**Introduction**

The Hiden EQS is a high transmission quadrupole secondary ion mass spectrometer. SIMS, delimits including a 4” electronic sector for simultaneous on energy analysis. Ions are collected on the axis of the device which makes it very popular for fitting as an after-market detector to a wide variety of surface analysis instrumentation. The standard EQS can also be used to monitor the residual gas when using an electron impact ionizer fitted within the device, from sample to the ionizer, leads to a low sensitivity. Sputtered neutral mass spectrometry, SNMS, is a desirable technique that contains SIMS by providing fast and quantifiable concentration data in the 0.1 to 100 atomic % regime where the matrix effect of SIMS makes direct quantification non-linear and unavailable.

**SIMS vs SNMS**

Both techniques provide mass resolved information for mass spectra, concentration depth profiles and images. SIMS is suited to trace analysis and SNMS to higher concentrations. Combining the techniques provides a very powerful quantitative materials analysis method.

- **SIMS**
  - ions created by the sputtering event
  - small fraction of all emitted particles
  - easily collected by electric field
  - absolute fraction depends on surface chemistry
  - non-linear when concentration above a few percent
  - quantifiable in range ppb to 5 atomic %
  - requires references materials of very similar chemistry

- **SNMS**
  - ions created by separate ionizer
  - neutrals represent most of the emitted particles
  - can only be collected by proximity of the ionizer
  - ionized fraction independent of surface chemistry
  - non-linear in all concentrations (0.1 to 100 atomic %)
  - requires reference material containing the element of interest

**Mass Interference**

The electron impact source also ionizes CO from the residual gas which can cause a significant mass interference at mass 28. However, use of an electron energy below the appearance energy of CO provides efficient selection of the Si signal.

In Use

Turning the filament off, with all other potentials remaining the same, permits detection of “breakthrough” SIMS ions to be monitored. Even in the case of a very high ion yield material, such as potassium, this only represents a few percent.

The data shown are from a natural mineral sample of microcline (KAlSi3O8) sputtered using 5 keV Ar+ ions. The K signal is detected as a function of kinetic energy, determined by sweeping the transit energy of the ions through the electrostatic analyzer.

The sample is insulating and a 500 V electron flood has been used to provide charge compensation. This is not actually required for the analysis of neutrals but must be provided to ensure the primary ion beam is not affected by high surface potentials.

Conclusions

Modification to the Hiden EQS analyser permits mass and energy analysis of fast neutral species for both materials analysis and basic surface emission studies. Selective measurement with the ionizer filament off enables any breakthrough ions to be detected, thus their contribution to the overall result can be subtracted.

**References**