Mobile High-Resolution Multiple-Reflection Time-of-Flight Mass Spectrometer for in-situ Analytics

Student Abstract Award Winner

J.LANG, W.R.PLAß, T.DICKEL, J.EBERT, H.GEISSEL, M.YAVOR, C.SCHEIDENBERGER

Giessen University / GSI, Germany

Many mass spectrometric methods, such as de-novo sequencing, require high mass resolving power and accuracy to determine unambiguously the composition and structure of molecules. Until now, mass spectrometers for these applications are rather large and immobile.

In this contribution a novel and mobile multiple-reflection time-of-flight mass spectrometer (MR-TOF-MS) will be presented. It will achieve a high mass resolving power exceeding 100000 and sub ppm accuracy in a compact design. Due to short cycle time (compared to FT-ICR and Orbitrap MS) vacuum requirements are rather moderate and the measurement rate up to 1kHz provides GC/MS compatibility. There is no fundamental upper mass limit and a large duty cycle allows for high efficiency. Its compactness and robust concept favors in-situ analytics at any place, even in an rough environment. Mechanical stability has been carefully considered to obtain a rugged setup in every component. An atmospheric pressure interface (API) for atmospheric ionization techniques (DESI, ESI, REIMS) makes it versatile and opens various fields of application. Besides the API the MR-TOF-MS consists of an RFQ cooler, RF ion trap, time-of-flight analyzer, MCP detector and DAQ. Vacuum system components, power supplies as well as electronics are mounted together with the ion optical mass spectrometer parts in a single frame. The system has been built and is currently being commissioned.

Projected applications include in-situ mass spectrometry such as realtime tissue recognition in electrosurgery, identification of mycotoxins and analysis of soil samples for environmental studies. This unique combination of high mass resolving power and accuracy, compactness, robustness and mobility perfectly qualifies for use in harsh environment, future space missions or airborne climate investigations.