

Accelerator-SIMS: technique and astrophysical applications

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The use of an ion source for Secondary Ion Mass Spectrometry (SIMS) coupled to the Accelerator Mass Spectrometry (AMS) facility allows expanding the measurement capabilities of both systems. Such a system is installed at ETH Zurich, where an ATOMICA SIMS ion source is coupled to the 6 MV Tandem.

As in AMS all molecules are destroyed at the tandem accelerator allowing for measurements without molecular interference. Furthermore, the high ion energies allow to identify isobaric interference in an ionization chamber. This is a big advantage over the conventional mass spectrometry in the heavy mass region where molecular and isobaric interferences severely limit mass spectrometric analysis.

Compared to similar measurements of stable isotopes using standard AMS facilities the SIMS source allows to sputter the sample material in a controlled way and a clean environment. In addition up to three isotopes can be measured quasi-simultaneously with the fast beam switching system at the first mass-analyzing magnet and a position-sensitive detector after the final mass-analyzing magnet. This results in higher accuracy of the measured isotopic ratios even under changing sputtering conditions.

Within the EuroGENESIS program we are using Accelerator-SIMS to measure isotopic compositions of heavy elements in pre-solar grains, which are difficult to analyze with conventional mass spectrometry due to molecular and isobaric interferences. The isotopic signatures in these grains carry the fingerprint of nucleosynthesis and provide valuable astrophysical information.