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

Wavelength Dispersive Spectroscopy (WDS)

Wavelength Dispersive Spectroscopy (WDS) is a complimentary technique to Energy Dispersive Spectroscopy (EDS) for performing x-ray analysis of materials to determine their elemental composition.

Elemental analysis by EDS suffers from several shortcomings, including high background levels and relatively poor energy resolution, which result in poorer detection limits and the inability to separate elements with peaks at similar energy.

WDS overcomes these limitations. It has much higher energy resolution so that closely spaced peaks can be readily separated, and it has cleaner background levels so that detection limits are greatly improved over EDS alone. This improves elemental quantification (with the use of appropriate standards) and identification.

WDS also has a much higher sensitivity to low atomic number elements, providing much better detection of elements as low as Be and B. WDS can also be used to provide two-dimensional elemental distributions as maps.

The end result is that you have a much higher confidence in the identification of the elements detected in any analysis.

How it Works:

When the electron beam in the Scanning Electron Microscope hits the surface of a sample, it causes the atoms in the material to become excited when they absorb the energy from the electron beam. When these atoms relax back to their normal state, they give off energy in the form of x-rays. The x-rays that are emitted have an energy specific to the element that emitted them.

Wavelength Dispersive Spectroscopy works on the principle of diffraction. When the x-rays being emitted from the sample enter the WDS, they hit a crystal with specific crystal lattice parameters. This causes the x-rays to diffract (bend), and the amount the x-rays bend depends on their energy. Thus, the diffractor acts like a prism, separating x-rays by their "color" (energy), which then travel on to the detector. The instrument has multiple diffractors to cover the entire energy range of interest.

Useful for:

- Separating EDS peak overlaps, for example Al-Br or Mo-S-Pb
- Trace element identification
- Elemental quantification using standards for increased accuracy
- Increased sensitivity to light elements, such as Be and B

Applications Include:

- Alloy composition
- Defect identification
- Mapping low atomic number second phases in steels and other alloys
- Defects in electronics and electronics packaging

Instrumentation:

ZEISS EVO LS 15 with Thermo Magnaray WDS and Thermo Ultradry EDS

Data Presentation:

Spectra are collected and are presented either singly, or overlaid onto other spectra for comparison. Quantification using standards are presented in tabular format. Both are stored in either MS Word or Adobe PDF format.

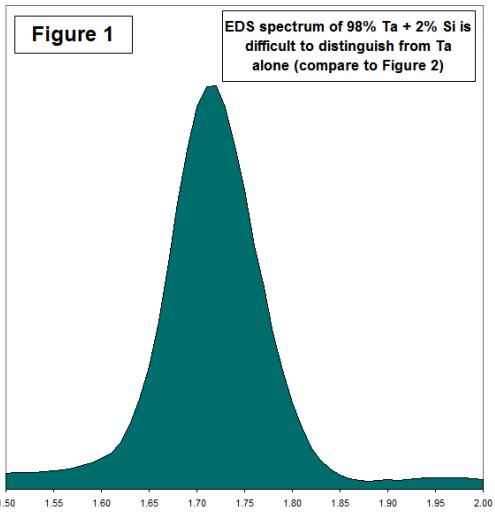
Sample Constraints:

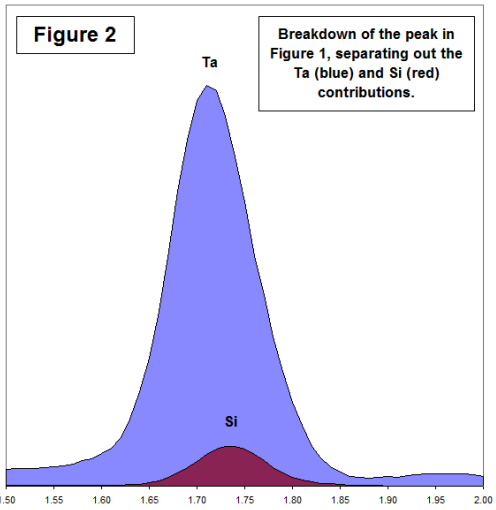
Maximum specimen height = 145 mm, Maximum specimen diameter = 250 mm, Maximum stage movements 125 x 125 mm (X, Y). Regions of interest should be flat and homogeneous for quantitative analysis.

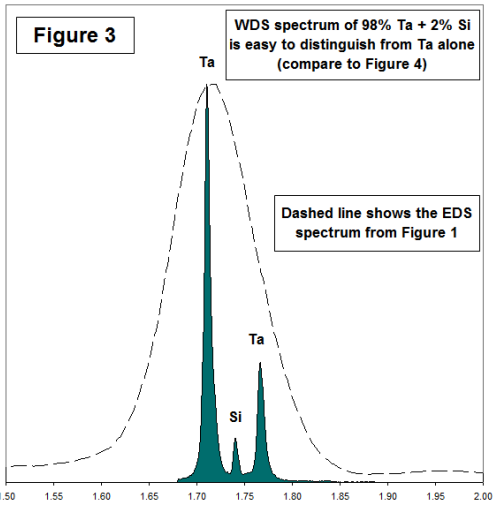
Example:

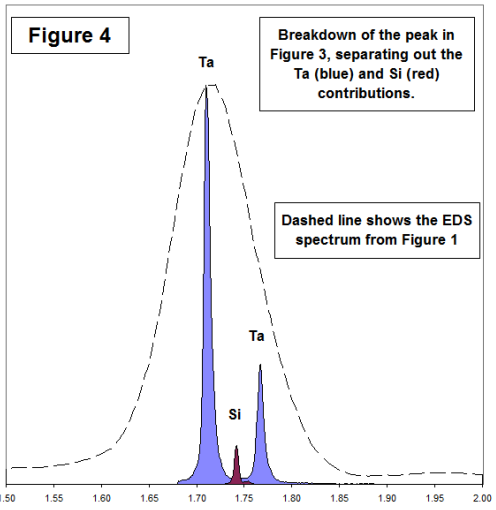
This example shows the spectrum of a small silicon inclusion in a tantalum alloy. Because of the small size of the inclusion, much of the x-ray signal comes from the surrounding tantalum, appearing as approximately 98% tantalum. This spectrum can be seen in Figure 1. Figure 2 shows what the spectra of the individual Si and Ta components would appear like if they could be separated. The shape and position of the Ta peak in Figure 2 (blue) is almost indistinguishable from the Ta + Si peak shown in Figure 1.

WDS has much higher energy resolution, so these overlap problems are eliminated. Figure 3 shows the WDS spectrum taken of the same inclusion using WDS. The small, sharp Si peak between the larger Ta peaks clearly shows that the inclusion was silicon. Figure 4 shows a similar breakdown of the individual components, showing the Ta and Si spectra separately. Figures 3 and 4 have the EDS spectrum from Figure 1 plotted as a dashed line, for comparison.









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