



SIMS-24

24th International Conference on Secondary Ion Mass Spectrometry

8-13 September 2024

La Rochelle, France

www.sims-24.com

New generation of microscope mode secondary ion mass spectrometry imaging

Felicia GREEN

Yifeng Jia¹, M. Elena Castellani^{1,2}, Zoltan Takats², Michael Burt¹, Mark Brouard¹, Felicia Green^{1,2}

¹University of Oxford Department of Chemistry, Oxford, United Kingdom

²Rosalind Franklin Institute, United Kingdom

Stigmatic ion microscope imaging enables us to decouple the primary ion (PI) beam focus from spatial resolution and is a promising route to attaining higher throughput for mass spectrometry imaging (MSI). Using a commercial "C" ₆₀⁺ PI beam source, we can achieve mass spectral imaging of positive and negative secondary ions (SIs). Our approach involves simultaneous desorption of ions across a large field of view, enabling mass spectral images to be recorded over an area of 2.5 mm² in a matter of seconds. To optimize mass resolution for a range of masses, we applied an exponential pulse on the extractor plate. The mass resolution for a 399 Da mass peak was improved from 705 m/Δm to 6907 m/Δm, effectively resolving a previously confluent peak into three distinct mass peaks. To demonstrate the spatial resolution, we used a Rhodamine B grid and with optimisation and image processing we were able to get spatial resolutions of 3-4 μm.

A Timepix3 camera has been integrated into the current instrument, leveraging the novel position-sensitive detector, the repetition rate has seen a remarkable increase from 6-7 Hz to 1000 Hz. This substantial enhancement means a reduction in data acquisition time of ~150 times. This advancement represents a significant leap forward for the new generation instrument, bringing it closer to fulfilling the potential of the microscope mode technique.