Synchrotron X-ray microfluorescence (SR-µXRF)

Data sheet

Type of samples : any type
Pixel size: 0,2 – 2 µm
Energy range: 2 – 35 keV
Max sample size: 2- 10 cm
Typical sample size: 5 mm
Sensitivity: ppb - ppm
Typical acquisition time: 30 minute / 2D scan
Sample preparation: none or thin sections
Available sample environment: temperature, flluids, mechanical

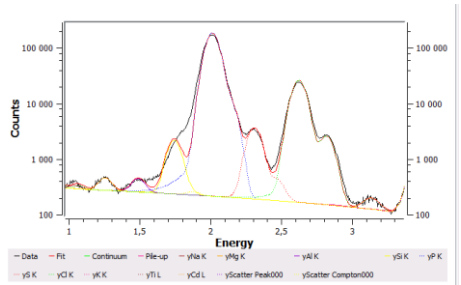
Why X-ray micro-fluorescence ?

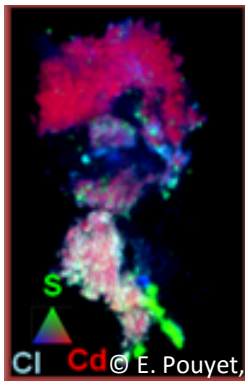
X-ray micro-fluorescence is quantitative technique used to detect, identify and localize trace elements (Z>5) in any type of materials.

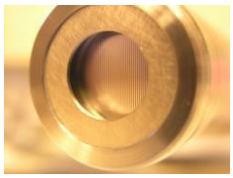
Principle

X-ray fluorescence is a process of interaction of material with X-ray which consists in the re-emission of X-ray photons of energy characteristic of the excited atoms. Incident X-ray photons indeed eject electrons from the inner layers of the target atom and the deexcitation process is realized through an electronic rearrangement in which electrons from the upper layers fill the gap created by the ejected electrons, accompanied by the emission of a fluorescence photon to ensure energy balance.

The energy of the emitted fluorescence photons is directly related to differences in energies of electronic levels, thus the fluorescence spectrum is unique to each element. The global spectrum of a material is characteristic of its elemental composition, and depends on the concentrations of mass.







The high flux and low divergence of the synchrotron beams can be exploited to reduce the size of incident beams down to sub-micron size, paving the way for chemical imaging in scanning geometry: by scanning the sample in front of the microbeam and collecting a spectrum of fluorescence at each point it is possible to rebuild elementary profiles (1D) or maps (2D).

Comparison with similar techniques

- Higher sensitivity than SEM-EX
- Higher spatial resolution than GDMS, LA-ICP-MS
- Higher penetration depth than nano-SIMS, SEM-EDX

Applications

- Detection and identification of trace elements (Z>5)
- Quantification of product diffusion
- Elemental mapping