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Lasers in Ghent – the 16th European Workshop on Laser Ablation

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In 1994, the first edition of the European Workshop on Laser Ablation (EWLA) was organized by the British Geological Survey in Keyworth, UK. Ever since, EWLA is a key international meeting focused on novel developments in LA-based micro-analytical techniques for spatially resolved elemental and isotopic analysis. Progress in research on laser–matter interactions, particle formation, transport phenomena and calibration, enables applications in very diverse contexts, ranging from geology and planetary research to environmental and biomedical sciences. During the EWLA meetings over the past three decades, such fundamental studies and challenging applications have been covered.

The 16th edition of EWLA took place in Ghent, Belgium, and attracted almost 200 participants who were not only offered an overview of the new developments in the field, but were also given an opportunity to get better acquainted with the city's historical centre and the Belgian (beer) culture.

The opening lecture of the 16th edition of EWLA was given by Prof. Dr Detlef Günther of ETH-Zürich. In a mere 30 minutes, he took the audience on a 40 year journey revisiting our understanding of LA-ICP-MS. Even though our fundamental understanding improved tremendously since the first introduction of the technique back in 1985 by Alan Gray,[1] some pieces of the analytical puzzle related to elemental fractionation and calibration, remain incompletely solved and new technical developments not only enhance the analytical capabilities of LA-ICP-MS but often also challenge our current views and serve as inspiration towards novel fundamental research.

The development of highly efficient low-dispersion ablation cells improved the analytical performance significantly, yielding lower particle agglomeration as a result of the shorter residence time of the aerosol in the ablation cell, suppressing ICP-induced elemental fractionation originating from incomplete particle vaporization.[2] Additionally, reduction of the aerosol dispersion also minimizes the duration of the transient peak profiles down to the sub-ms range, boosting the pixel acquisition rate of elemental mapping up to 1000 pixels per second.[3,4] However, the enhanced detail with which the aerosol behaviour can be studied using such improved set-up also gave origin to novel fundamental questions.

Due to the highly efficient transport nowadays achievable, LA has also been gaining popularity as an alternative sample introduction system for single particle ICP-MS (SP-ICP-MS), ever since its first application in 2019 revealing the quantitative distribution of Au nanoparticles (NPs) in cross-sections of sunflower plants.[5] The approach is based on low-energy LA scanning to release the metallic NPs as intact entities from biological material. Short signal spikes ($\approx$500 μs) associated with intact metallic NPs can be monitored and distinguished from the continuous signal arising from the same element present in a non-particulate form. In this themed issue, two papers from the group of Prof. Dr Andreas Limbeck (TUWien, Austria) are dealing with the development of novel calibration approaches for LA-SP-ICP-MS. One of these papers reports on a quantification strategy based on external calibration with spin-coated thin polymer films spiked with known amounts of liquid elemental standards. NP sample suspensions were embedded similarly in thin polymer films and quantitatively ablated at low fluence to maintain the integrity of the NPs. Calibration curves were constructed based on the mean peak area and the absolute mass of the target element corresponding to each laser pulse, from which spherical-equivalent particle size distributions could be derived (**https://doi.org/10.1039/D4JA00385C**). A second work also reported on the use of similar spin-

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coated thin polymer films but used in the context of the analysis of spherical polystyrene (PS) microplastic particles based on $^{13}C^{+}$ monitoring (https://doi.org/10.1039/D4JA00351A). The PS bead suspensions were spotted on a glass substrate after dilution with ethanol, followed by oven-drying, and low-energy LA was used to catapult or non-destructively desorb beads from the glass slide.[6]

Prof. Dr Takafumi Hirata (The University of Tokyo, Japan) and his research group presented a novel setup for simultaneous mapping of elements and biomolecules relying on a femtosecond LA-system with galvanometric mirrors, in combination with a split-flow approach enabling the simultaneous use of two mass spectrometers equipped with different plasma-based ion sources (https://doi.org/10.1039/D5JA00039D). For hard ionization and subsequent elemental analysis, an ICP ion source combined with a quadrupole-based ICP-mass spectrometer was relied on, while for soft ionization and molecular analysis, a dielectric barrier discharge ionization (DBDI) source was coupled to a hybrid quadrupole time-of-flight mass spectrometer. An additional heater was installed upstream of the DBDI to boost analyte desorption from the LA-generated aerosol. The analytical performance of the instrumental setup was demonstrated by revealing the distribution of endogenous elements, such as Mg, P, Cu, Fe, Zn and Mo, alongside that of metabolites and lipids, *e.g.*, cholesterol, ceramide, sulfatides and adenine, in mouse brain tissue sections.

Overall, there was a lot of interest in the latest developments of cryogenic ablation chambers mainly developed for the analysis of ice cores as natural chronological archives and the fundamentals of femtosecond LA of ice were reported on. The development of the N_2-based microwave inductively coupled atmospheric-pressure plasma (MICAP) ion source and its coupling to mass spectrometry enabled successful application of N_2 as a viable alternative to He as the carrier gas.[7]

This year's edition of EWLA introduced the "Upcoming Talent" awards for early career researchers (up to 3 years after obtaining their PhD) and the winners were Dr Kristina Mervič (National Institute of Chemistry, Ljubljana, Slovenia) and Dr Sota Niki (Nagoya University, Japan). Kristina presented her research that led to the development of novel calibration methods based on volume correction, enabling quantitative LA-ICP-MS analysis without matrix-matched standards. Sota's award lecture unveiled a novel system for online isotopic analysis of individual particles produced *via* femtosecond laser ablation, shedding light on the mechanisms of elemental fractionation. A special thanks to *JAAS* and the Royal Society of Chemistry for sponsoring these awards and congratulations to these successful young researchers.

Finally, a big and heartfelt "thank you" to all attendees and all sponsors of the conference for making this a successful edition of EWLA. See you all in Milan, Italy for EWLA2026!

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