MALDI Mass Spectrometry: What do we know about the Mechanisms
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Over the last decade mass spectrometry has acquired a central role as an analytical tool in the life sciences. Proteomics as conducted now a days in particular depends entirely on mass spectrometry and is, in fact, driven by it. Matrix-Assisted Laser Desorption/Ionization Mass Spectrometry (MALDI-MS) is one of the two techniques which allows for the efficient generation of single ions of large labile biomolecules.

While the applications of MALDI-MS are widespread meanwhile, spanning all fields of analytical chemistry from small organic molecules to synthetic polymers and biopolymers, our understanding of the mechanisms, which lead to the formation of relatively abundant and stable ions under laser exposure of the matrix-embedded samples, is still very limited. Most of the information, collected so far is based strictly on the analysis of the ions recorded in the spectra and their dependence of the various experimental parameters. Because by far most of the material removed by the laser exposure consists of neutral molecules and clusters, it is important to investigate their properties as well.

After a short introduction into MALDI-MS and how to do it, the lecture will present experiments which shed some light on the sample formation and the interaction of the laser beam with the sample. Incorporation of analytes into the matrix lattice and its implication for the ion formation will be discussed first. Measurements of the material removal and documentation of the dynamics of the plume development will follow.

Suggested readings:

Horneffer, V.; Forsmann, A.; Strupat, K.; Hillenkamp, F.; Kubitscheck, U.;
Localization of Analyte Molecules in MALDI Preparations by Confocal Laser Scanning Microscopy
Anal. Chem. 73 (2001) 1016

L. R. H. Cohen, K. Strupat and Franz Hillenkamp
Analysis of Quarternary Protein Ensembles by Matrix Assisted Laser Desorption/-Ionization Mass Spectrom.

Mechanisms in MALDI Analysis: Surface Interaction or Incorporation of Analytes?

Menzel, Ch., K. Dreisewerd, St. Berkenkamp and F. Hillenkamp
The role of the Laser Pulse Duration in Infrared Matrix-Assisted Laser Desorption/Ionization Mass Spectrometry

Rolfing, A., Ch. Menzel, L. M. Kukreja, F. Hillenkamp and K. Dreisewerd
Photoacoustic Analysis of Matrix-Assisted Laser Desorption/Ionization Processes with Pulsed Infrared Lasers

Arne Leisner, Andreas Rohlffing, Stefan Berkenkamp, Franz Hillenkamp and Klaus Dreisewerd
Infrared Laser Post.Ionization of large Biomolecules from an IR-MALDI(1) Plume

G. Westmacott, W. Ens, F. Hillenkamp, K. Dreisewerd, M. Schurenberg
The influence of laser fluence on ion yield in matrix-assisted laser desorption ionization mass spectrometry

Luedemann, Hans-Christian, Robert W. Redmond, and Franz Hillenkamp
Singlet-Singlet Annihilation in UV-MALDI Studied by Fluorescence Spectroscopy