ENERGY DISPERSIVE X-RAY SPECTROSCOPY (EDS)

Energy Dispersive X-Ray Spectroscopy (EDS) is an analytical technique to qualitatively and quantitatively identify the elemental composition of materials analyzed in an SEM. EDS analyzes the top few microns of the sample with a spatial resolution as small as one micron.

Modern, ultra-thin polymer windowed EDS can detect elements with atomic numbers greater than boron, with limits of detection as low as 0.1 weight percent (depending on material).

Individual spectra can be collected from spots or areas, or EDS data can be collected as either element maps or line profiles with a spatial resolution of one micron.

EDS Applications Include:

Materials Evaluation

Contaminant location
Contaminant identification
Alloy and intermetallic identification
Composition verification
Elemental diffusion profiles

Failure Analysis

Identification and quantification of unknown materials
Stringer location
Cosmetic stain identification

Quality Control

Material verification
Alloy identification
Certifying plating to specification

Principle of Operation:

When the electron beam of the SEM is scanned across the sample, it causes excitation of characteristic x-rays from the atoms in the top few microns. The energy of each x-ray is specific to the atom from which it escaped. The EDS system collects the x-rays, sorts them by energy and displays the number of x-rays versus their energy. This qualitative EDS spectrum is captured electronically for display and processing.

The data can be further analyzed to produce either an area elemental analysis or a linear elemental analysis showing the distribution of a particular element within the top two microns of the surface of the sample. EDS data can be compared to known standard materials or computer-generated theoretical standards to produce either a full "quantitative" or a "semi-quantitative" analysis.

Data Output:

EDS element maps and line scans may be smoothed, background corrected and overlaid to show the distributions of several elements together. EDS systems also produce color maps which show each element's distribution in a different color. These systems also compute concentration line profiles displaying exact composition in steps as small as 1 micron across the sample. Qualitative EDS data is typically presented as false color displays or as full-page spectral plots while quantitative EDS data is typically presented as tables.

Sample Constraints:

The sample can be up to 15 cm x 10 cm x 75 cm in size. The sample must be compatible with a 10^{-6} torr vacuum, i.e., non-volatile and not susceptible to electron beam induced damage.