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Full Mass Range, Multi-Elemental Analysis with a Rapid Scanning Single Collector Sector Field ICP-MS for Laser Ablation Analysis

Meike Hamester, **Julian Wills**, **Reinhold Pesch** & **Johannes Schwieters**

Finnigan MAT GmbH, Barkhausenstrasse 2, Bremen, 28205, Germany

For single spot and particularly single pulse laser ablation analyses, sector-field ICP-MS with its high instrumental sensitivity is ideally suited for multi-elemental applications requiring high spatial resolution (small spots) as the amount of ablated of material is very small (in the order of ng).

Traditionally, magnetic sector based ICP mass spectrometers are considered to be much slower than quadrupole based instruments. The latest generation of double focusing magnetic sector ICP-MS instruments however, through a combination of fast magnet jumps across the mass range and fast electrical scanning over a wide relative range (magnet rest mass +30%), provide the analyst with comparable sample measurement times for multi-elemental analyses. However, this scan speed was still not fast enough to monitor several elements from short sampling events for example single laser pulses.

The present work describes a newly developed high power magnetic field regulator for a high-resolution magnetic sector-field ICP-MS (Finnigan MAT ELEMENT2) that doubles the magnetic scan speed. Through the implementation of this modification the average magnetic jump time from m/z 6 to m/z 250 drops to ~500 s/amu, while the corresponding jump back is cut to ~30 ms.

This reduction in scan cycle offers for the first time the possibility to use the high sensitivity of sector field ICP-MS for fast transient data analysis from laser ablation based applications.

The advantages of the combination of high sensitivity and high scan speed will be shown through examples from a selection of different geological applications for example major and trace REE analyses in single crystals.