Dynamic Secondary Ion Mass Spectroscopy (DSIMS)

SCIENCE ET SURFACE
Filiale de SERMA TECHNOLOGIES

SPECIFICATIONS

- **Elemental analysis**: all elements are detectable (H included), but sensitivity varies from an element to an other
- **Analytical depth**: depth from 1 nm to 20 µm
- **Quantitative analysis** :
  - Absolute: impossible without preliminary calibration (matrix effects)
  - Comparative: possibility to compare intensities between samples with same matrix.
- **Detection level**, depending on the element and matrix:
  - Alcalines and halogens: < ppm (part per million: 1 atom on 1 million)
  - Organic elements (H, C, O, N): around ppm,
  - Metals: 100 ppb to 100 ppm
  - Noble metals (Au, Pt): 100 to 10 000 ppm
  - Rare gases: < several tenths of atomic % or undetectable
- **Spatial resolution** : > 100 nm in imaging mode
- **Micro-analysis** : 10 x 10 µm² minimum to 2 x 2 mm² maximum
- All specimen analysis including **insulating samples**
- Analysis under **ultrahigh vacuum** (10^{-9} - 10^{-10} torr)

PRINCIPLE

The surface of the sample is bombarded by a few keV ion beam, called primary ions. Under bombardment the material is eroded and many secondary particles are emitted from the surface (electrons, photons, atoms and neutral molecules, excited atoms and molecules, ions).

The **secondary ions** produced by the pulverization are analyzed by **mass spectrometry**. The type of analysis is conditioned by the ion detection mode: elemental analysis (mass spectrum), distribution depth profiling (evolution of the ion intensity as a function of etching time), linescan (evolution of the ion intensity along a scanning line) and ion imaging (chemical mapping).

The density of primary ions can be varied, in order to obtain a wide range of analyzed depth (from 1 nm to 20 µm). SIMS is thus **a surface analysis technique.**

There are two modes of analysis: positive ions / negative ions, depending on the elements to be analyzed.

Generally, electropositive elements will mainly give positive ions and electronegative elements, negative ions.