Goldschmidt 2024 Abstract
https://doi.org/10.46247/gold2024.24841

Advances in Aligned LA–ICP–MS

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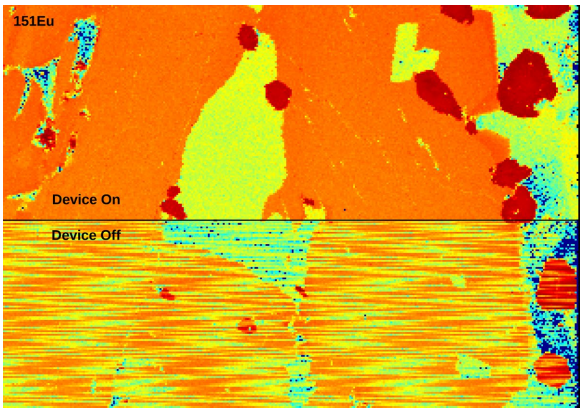

The use of fast-washout ablation cell (“fast cells”, washout time to 1% < 50 ms) for LA–ICP–MS can improve spatial resolution of images, reduce measurement time, and raise peak signal intensity – which in some cases may bring signals above detection. The obvious application of fast cells has been for imaging, which is a powerful and useful technique with a wide range of applications in the earth, material, and biological sciences[1].

The main issue caused by using fast cells with a sequential mass spectrometer, such as a quadrupole, is the prevalence of aliasing. While some measurement strategies can mitigate this problem, the resulting conditions will be sub-optimal for the application. One approach would be to lengthen the response time of the ablation cell, which is then fundamentally at odds with the objective of collecting images that contain millions of pixels[2].

Our new approach[3] is to align firing of the pulsed laser with the sweep time of the single-detector mass spectrometer. We call this aligned LA–ICP–MS and the technique can be implemented by way of an external circuit that monitors the mass filter position of the mass spectrometer in real time and fires the laser as required.

To demonstrate the technique we have collected a series of images from biological and mineral samples which show that aligned LA–ICP–MS makes it feasible to use fast cells with quadrupole mass spectrometers by eliminating aliasing. We will also demonstrate recent advances, such as the ability to selectively increase or decrease the signal intensity for individual masses within the sweep, how we can perform simultaneous detection on a sequential mass spectrometer, expanded support for different mass spectrometers, and the “sweep log” feature which for the first time allows sweep-perfect integration periods to be automatically aligned to laser firing periods.

[1] Doble, Philip A., et al. *Chemical Reviews* 121.19 (2021): 11769-11822.

[2] Marillo-Sialer, Estephany, et al. *Journal of Analytical Atomic Spectrometry* 35.4 (2020): 671-678.

[3] Norris, C. Ashley, et al. *Journal of Analytical Atomic Spectrometry* 36.4 (2021): 733-739.