Analytical Answers, Inc.

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ENERGY DISPERSIVE X-RAY SPECTROSCOPY (EDS)

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

Beryllium windowed EDS detects all elements with atomic numbers greater than oxygen at concentrations greater than 0.1%. "Windowless" EDS detectors can also detect carbon, nitrogen and oxygen at concentrations greater than 1.0%.

EDS displays the distribution of elements as either dot maps or line profiles with a spatial resolution of one micron.

EDS Applications Include:

1. Materials Evaluation

Contaminant location and identification
Alloy and intermetallic identification
Material composition verification
Discrimination between electroless and electroplated nickel
Elemental diffusion profiles
Multiple spot analysis of areas from 1 micron to 10 centimeters

2. Failure Analysis

Contaminant identification
Identification and quantification of unknown materials
Stringer location
Cosmetic stain identification

3. Quality Control Screening

Material verification
Alloy identification
Certifying platings to specification

Principle Of Operation:

When the electron beam of the SEM is scanned across the sample, it generates x-rays from the atoms in the top two microns. The energy of each x-ray is characteristic of 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 can be either photographed or plotted.

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

Data Output:

EDS dot maps and line scans may be smoothed, background corrected and overlaid to show the distributions of several elements together. EDS systems also produce color dot 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 color photographs 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.