Between fundamentals and applications – the important role of analytical chemistry

C. Neff, P. Becker, T. Vonderach, J. Koch, B. Hattendorf, D. Günther

Laboratory of Inorganic Chemistry, ETH Zürich,
Vladimir-Prelog-Weg 1, CH-8093 Zürich, Switzerland
detlef.guenther@inorg.chem.ethz.ch

The major challenges of our times request sustainability in everything we are planning in the future. Environmental protection, discovery of new resources, characterization of new and lightweight materials, material replacement and reduction in the construction industry, food production and safety and life science and medicine are important topics, among others, where analytical chemistry plays a major role. The availability of the entire portfolio of analytical techniques is of utmost importance while constant refinement and development is required in order to provide high compatibility and flexibility for applications in the aforementioned research fields.

The group for Trace Element and Micro Analysis at ETH Zurich studied a variety of instruments, processes and methods related to element analysis and isotope ratio determinations. Instruments were developed which become more and more applied. For example, a significantly improved prototype inductively coupled plasma time of flight mass spectrometer (ICP-TOFMS) led to the renaissance of TOF-MS instruments and they are now commercially available (TOFWERK AG, Thun Switzerland). These instruments contribute to knowledge generation in many fields of research, e.g. in life science, medicine, geology and chemistry. Here we report a new sample introduction system for laser ablation generated aerosols introduced into an ICP-TOFMS, which has recently been developed and tested in our group. The aerosol washout and the improvements in terms of image acquisition time will be discussed.[1]

For many decades Argon has been the plasma gas of choice for ICP-MS, even though alternative gases have been proposed and tested. To exploit the possibility of Argon substitution, a recently introduced Nitrogen plasma source (Radom, Milwaukee, USA)[2] has been studied in combination with laser ablation. We also report results on direct solid analysis by LA-ICP-MS using nitrogen as plasma gas.[3]

Finally, the analyses of single cells gained significant attention using a cy-TOF-MS. Therefore, the geometry of the ICP-MS has been modified to improve the throughput of single cells and nanomaterials.[4] The system and the current performance will be presented.[5]

[1] C. Neff, P. Becker, D. Günther, *JAAS* **2022**, 37 (3), 677-683.
[2] M. Schild, A.W. Gundlach-Graham, A. Menon, J. Jevtic, V. Pikelja, M. Tanner, B. Hattendorf, D. Günther, *Anal. Chem.* **2018,** 90 (22), 13443-13450.
[3] C. Neff, P. Becker, B. Hattendorf, D. Günther, *JAAS* **2021**, 36 (8), 1750-1757.
[4] T. Vonderach, B. Hattendorf, D. Günther *Anal. Chem.* **2021,** 93 (2), 1001-1008.
[5] T. Vonderach, D. Günther, *JAAS* **2021**, 36 (12), 2617-2630.