

Matrix-Assisted Laser Desorption/Ionization with ultrashort laser pulses

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Matrix-Assisted Laser Desorption/Ionization (MALDI) is one of the most important tools to transfer non-volatile large molecules into the gas-phase. In combination with mass spectrometry, it is a powerful technique in the field of biochemical or physiological research. Nevertheless, the MALDI process itself is still controversial, especially the charge transfer from the matrix to the analyte [1].

Several theoretical and experimental investigations have been performed in order to examine the charge transfer. Common matrix substances have got absorption bands in the UV and a weak bounded proton, which is transferred to the analyte molecule. Due to its wavelength (337 nm) and its pulse duration in the nanosecond regime, N₂-lasers are widely used in commercial MALDI apparatuses.

In our group, we perform successfully MALDI by using femtosecond laser techniques in order to examine the ionization process. One recent result is MALDI with ultrashort laser pulses in the near IR (central wavelength of $\lambda=800$ nm) [2]. In this wavelength regime, used matrix substances have no absorption bands. Experiments with different laser pulse durations suggest that multi photon ionization is a relevant factor. Charge transfer reactions have also been examined by using cations like K⁺ instead of protons. Employing ultrashort laser pulses in the near IR regime, it was possible to apply coherent control techniques on MALDI. First results will be presented.

[1] F. Hillenkamp and J. Peter-Katalinić (editors), MALDI MS A practical guide to instrumentation, Methods and Applications, (2007), Wiley VCH

[2] J. Wichmann et al., Rapid Comm. in Mass Spectrom. 23, 1105-1108 (2009)