CONSTGLASS

Technical Data sheet

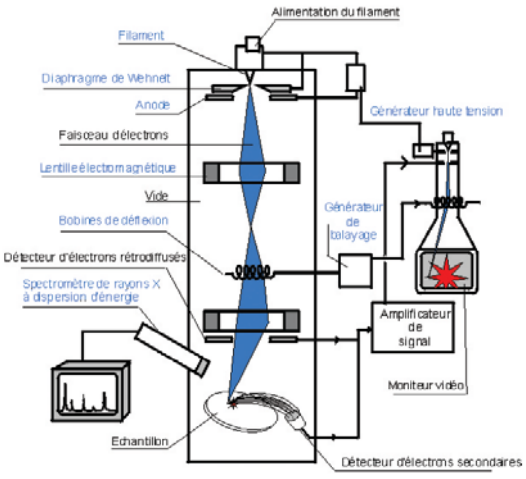
Technique :	**Scanning Electron Microscope (SEM) coupled with energy-dispersive X-ray spectroscopy (EDX)**

General description

This technique permits magnifications up to 100 000 times on most of the solid materials, while maintaining a large depth of field.
It is often coupled with energy-dispersive X-ray spectroscopy, which gives an elementary chemical analysis of samples observed.

MEB-EDS JEOL 5600

Operating principle



An electron beam is produced by a thermo electronic effect from a tungsten filament raised to high temperature (2700°C). This beam is accelerated by the high tension created between the filament and the anode. It is then focused on the sample by a series of three electromagnetic lenses. This probe, which is under 4 nm of diameter, scan the surface of sample point by point.

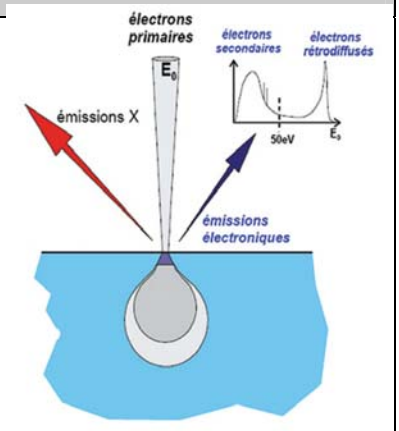
This interaction electron/material leads to many physical phenomena including the emission of secondary electrons, backscattered electrons or X-rays.

The detection of these emissions using specific detectors permits to form an image or to perform elemental analysis.

Scheme of a SEM-EDX

Electron emissions

Secondary electrons	They are low-energy electrons (approx. 50 eV), which comes from the superficial layers of the sample (inferior to 10 nm). This secondary electron emission is very sensitive to the relief of the sample surface. The minor detail change the amount of electrons collected and gives information on the topography of the sample.
Backscattered electrons	They come from the primary beam. They have a relatively high energy (up to 30 keV) and can be released at a greater depth in the sample (few µm). They are sensitive to atomic number elements (Z) : the heavier atoms (those with a large number of protons) re-emit more electrons than the lighter atoms. Thus, areas composed of atoms with a high atomic number appear brighter than others, this is the phase contrast.



X-rays (micro-analysis)	The impact of a primary electron with high energy can ionize an atom of an inner layer. The resulting emission occurs in a "pear" with a volume of about a micrometer. EDX detector (diode of silicon crystal, doped with lithium on the surface) collect the photons emitted during the excitation of atoms, and determine their energy. A multichannel analyser reconstitute the emission spectrum of the sample in the form of a diagram showing the position in energy and intensity of the lines of these elements. These analysis are performed either on a limited area (points), in scan mode (on a larger area) or as a mapping.