

Photoionization Interest Group Workshop Report

“Photoionization MS: How to Identify the Best Technique for an Analytical Problem?”

70th ASMS Conference on Mass Spectrometry and Allied Topics, Minneapolis, MN

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Organized by:

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Luke Hanley (University of Illinois at Chicago)

Christopher Rüger (University of Rostock, Germany)

Approx. Attendance: 25

Description:

We reviewed the fundamentals of photoionization (PI) MS in our 2018 workshop and discussed existing techniques as either vacuum or atmospheric pressure-based in 2020. We have therefore decided that this year's PI workshop will address the challenge of identifying the most suitable PI technique for an analytical problem. This topic ties up to the 2019 workshop in which we addressed the transfer of PI techniques from academic research to industrial applications.

With the goal of addressing the wide variety and complex nature of techniques, three presentations were selected to cover a diverse set of methods and to illustrate the substantial differences between existing approaches beyond just their pressure regimes. Each of the presentations was followed by a discussion of the respective technique's experimental requirements and its analytical potential. The discussion of topics of general interest to the photoionization interest group was encouraged and led to conversations about such as the commercial availability of light sources (e.g., APPI lamps) and recent changes (e.g., APLI is no longer commercially available).

Dr. Ryan Rodgers (MagLab, FL, USA) presented on his utilization of APPI for the analysis of complex samples (e.g., petroleum, asphaltene, crude oil, bio-oil) with high resolution FT-ICR MS. His presentation demonstrated the importance of interactions of species at high pressure regime, especially when following a “dilute and shoot” approach to minimize sample preparation. Ryan's presentation illustrated how matrix effect issues can complicate APPI/APCI application, e.g., the selective ionization of low molecular weight acidic or basic compounds in positive and negative ion modes, respectively. Ryan emphasized that APPI is the most robust technique for his applications, but sample preparation can be needed to overcome ionization suppression and matrix effects.

Dr. Sven Ehlert (Photonion, Germany) drew a distinctly different picture for the field of vacuum-based photoionization, highlighting the advantage of minimized interaction between analytes

with one another and with matrix species at vacuum conditions, but also pointing out the reduced analytical sensitivity due to the pressure reduction. He presented data from applications from coffee roasting and tobacco smoke analysis (with high temporal resolution, “puff resolved”) and discussed details such as several different light sources (e.g., 10.5 eV vs. F₂ excimer laser at 157 nm), as well as selectivity with approaches such as REMPI, being highly sensitive and selective towards aromatic constituents.

Dr. Simeon Vens-Cappell (Bruker Daltonics, Germany) presented about recent developments in the field of post-ionization and the commercialization of the MALDI-2 technique for mass spectrometry imaging on an orthogonal high-resolution time-of-flight platform. Simeon illustrated very impressive enhancement capabilities of the imaging contrast for species such as lipids and N-glycans. He discussed important additional fundamental parameters such as the timing delay or laser fluence that are introduced with the additional modality.

Due to an intense discussion and interaction between the speakers and the audience, the workshop went even overtime on the 70 min timeframe.

Next year’s workshop will be organized by Luke Hanley and Christopher Ruger, together with a newly selected volunteer to serve as coordinator for the next three years.