MS 4: New Methods and Technical Developments

Time: Tuesday 14:30–15:30 Location: RW 2

Invited Talk MS 4.1 Tue 14:30 RW 2

Secondary ion mass spectrometry using large gas cluster ion bombardment — •Hubert Gnaser — Department of Physics and Research Center OPTIMAS, University of Kaiserslautern, Germany

The characterization of organic and biological materials by secondary ion mass spectrometry (SIMS) has greatly benefited from the use of cluster ions as primary bombarding species. In particular, large gas cluster ions such as Ar_n^+ (with n > 1000 Ar atoms and an impact energy of about 10 keV) have led to a substantial improvement in those analyses. Using large cluster ions for sputtering, the emission of intact organic and biological molecules from surfaces is often observed. In addition, these "soft" ejection processes result in a pronounced reduction of molecular fragmentation. Thereby, depth profiling and 3D imaging of such specimens became feasible.

In this presentation, the basic processes of the interaction of large cluster ions with solid surfaces are discussed, emphasizing the influence of specific cluster parameters (cluster size, energy per cluster atom) on the emission yields and fragmentation. Furthermore, selective examples of the application of large gas cluster ions in SIMS of organic and biological systems are described.

MS 4.2 Tue 15:00 RW 2

Exploring MeV-SIMS with a capillary microprobe — •Klaus-Ulrich Miltenberger, Martina Schulte-Borchers, Arnold Milenko Müller, Matthias George, Max Döbeli, and Hans-Arno Synal — Laboratory of Ion Beam Physics, ETH Zürich, Switzerland

Over the course of the last two years, the new MeV-SIMS capillary microprobe setup CHIMP (Capillary Heavy Ion MeV-SIMS Probe) was developed and built at the ETH Zurich 6 MV TANDEM accelerator facility. The setup enables the use of a large variety of primary ions with energies of up to 80 MeV and even molecular or cluster ions (e.g. C_{60}) to enhance molecular secondary ion yields. The heavy and energetic MeV ion beams are collimated using a glass micro-capillary to diameters on the order of 1 to 10 μm, while molecular imaging with good spatial resolution is enabled by a piezo sample raster stage.

For mass spectrometry of the positive secondary ions a time-of-flight (ToF) spectrometer is used, which can be operated both in pulsed or continuous mode. While in pulsed mode the start time is derived from the pulsed primary ion beam, in continuous beam mode the start signal is either obtained from a transmission Bragg gas ionization detector (for thin samples) or from a channeltron detecting secondary electrons from the sample surface. This allows measurements with very high duty cycles and efficiencies.

The CHIMP setup as well as measurements characterizing its performance will be presented.

MS 4.3 Tue 15:15 RW 2

Design of a Beam Profile Monitor for measurements of the phase space — •Daniele De Maria, Hans-Arno Synal, Arnold Müller, and Sascha Maxeiner — Laboratory of Ion Beam Physics, ETH Zurich, Switzerland

In a typical AMS system, a beam of negative ions arises from the analyzed sample. The phase space of this beam, given by its width and divergence, is an interesting quantity, as it allows, for example, to optimize the beam transport through the system. To investigate the phase space generated by a MICADAS type ion source, a Beam Profile Monitor (BPM) based on two oscillating sensing wires located at two different positions along the beam axis has been developed. The versatile measurement board Red Pitaya implemented in the experimental set up has been programmed such that both the driving signal for the wires taking the intensity profile of the beam, as well as data acquisition of measured beam current are provided. Measurements of the behaviour of the phase space after the first dipole magnet were performed as a function of the beam's energy in the range between 30 keV and 50 keV at the MyCadas facility at the Laboratory of Ion Beam Physics at ETH Zurich. The measurements allowed to identify the phase space in the horizontal plane and in the vertical plane, respectively. In the talk, the algorithms studied to calibrate the relative position of the BPM respect to a reference beam and to derive its width and divergence are presented. The results of the performed measurements are discussed too, as well as the sources of uncertainty and possible improvements.