Auger Electron Spectroscopy (AES)

**Background:**

AES involves the excitation and emission of Auger electrons by a finely focused electron beam having a primary energy of maximum 20 keV. AES provides information about the elemental composition of solid surfaces to a depth of up to 10 nm. The analysis is non-destructive, semi-quantitative and covers all elements except H and He. The materials that can be analysed by AES are limited by their compatibility for doses of primary electrons and by the required conductivity. With the aid of a fracture-stage it is possible to use AES to study fresh fracture planes in suitable samples in ultra-high vacuum (UHV).

**Analysis modes:**

**Surface spectroscopy**

The surfaces of solids can be analysed at spots or in freely defined areas. The lateral analysis resolution is about 100 nm.

**Surface imaging**

In addition to secondary electron images, AE element distribution maps with a lateral resolution of about 100 nm can be recorded by scanning the primary electron beam across the surface.

**Depth profiling**

Using inert gas sputtering with simultaneous AE spectroscopy, quantitative elemental depth profiles down to about a micron can be recorded and hence the near-surface topo-chemistry of a sample can be determined.

**Areas of application:**

The main applications of AES are as follows:

- Internal and external metallic interfaces: segregation, contamination, corrosion
- Semiconductor surfaces: 3-D-structure, particle contamination, depth profiles
- Thin oxide or metallic films: Interface composition, elemental structure
- Analysis of fracture planes: segregation, grain boundary embrittlement, segregations at grain boundaries

Top: Secondary electron image of a fracture plane, induced in UHV, in the embrittled heat-affected zone of a Ni-alloy UDIMET 700

Bottom: Associated AES element distribution map for sulphur with monolayer concentration as the cause of embrittlement