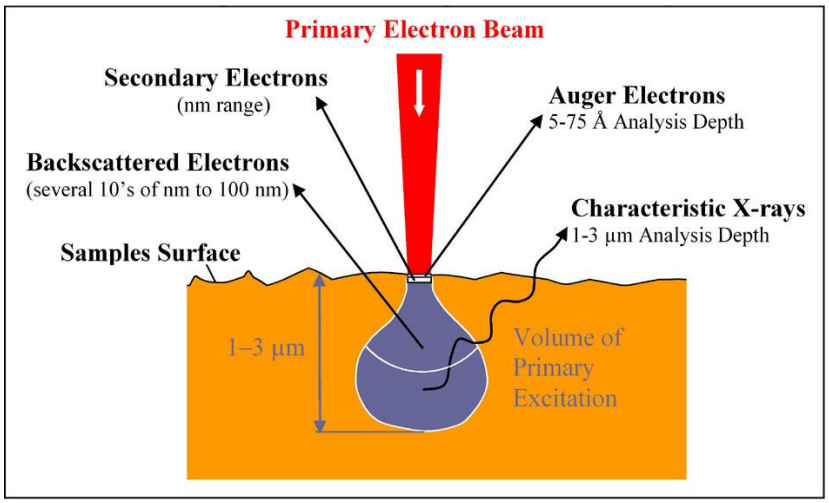
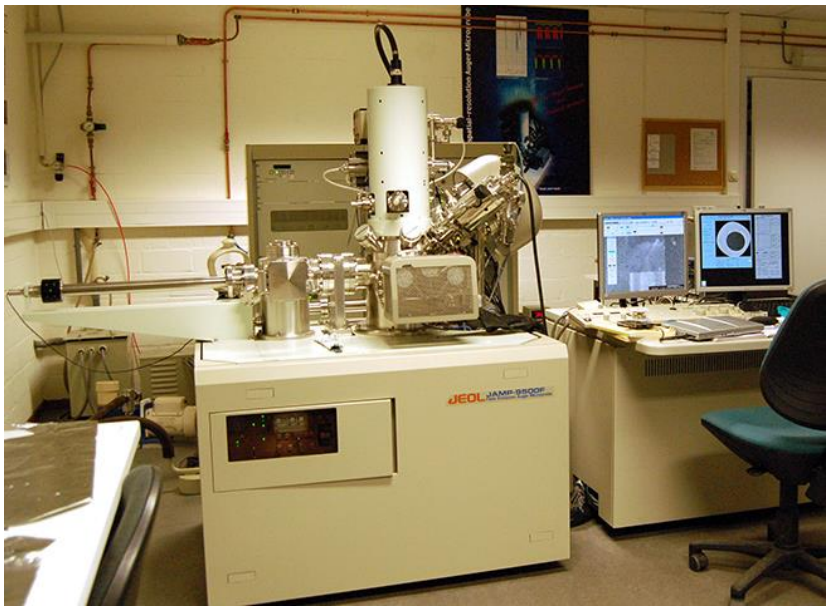
Auger Electron Spectroscopy - AES



Auger spectroscopy is a vacuum technique where a stream of primary electrons is focused onto the sample surface resulting in a number of different particles or waves being emitted (secondary electrons, back-scattered electrons, X-rays, photons, Auger electrons…). The kinetic energy of the escaping Auger electron is characteristic for the emitting atom. Consequently, measuring this energy allows the identification of the atoms present at the surface of the sample under study, while the number of detected Auger electrons of a certain energy is an indication for the concentration of the concerned element.

The Auger electrons are emitted from the first 5-75 Å of the sample surface which results in a very surface sensitive analysis technique.

Instrumentation @ SURF:



- The JEOL JAMP-9500F field emission AES offers an excellent spatial resolution (min. probe diameter of 3 nm for the secondary electron image & 8 nm for Auger analysis). The electron spectrometer is an electrostatic hemispherical analyzer (HSA) with a multi-channel detector, and was optimally designed for Auger analysis. It provides a variable energy resolution from

0.05% to 0.6%. With the JAMP-9500F, high resolution SEM imaging is possible as well as Auger image (mappings) and line profile analysis. Depth profile analysis can be performed using Argon ion etching.

- The PHI-650 AES is equipped with a cylindrical mirror analyser (CMA). Here the energy resolution is fixed at 0.6% and the lowest possible probe diameter is about 200 nm (@ 10 kV). Also in this equipment depth profiling is possible using Argon ion sputtering.

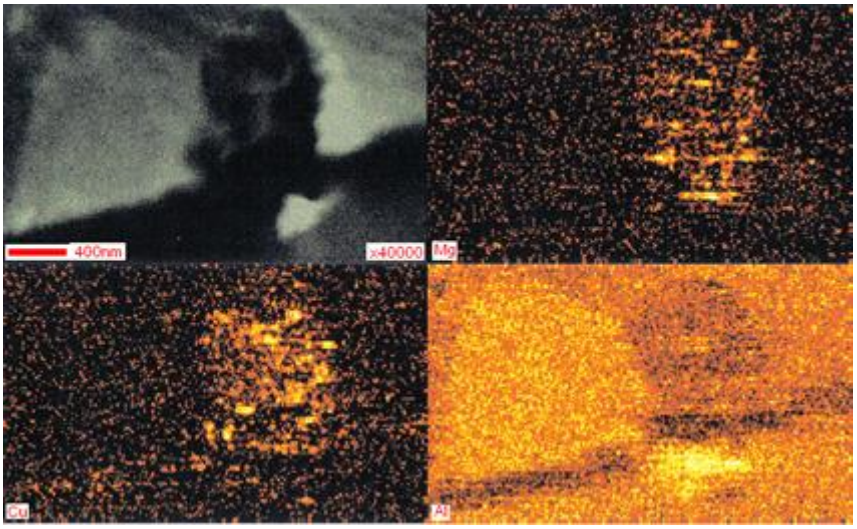
Sample requisites:

- samples should be relatively flat and conductive;
- maximum size : 1.5 cm x 1.5 cm (maximum height 0.5 cm);
- 'wet' samples cannot be analysed due to the high vacuum conditions;
- powders are not allowed in the JEOL JAMP-9500F field emission AES.

Examples of previous or on-going case studies:

- growth mechanism of thin films on different metallic substrates (Al, steel, Cu…);
- intergranular corrosion (IGC) on different alloys;
- nitriding of steel;
- oxidation and hydration of aluminium;
- oxidation of differently thermally treated steel substrates…

In the figure below an example of an Auger mapping is shown. The elemental distribution of Mg, Cu and Al, as well as the corresponding SEM image are visible at a grain boundary of the aluminium substrate. The important compositional effects of Mg and Cu enrichments at the grain boundaries inducing intergranular corrosion of the aluminium substrate were studied with sortalike Auger mappings.



Auger map of a Mg and Cu enriched area at the grain boundary