MS 8: Accelerator Mass Spectrometry III

Time: Friday 11:00–12:45 Location: F128

Invited Talk MS 8.1 Fri 11:00 F128

Two color resonant laser SNMS for isotope micro imaging of nuclear fuel debris — •Tetsuo Sakamoto — Kogakuin University, Tokyo, Japan

Tetsuo Sakamoto

Great East Japan Earthquake occurred in 2011. Effect of the earthquake was very large. Fukushima Daiichi (1F) nuclear accident is one of the serious disasters. The decommissioning of 1F is now in progress. There are many problems to be solved. One of those is the method for taking out nuclear fuel debris safely. For that reason, there is a strong need for analysis methods of debris precisely. The most important thing in the debris analysis is isotope ratio of a certain elements, because the ratio is closely related to both the accident progress and the state of debris. Secondary ion mass spectrometry (SIMS) is a candidate for the analysis. However, isobaric interferences often make it difficult to analyze precise isotope ratio analysis.

The author has been developed a resonance ionization sputtered neutral mass spectrometer (R-SNMS) for element-selective ionization and detection by using a set of newly developed tunable Ti:Sapphire lasers. It consists of two lasers independently tunable at a repetition rate of 10 kHz.

MS 8.2 Fri 11:30 F128

Isobar separation in the actinide range with ILIAMS — •Andreas Wiederin[1,2], Karin Hain[1], Martin Martschini[1], Aya Sakaguchi[3], Peter Steier[1], and Robin Golser[1] — [1]University of Vienna, Faculty of Physics - Isotope Physics, Austria — [2]University of Vienna, Vienna Doctoral School in Physics, Austria — [3]University of Tsukuba, Faculty of Pure and Applied Science, Japan

Isobaric background is among the main obstacles to the development of new AMS applications. By combining ILIAMS (Ion Laser InterAction Mass Spectrometry) with the actinide beamline of VERA (Vienna Environmental Research Accelerator), instrumental isobar separation in the mass range of the actinides has become available for the first time in AMS. ILIAMS combines an RFQ ion guide with high-powered lasers or reactive gases for isobar separation of anions at thermal energies.

The first application for ILIAMS in this mass range is the characterization of a recently produced ^{236}Np spike material intended for normalizing environmental ^{237}Np measurements. ILIAMS is used to monitor potential isobaric interference from ^{236}U or ^{236}Pu co-produced alongside the desired ^{236}Np and even suppresses ^{236}U by several orders of magnitude.

The isotopic ratios ^{238}Pu/^{239}Pu, ^{241}Pu/^{241}Pu, and ^{238}Pu/^{241}Pu are used as fingerprints for nuclear emission sources but partially require extensive chemical separation procedures and tedious radiochemical analysis. First results indicate that ILIAMS will also enable unambiguous mass-spectrometric access to ^{238,241}Pu usually superimposed by isobaric background from ^{238}U and ^{241}Am, respectively.

MS 8.3 Fri 11:45 F128

A new setup to characterise the tritium content of reactor graphite at Cologne-AMS — •Timm-Florian Pabst, Markus Schiffer, Gereon Hackenberg, Stefan Heinze, Martina Gwozdz, Alfred Dewald, and Dennis Mücher — Institute for Nuclear Physics, University of Cologne, Germany

There is approximately one kiloton of activated reactor graphite in Germany, mainly originating from research reactors and waiting for characterization and disposal. For storage in repositories like the mine Konrad, activity limits have to be considered. Reactor graphite has a complex radio nuclide vector with ^{3}H and ^{14}C as its main components. We are aiming for a small AMS system dedicated for ^{3}H measurement, by which gas is extracted from the reactor graphite and directly injected into a sputter ion source. Such a set-up is well suited for automated measurements and a high sample throughput. As a first step we expanded our ion source test bench at Cologne-AMS by a 100 kV tandem accelerator with a carbon stripper foil and a 90° analysing magnet followed by a multi-Faraday cup unit. The gas analyte is provided by heating the reactor graphite to approximately 1000°C, enhancing the diffusion of ^{3}H. Isobar molecules are suppressed by the tandem accelerator stage. A dedicated control system based on Siemens S7 programmable logic controllers and a LabVIEW based control software allows complete remote operation of all components of the setup.
In this contribution we will present the system layout as well as results of first test measurements with an H-beam regarding sample preparation, system transmission and molecular dissociation.

MS 8.4 Fri 12:00 F128

Anthropogenic Actinides as Potential Markers for the Anthropocene — •Janis Wolf[1,2], Andreas Maier[3], Maria Meszar[4], Michael Strasser[5], Michael Wagreich[4], and Karin Hain[2] — [1]Helmholtz-Zentrum Dresden-Rossendorf, Dresden, Germany — [2]University of Vienna, Faculty of Physics, Vienna, Austria — [3]University of Vienna, Department of Geography and Regional Research, Vienna, Austria — [4]University of Vienna, Department of Geology, Vienna, Austria — [5]University of Innsbruck, Department of Geology, Innsbruck, Austria

To establish the Anthropocene as a new geological epoch, a reference point for the base of this epoch has to be defined using stratigraphic markers. Long-lived anthropogenic actinides released by atmospheric nuclear weapons testing may be suitable markers.

Thus, anthropogenic actinides U-233,236, Np-237 and Pu-239,240,241 were analyzed in a peat bog core taken from the Pürgschachen mire, using Accelerator Mass Spectrometry (AMS). The distribution of the actinides in the peat bog is compared to their distribution in other environmental reservoirs including a lake sediment core and urban sediments. This presentation will discuss the measurement results and interpret the isotope ratios in terms of emission source identification and their suitability as geological markers for the Anthropocene.

MS 8.5 Fri 12:15 F128

Characterisation of Reactor Graphite with AMS Ion Beam Techniques — Martina Gwozdz[1], Markus Schiffer[1], •Stefan Heinze[1], Klaus Eberhardt[2], Gereon Hackenberg[1], Susan Herb[1], Timm- Florian Pabst[1], Max Stefan[1], Alexander Stolz[1], Erik Strub[3], Alfred Dewald[1], and Dennis Mücher[1] — [1]Institut für Kernphysik, Universität zu Köln — [2]Institut für Kernchemie, Johannes Gutenberg Universität, Mainz — [3]Institut für Kernchemie, Universität zu Köln

Activated graphite, e.g. from graphite moderated reactors contains several radioactive isotopes like ^{14}C, ^{36}Cl, or ^{3}H. For the final disposal of such material a quantitative characterization is demanded. We are aiming for a system which enables automated measurements using the AMS technique with gaseous samples for the above mentioned isotopes. The aimed system should provide a high sample throughput as well as the possibility of sample dilution in cases of high activity. At CologneAMS, a new gas-interface was built and tested for ^{14}C measurements which uses a syringe for the transport of the sample gas into the ion source and a separate reservoir which can be used for high dilution. An advantage over the already established procedure using Liquid Scintillation Counting (LSC) is that the setup at the CologenAMS does not need elaborate chemical sample preparation and has a sensitivity down to $3 \cdot 10^{-9}$Bq/g. In this contribution we will present the layout of our systems as well as the stage of realisation. Supported by BMBF under contract number 15S9410B.

MS 8.6 Fri 12:30 F128

Super-SIMS at HZDR: Status and Future — •Georg Rugel[1], René Ziegenrücker[1], Axel D. Renno[1], Dominik Koll[1], Johannes Lachner[1], Pavol Noga[2], Carlos Vivo-Vilches[1], Anton Wallner[1], and Michael Wiedenbeck[3] — [1]Helmholtz-Zentrum Dresden-Rossendorf, Dresden, Germany — [2]Slovak University of Technology in Bratislava, Trnava, Slovakia — [3]Deutsches GeoForschungsZentrum GFZ, Potsdam, Germany

The status and the future setup of the Super-SIMS at HZDR, Dresden will be outlined. The instrument is the combination of a commercial **S**econdary **I**on **M**ass **S**pectrometry instrument (CAMECA IMS 7f-auto) with DREAMS (DREsden AMS). While the SIMS provides micron-scale lateral resolution, AMS ensures high selectivity through highly effective molecule suppression by the stripping process. High transmission for major element ions including silicon, fluorine and iodine has been demonstrated in initial tests (see ref. [1]). The high energies from our 6-MV tandem were not actually required for our background suppression needs. Our new compact 1-MV AMS system will be used in the future for Super-SIMS.

[1] Rugel et al. NIMB 532 (2022) 52-57.