrons of the atoms of the target. Photons are emitted when the excited electrons jump to a lower energy level. 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 impinging electrons and the target material. X-rays have the ability of penetrating solid objects; the density of the object determines how many electrons penetrate the detector.

Geometric magnification is made possible 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 it is from the detector, the larger the image will be on the detector.

XM Applications Include:

Materials Evaluation

- Dispersion of fillers polymers
- 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
- Loose or Extraneous components in packages
- Construction details
- Deformed internal components
- Micro-fracture detection in materials

Quality Control

- Ball Grid Array (BGA) voiding in solder balls
- Voids or cracks in welds
- Die attach voiding
- Linear measurements
- Inspection of medical products while in sterile packaging
- Clearance between embedded wires

Data Presentation:

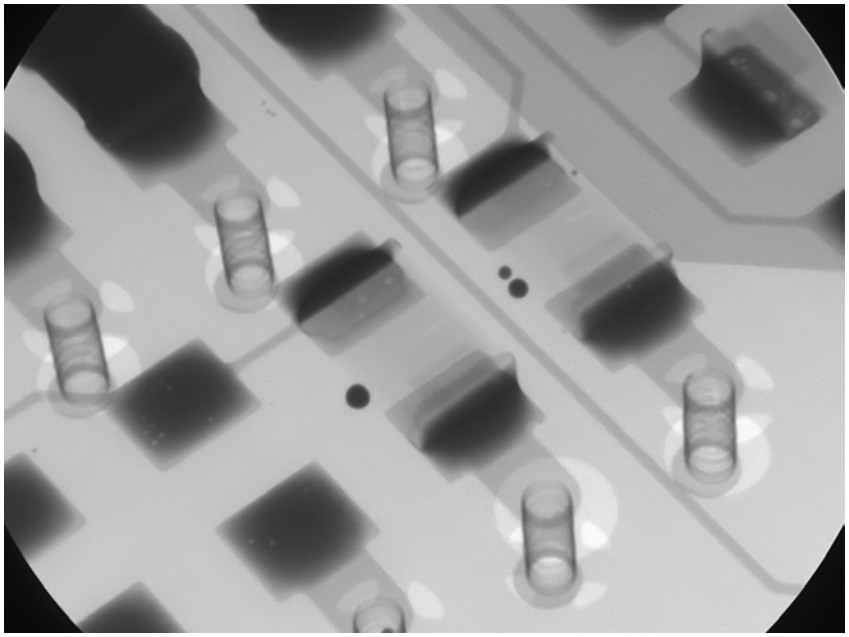
We can present data either as an image on a computer monitor or as an electronic image on CD. The system is capable of recording videos of the sample under examination to allow further viewing of how the components work together. These videos are recorded in the .mpg format.

Sample Constraints:

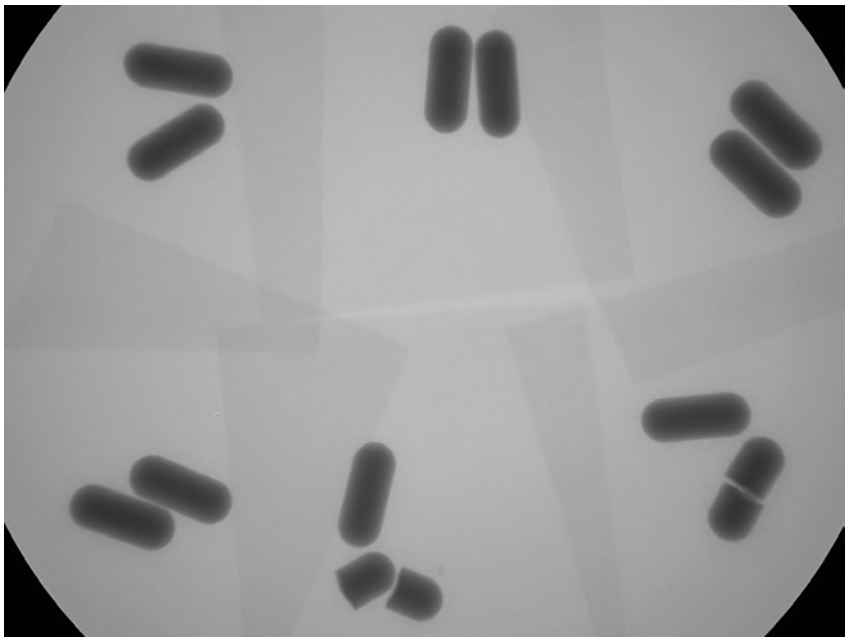
The necessary sample size is usually determined by the amount of translation needed and type of examination. The maximum sample size is approximately 14 by 15 inches

(although larger may be possible in specific instances) and the sample can weigh no more than 10 pounds.

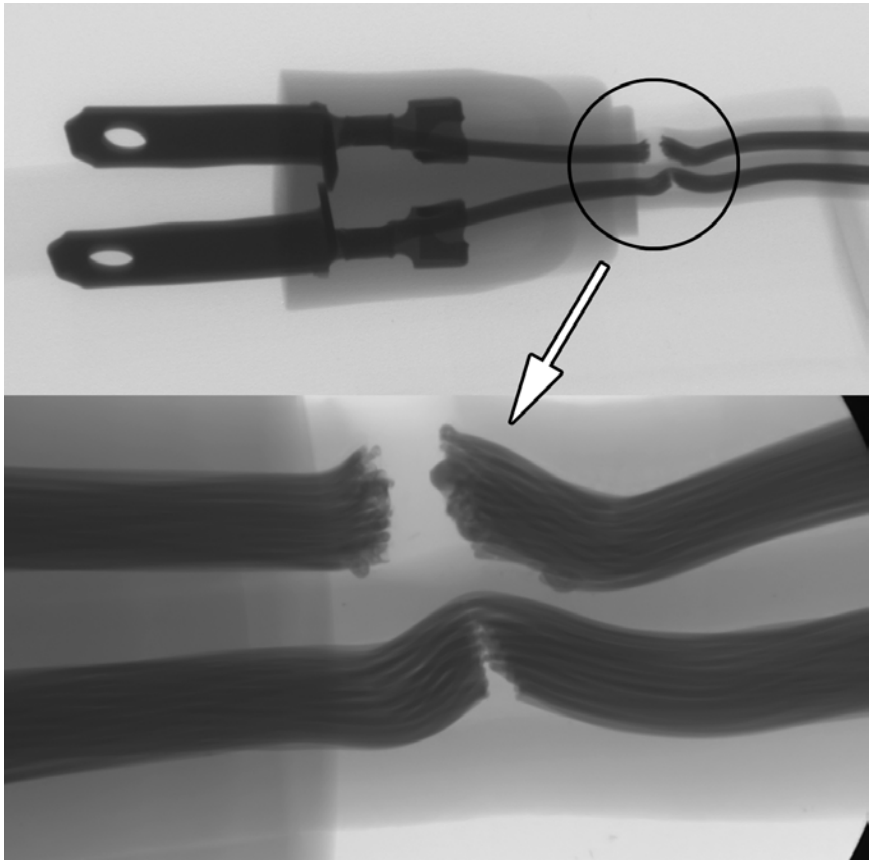
Examples of Data:



Angle view of printed circuit board with surface mount components. Note small, spherical solder balls loose inside the sample (center of view), which can possibly lead to electrical shorts if loose inside the package.



Inspection of pharmaceutical tablets for damage during manufacturing, while still sealed in their sterile foil pouches.



Failed conductor in a household appliance. Note the melting of the individual conductors caused by arcing (near the tip of the white arrow).