WS202 LOW-DISPERSION LA-ICP-MS CELLS: HIGH-RESOLUTION TISSUE IMAGING AND SINGLE CELL ANALYSIS

Stijn Van Malderen, Frank Vanhaecke, Eva Vergucht, Laszlo Vincze, Department of Analytical Chemistry, Ghent University, Krijgslaan 281–S12, B-9000 Ghent, Belgium; Colin Janssen, Department of Applied Ecology and Environmental Biology, Ghent University, Jozef Plateaustraat 22, B-9000, Ghent, Belgium; Tessa Buckle, Department of Radiology, Leiden University Medical Center, Albinusdreef 2, PO Box 9600, 2300 RC Leiden, The Netherlands; Charlotte Carlier, Wim Ceelen, Ghent University Hospital, Department of Gastrointestinal Surgery, De Pintelaan 185, B-9000, Ghent, Belgium; stijn.vanmalderen@ugent.be

In the past few years, novel applications of, and sampling approaches for elemental mapping via Laser Ablation – Inductively Coupled Plasma – Mass Spectrometry (ICP-MS) have been emerging in cellomics, metallomics and proteomics. Simultaneously, efforts in the development of new aerosol transport setups have accelerated, and the metrics related to the initial aerosol dispersion within the ablation cell and the aerosol dispersion induced by difusion and turbulence are being improved [1,2]. These new applications and sampling approaches clearly benefit from better detection limits and higher sample throughput associated with low-dispersion ablation cells. Novel applications include the quantification of trace elements within structures no larger than the beam size, such as single-celled organisms. In a first study, the model organism *Scrippsiella trochoidea*, a photosynthetic dinoflagellate (unicellular protist), was exposed to Cu concentrations at 12 different levels, ranging from 0.5 to 100 µg/L. The cells were treated with a critical point drying protocol, transferred from a polycarbonate membrane to a carbon stub and sputter-coated with a Au layer for scanning electron microscopy (SEM) analysis. After SEM analysis, ~100 cells of each population were individually ablated using a single-point ablation protocol. The approach allowed not only the mean concentration of Cu in the cell population, but also the Cu distribution in the entire population across different exposure levels to be evaluated. These results complement synchotron radiation confocal X-ray fluorescence (XRF) micro-imaging results of individual cells at the sub-cellular level, captured and manipulated by optical tweezers for *in vivo* analysis [3].

A second topic that will be presented, is the implementation of faster scanning rates, in combination with low-dispersion cells and the combined effect on the lateral resolution in the scanning direction in nuclide distribution images of crytomed tissue sections. In this context, we highlight the current fundamental and technical limitations imposed upon current instrumentation, such as the data aquisition rate and transport efficiency. We view this information to be of interest due to the current limitations on the throughput, which inhibit LA-ICP-MS to be broadly deployed as a diagnostic tool. The examples addressed comprise high-resolution (5-20 µm spot size) mapping of a mouse tissue section doped with a C-X-C chemokine receptor type 4 lanthanide [^{165}Ho] fluorescent probe and the cisplatin ($PtCl_2(NH_3)_2$) distribution in peritoneal tumor nodules after intraperitoneal chemoperfusion. Both examples demonstrate the value of higher lateral resolution in LA-ICP-MS.

[1] S. J. M. Van Malderen, J. T. Van Elteren and F. Vanhaecke, *Anal. Chem*., **87**, 6125-6132 (2015).

[2] S. J. M. Van Malderen, J. T. Van Elteren and F. Vanhaecke, *J. Anal. At. Spectrom*., **30**, 119-125 (2014).

[3] E. Vergucht, T. Brans, F. Beunis, J. Garrevoet, M. De Rijcke, S. Bauters, D. Deruytter, M. Vandegehuchte, I. Van Nieuwenhove, C. Janssen, M. Burghammer and L. Vincze, Sci. Rep., **5**, 9049 (2015).