INTDS

Newsletter

International Nuclear Targets Development Society

Stable Isotope Materials and Chemistry Group: Dispensing and Technical Services
Oak Ridge National Laboratory, Oak Ridge, Tennessee, United States

May 2023
Volume 50
Number 1

Contents

Editorial

Dear Members of the INTDS!

Today, you will find the newsletter in a new design, hopefully fit for the next generation. Please feel free to give us your opinion about it.
We thank Matt Gott and his colleagues from Oak Ridge National Laboratory for their contribution to our series **Target Laboratories of the World**! Please be aware, that everyone is welcome to volunteer for introducing his or her lab in one of the next issue, just contact the editors.
This newsletter also contains the report of Ntombizonke Kheswa, iThemba, South Africa. She spent a week at GSI in Darmstadt, Germany, in advance of the INTDS 2022 to deepen her contacts in materials research and the target laboratory and to learn about new technologies.
Originating from interesting new contacts and discussions during the INTDS 2022 colleagues from JRC Belgium, University of Jyväskylä Finland and PSI/ETH Zurich Switzerland visited the target laboratories of GSI in Darmstadt and of the Helmholtz Institute and the Johannes Gutenberg-University in Mainz, partly supported by the Frank Karasek Memorial Scholarship Fund.
We hope, these exciting reports will inspire one or the other to send a new employee or a student to another target laboratory for learning and discussion.

Please help us, keeping the Newsletter interesting and informative and send contributions, ideas, advertisements, or whatever you want to share with the INTDS members to INTDS-Newsletter@gsi.de. So please, give yourself a jolt and share some of your tips and tricks with other target makers!

Bettina Lommel, Birgit Kindler and Noemi Cerboni

Target Laboratories of the World

"Stable Isotope Materials and Chemistry (SIMC) Group: Dispensing and Technical Services"
Oak Ridge National Laboratory, Oak Ridge, Tennessee, United States
Matt Gott, Jenny Conner, Mike Zach, and Cherlyn Foster

The US Department of Energy Isotope Program's (DOE IP's) National Stable Isotope Repository is the foundation for the Stable Isotope Materials and Chemistry (SIMC) Group target laboratories at Oak Ridge National Laboratory (ORNL). The SIMC Group manages the National Stable Isotope Repository, maintains the stable isotope target laboratories and equipment, and performs specialized technical services toward providing stable isotope targets. The SIMC Group is a part of the Enrichment Science and Engineering Division (ESED) at ORNL. ESED continues to expand the National Stable Isotope Repository by advancing electromagnetic isotope separations (EMIS) technology and pursuing new enriched isotope production approaches. ORNL is also home to two user facilities of interest to the International Nuclear Target Development Society (INTDS), which include the High Flux Isotope Reactor (HFIR) and the Spallation Neutron Source (SNS). Additional information regarding ORNL is available at ornl.gov.
The repository — a comprehensive inventory of stable isotopes — is a DOE Office of Science resource that ensures a supply of crucial isotopically and chemically purified materials. The National Stable Isotope Repository was formed because of the 50+ years of stable isotope production in Oak Ridge using EMIS technology. The repository consists of more than 2,000 quality-controlled batches of 225 stable isotopes of approximately 50 elements. A catalogue of batches that are ready for delivery is available at isotopes.gov.

The technical services performed by the SIMC Group include the following:

- inorganic chemical conversions,
- arc melting,
- alloying,
- drop casting,
- thin film evaporations,
- wire swaging and rolling,
- hot and cold rolling metal foils,
- sintering of metal and ceramic powders,
- scanning electron microscopy (SEM),
- energy dispersive x-ray spectroscopy(EDS),
- pyrochemical conversions,
- vacuum hot pressing,

- plasma sputtering,
- precision sectioning with a diamond wire saw, and
- air-sensitive processing with vacuum packaging.

Fig. 1 shows examples of targets made by the SIMC Group. A variety of discs, foils, and pellets are shown as well as a vacuum sealed package. The broad range of technical services provided by the SIMC target laboratories are performed to create isotopic targets that meet customer expectations using minimal amounts of material and that prevent loss of the extremely valuable isotopes.

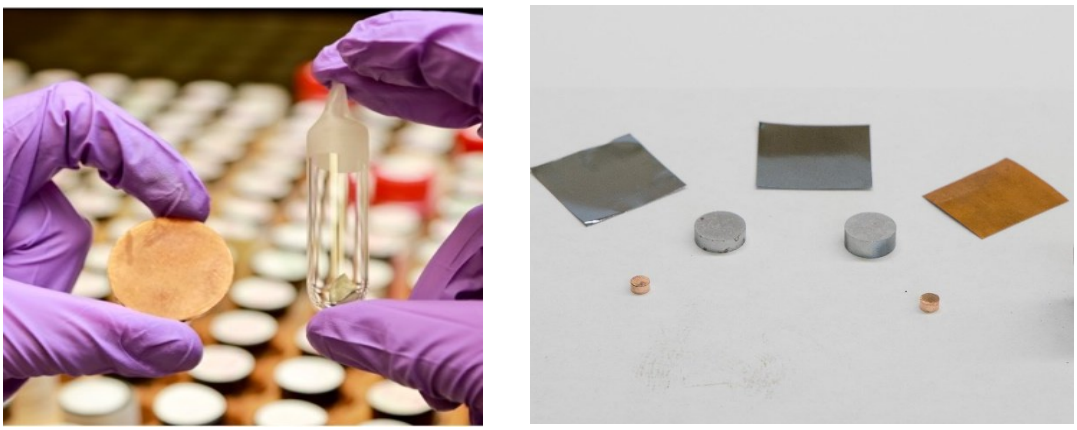


Figure 1: Examples of targets made by the SIMC Group.

A specialized capability of the SIMC target laboratories includes the wide range of pyrochemical and thermal conversion techniques that are combined with arc melting and hot rolling to produce thick metal foils and discs. The arc melter and one of the three rolling mills are shown in Fig. 2 and Fig. 3.

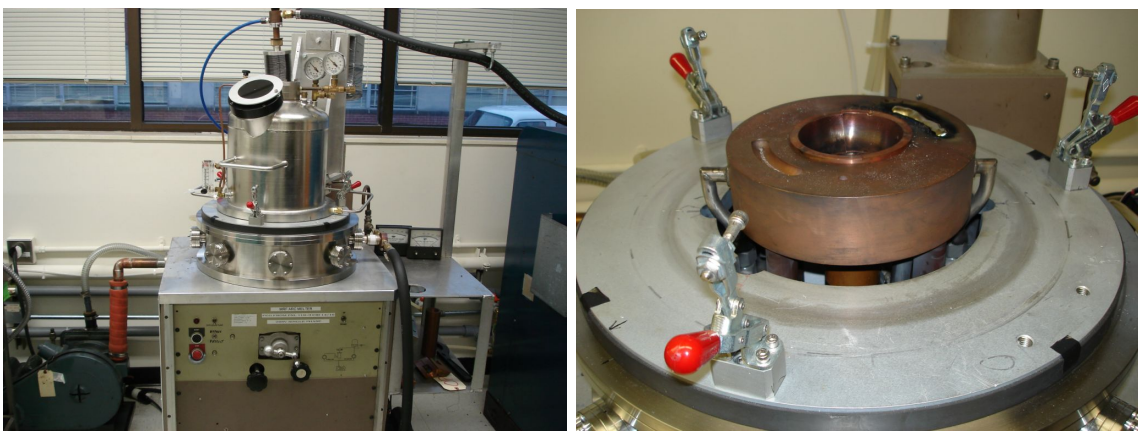


Figure 2: The arc melter and hearth in the SIMC target laboratories.

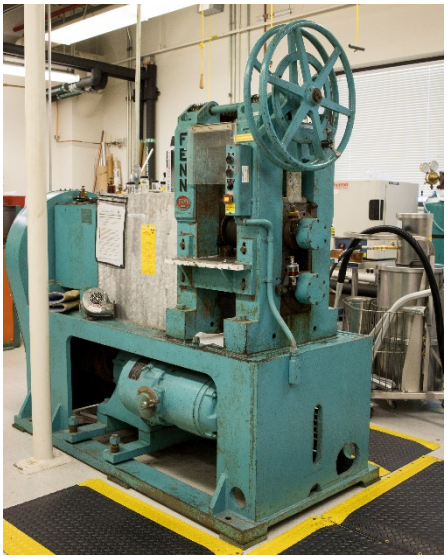


Figure 3: *Left*: the Fenn rolling mill. *Right*: rolling a foil in a stainless steel pack.

Other specialized capabilities of the SIMC Group were highlighted at the INTDS 2022 conference by researchers Dr. Mike Zach and Ms. Jenny Conner (Fig. 4).


Figure 4: SIMC Group members Dr. Zach and Ms. Conner. Dr. Zach is flame sealing air sensitive product into a glass tube. Ms. Conner is dispensing isotopic material for a customer.

The specialized capability of spherical powder production was presented by Dr. Zach. The SIMC Group recently acquired an ultrasonic atomization instrument from AMAZEMET and is developing techniques to manufacture and utilize spherical powders to broaden the application and performance of isotopic materials. Fig. 5 shows the equipment and samples of spherical powders.

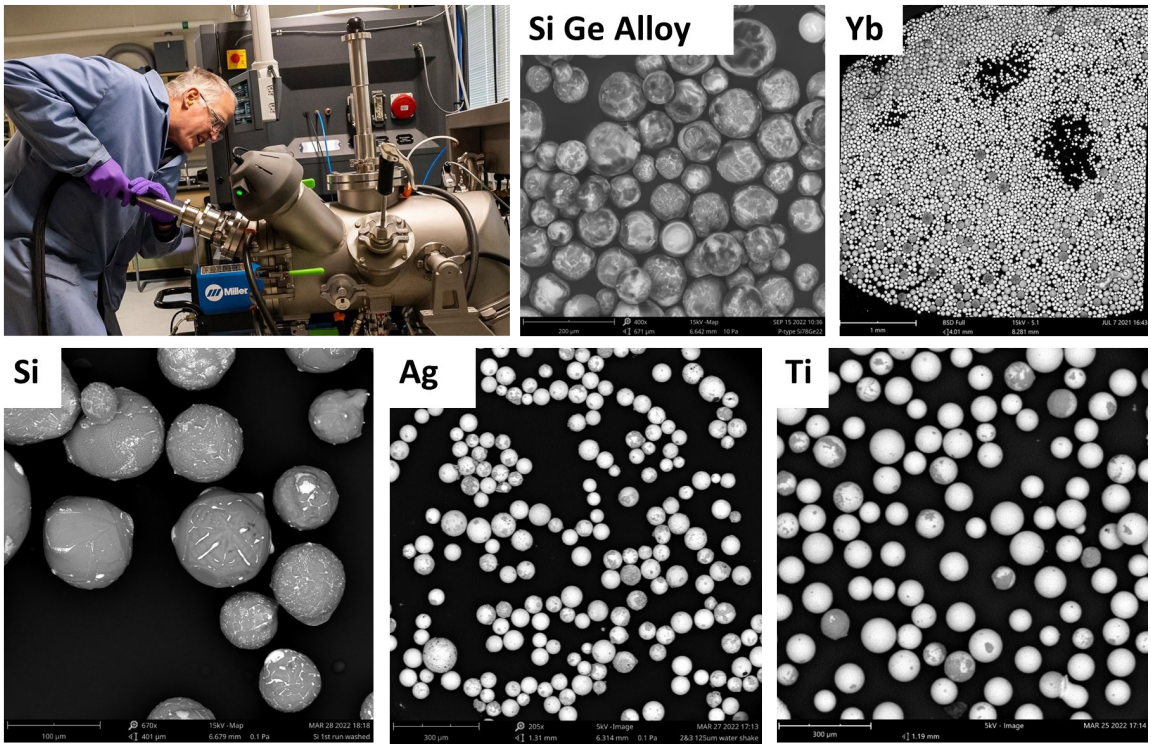


Figure 5: The ultrasonic atomization instrument in operation. Various metal samples produced by ultrasonic atomization. (Images from a presentation by Dr. Zach at INTDS 2022)

Another specialized capability of the SIMC Group is the development of new techniques when requested by a customer. Ms. Conner presented the development of a safe technique for thallium foil fabrication during the 2022 INTDS conference.

In summary, the ORNL stable isotope target laboratory, owned and managed by the SIMC Group, is highly specialized in terms of its tools, methods, experience, knowledge, and team. The team looks forward to continued collaborations with all those in the INTDS to meet the most challenging target needs.

Acknowledgment:
"This program and its research are supported by the U.S. Department of Energy Isotope Program, managed by the Office of Science for Isotope R&D and Production."

Visit of the Target Laboratory and Nano-Group of the Material Research Sciences of Helmholtzzentrum für Schwerionenforschung (GSI) in Darmstadt, Germany

Ntombizonke Kheswa

On the 19th and 23rd September, 2022, I was offered an opportunity to visit GSI, Target Laboratory and the Materials Research facilities. I am honored and pleased to report that I received a warm welcome by the hosts in both laboratories.

While at the GSI Target Laboratory, I had a hands-on experience using sputtering technique to deposit gold and the self-supporting 112 nm tungsten target. In the picture below, I show an image of the W target after successfully mounting in onto a frame. It was my first-hand experience in using a sputtering technique to deposit thin films. My main focus was to understand the technique and to prepare the thin films of Au on a support, and self-supporting tungsten (W) targets. These targets were required for various applications in my institute, for example, used as targets for nuclear physics and ion beam analysis experiments. Given the limited time available, in the two days I gained an insight of the technique in which I was planing to work on the improvement in terms of the quality of target based on thickness and reduce moisture content. These were the conclusions that we reached with the Target Laboratory team at GSI.

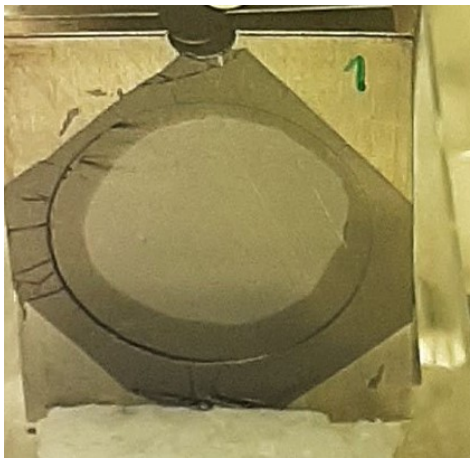


Figure 1: Thick W-target (112 nm) made by sputtering method

Whilst still in the Target Laboratory, I also had chance to see other instruments used for target preparations for various applications in research and industry. In reference to vacuum deposition systems with different heating sources, mechanical methods like rolling and polishing as well as the quick characterization of thin film surfaces using microscopic methods.

In reference to vacuum deposition systems with different heating sources, mechanical methods like rolling and polishing as well as the quick characterization of thin film surfaces using microscopic methods.
GSI Target Laboratory is well-known for betaine-sucrose parting agent application to the substrate in where they work tirelessly on improving the technique continuously, I also had a chance to be taken through the skill and given chance to practice using the technique.

In the Nano-Group of the Material Research Sciences, the researchers demonstrated how the ion-tracked polymer membranes are made as tracked etched membranes to produce nanowires and sensors. This involved electrochemistry procedures, making of conductive layers as well as the characterisations of the membranes by microscopic procedures. I also had an opportunity to see where the experiments are conducted to make these ion tracks on membranes using ion beams.

Lastly, I had an opportunity to join the tour to the FAIR construction site at GSI where we were given an update of the facility. It was a great pleasure to see this fascinating site, a large science infrastructure project being build, looking forward to see it in operation.

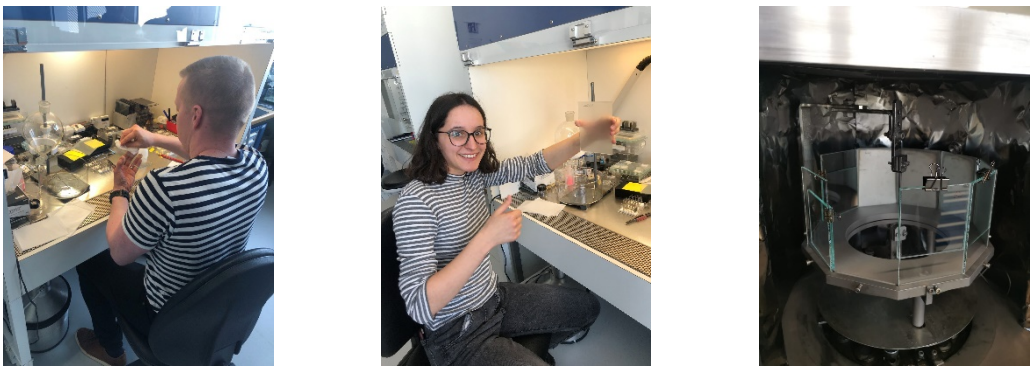
Target Labs visit at GSI and JGU Mainz

Noemi Cerboni, Jukka Jaatinen, Jolanta Karpinska

The last INTDS conference allowed, amongst other things, to expand the network of target makers. It was in this occasion that I had the pleasure to meet Bettina Lommel and Birgit Kindler, who kindly invited me to visit the Target Laboratory at the GSI in Darmstadt, and the Institute of Nuclear Chemistry at Johannes Gutenberg University and the Helmholtz Institute in Mainz. In fact, Bettina organized a stay between March 13th and March 16th 2023 for me, a PhD student from PSI, and two other scientists: Jolanta Karpinska, project officer at the Joint Research Centre of the European Commission in Geel, Belgium, and Jukka Jaatinen, laboratory engineer in the department of physics at the University of Jyväskylä, Finland. During this visit, we had the opportunity to get a general overview on different target preparation and characterization techniques applied in both laboratories.

Monday started with a general tour of the target laboratory of GSI by Bettina: she introduced us to the carbon deposition on glass plates coated with betain sucrose, evaporation station used for the deposition from powders and the sputtering device for the deposition from solid sources. In addition, she showed us the glovebox for handling and storage of air-sensitive chemicals as well as the optical and scanning electron microscope. Further, we had a look at the chemistry laboratory, where both wet and solid state chemistry as well as polishing take place. Next, Annett Hübner introduced more in detail the DC sputtering from solid sources by letting us deposit gadolinium metal onto a glass backing. Afterwards, we also got the chance to play with the new, very fancy digital 3D microscope. We also had the opportunity to visit the existing heavy ion accelerator facility of GSI and the FAIR construction site with Daniel Severin. The afternoon continued back in the lab, where Jutta Steiner gave us a demonstration on how to coat glass with betain sucrose, which we could try on our own, and their subsequent coating with carbon by evaporation (Fig. 1 *a*-*c*). Lastly, we evaporated bismuth oxide on a carbon backing. The day finished with a friendly dinner in Darmstadt with Bettina, Jutta with their respective husbands and Birgit.
The next day, with Elif Celik Ayik, we continued the process on the evaporated carbon thin films, namely cutting the film in identical pieces, detaching them from the glass backing by immersing them in water and fishing them out with the appropriate frames (Fig. 1 *d*-*f*). The next steps consisted in gluing the carbon foil to the frame and finally measure the deposited thickness by either UV/Vis spectroscopy or simply by measuring the weight. After that, Bettina and Jutta gave us a tour of the radioactive lab of the target laboratory, where uranium sputtering and rolling are performed.

Lastly, Vera Yakusheva gave us an introduction on cold rolling of foils and pressing of tablets. The lovely stay at GSI concluded with a guided tour of Darmstadt by Bettina.



a *b* *c*

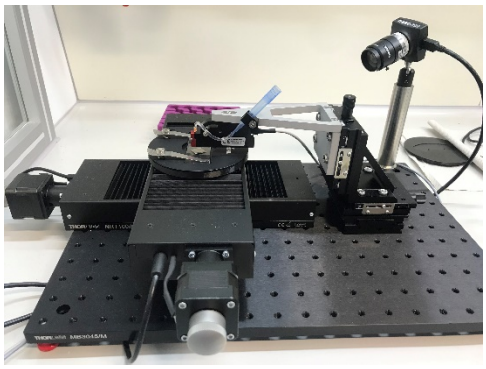
d *e* *f*

Figure 1: An illustrated representation of us trying to reproduce the process of the production of carbon thin films used either as target or as backings: *a-b* successful coating of betain sucrose on glass substrates and *c* subsequent carbon evaporation. After taking out the carbon coated glasses of the oven, one has to *d* cut the carbon thin film in the desired pieces, *e* detach them from the glass and *f* fish them out with the suitable frame.

There is no rest for the target makers: our journey continued at the University of Mainz, where we met Dennis Renisch. He gave us a general overview of the laboratories at JGU Mainz: the rooms for α- and γ - spectroscopy, the radiography setup, for measuring the lateral distribution of radioactive materials, and the atomic force microscopy, for measuring the surface roughness of backing materials and the surface morphology of the deposited films. In addition, he also showed us the labs used for the molecular plating and drop-on-demand inkjet printing. In the afternoon, Dennis gave us a detailed presentation and tour on the TRIGA research reactor, where we could admire the Cherenkov radiation for the first time! In the evening, we had the pleasure to have fruitful discussion over a dinner with Dennis, Ernst Artes, Jonas Stricker, Miriam Jäger, Andrea Nyffeler and Christoph Düllmann. The discussions carried on over some drinks (Fig. 2 *a*).
The last day of our stay started with a detailed presentation on the preparation of targets for super-heavy elements research, given by Ernst.

Later, he gave us an in-depth explanation and a tour on the molecular plating labs at JGU Mainz: the different cells for different targets and the glovebox, used for the storage of air-sensitive chemicals and solvents as well as for the molecular plating of targets with a controlled atmosphere.

a



b

c

d

Figure 2: *a* a cheerful evening in Mainz with Jonas, Noemi, Jukka, Ernst and Miriam (from the left). *b* the drop-on-demand inkjet printer at the HIM and *c* its operation; *d* the visualization of the nanoliter droplets is done by optical microscope.

In addition, he showed us the new electrochemistry setup used for the electrodeposition of metallic lanthanides at the Helmholtz Institute Mainz. There, we also got the chance to use the drop-on-demand inkjet printer (Fig. 2 *b*-*c*), under the guidance of Dennis. We looked at the resulting deposited droplets with the optical microscope (Fig. 2 *d*). Our journey ended with the visit at the hot cell of the JGU Mainz, right next to the reactor hall.

Acknowledgment:
We would like to thank heartily Bettina and Dennis for the time invested in the organization of our visit and their warm hospitality during our stay as well as all the people who took some time to show us their work. In addition, we are grateful for the opportunity of visiting the labs of GSI and JGU Mainz given by our respective research institutes. We hope that this visit opened the doors for future exchange of knowledge or, even, collaborations. Since half of my stay was financed by the Frank Karasek Memorial Scholarship, I would like to take a moment to thank all the INTDS board members for considering and accepting my application.

Orbituary

The INTDS society sadly lost two pioneers of target making and target networking in January 2023:

Helmut Folger

17.01.1932 – 25.01.2023

After his diploma thesis in nuclear chemistry at the University of Mainz, Germany, Helmut Folger started his work at the Gesellschaft für Schwerionenforschung, GSI, in May 1972 for the planning and construction of irradiation facilities at the linear accelerator UNILAC and the development of target systems. Together with Josef Klemm, Willi Hartmann, Dieter Marx, Frank Nickel and Werner Thalheimer, they developed targets and setups for the first experiments and founded the target laboratory at GSI.

He took over the management of the target laboratory in July 1979. He handed over the laboratory management in July 1996 to Bettina Lommel and left GSI at the end of January 1997 for his well-deserved retirement.

Helmut Folger gained international scientific recognition as a member of the Users Executive Committee of the Isotope Facility in Oak Ridge and as a board member of the International Nuclear Target Development Society. He joined the INTDS in 1982. In 1988, he organized the INTDS conference at GSI together with the International Atomic Energy Agency (IAEA) – International Nuclear Data Committee (INDC). In 1998, he received the Award of Recognition of the INTDS at the conference in Oak Ridge for his achievements in target preparation and his longstanding support of the society.

Orbituary

Dr. Peter Maier-Komor

30.06.1941 – 01.01.2023

Peter Maier-Komor took his diploma thesis in 1968 and his doctoral thesis 1974 on nuclear spectroscopy at the Technical University of Munich, where he first came into contact with nuclear target making.

From 1968 on, he worked as a physicist at the accelerator laboratory of the Technical University Munich, Germany. After his PhD he built up the target laboratory at the Technical University of Munich in fruitful cooperation and creative competition with the target laboratory at the Ludwig-Maximilian University, Munich, Germany in close vicinity headed by Hans-Jörg Maier.

He attended the first international INTDS-conference in Gatlinburg, USA, in 1971 and became a member of the first Board of Directors, when the INTDS was incorporated in 1975.

During decades devoted to target preparation, he has made great contributions not only to new techniques but also to theoretical target developments. He was Co-Chair of the INTDS conference in Garching, Germany, in 1978 and served the INTDS as President from 1998 - 2003. He received the Award of Recognition of the INTDS in Tsukuba, Japan, in 2006. Unfortunately, he could not attend the 2006 conference and the formal presentation was made to him at the conference in Caen, France, in 2008.

Facility for Antiproton and Ion Research

Helmholtzzentrum für Schwerionenforschung GmbH

GSI Helmholtzzentrum für Schwerionenforschung in Darmstadt is one of the leading particle-accelerator laboratories for science. In the next few years, the new FAIR (Facility for Antiproton and Ion Research), one of the world's largest research projects, will be built in international cooperation. GSI and FAIR offer the opportunity to work together in this international environment with a team of employees committed to conduct excellent science.

The GSI Target Laboratory is looking for a

Postdoctoral Researcher (Physicist, Chemist or Material Scientist) (all genders) – Tenure Track

Posting ID: 23.39 6260

The Target Laboratory is one of the scientific-technical infrastructure departments of GSI and FAIR and a world-leading laboratory for the production of customized targets and stripper foils for accelerator-based research and accelerator applications. The department also provides support and advice to scientific and technical staff members of GSI and FAIR in related topics, and collaborates with target laboratories worldwide.

The position is focused on the development and the construction of a set-up for the reduction of highly enriched rare-earth isotopes for the production of targets and ion source materials for experiments with heavy ions. A close collaboration with experimental groups and the participation in experiments with the manufactured targets and ion source materials is desired.

Your Tasks:

- Investigation on reduction processes of rare-earth isotopes.
- Analyzing the requirements on rare-earth isotopes for ion-source operation and heavy-ion experiments.
- Conceptional design and construction of suitable set-ups for material preparation for target and ion-source application.
- Cooperation with experimental groups within GSI and within GSI-collaborations.
- Supporting the daily work of the target laboratory.

Your Qualification:

- PhD in experimental physics, material science or chemistry.
- Several years of experience of independent work in a physical or chemistry laboratory.
- Preferably, experience in the design and the construction of chemical-physical set-ups.
- Preferably, experience in handling of small amounts of material.
- Good knowledge in the fields of material properties, physical vapor deposition techniques and vacuum technology.
- Good knowledge in physical analytical methods.

- Good command of spoken and written English and a good command of the German language; fluency in German (oral and writing) will be required latest for a successful tenure track evaluation.

We are looking for a person with an independent and responsible approach to work, that feels comfortable to work independently but also has a high level of team spirit and enjoys cooperative teamwork

We offer an interesting and challenging tenure-track position in an international environment. The position is initially limited to five years. After successful evaluation, the position will become permanent.

Salary and benefits are based on the collective agreement for public employees (TVöD Bund) effective at GSI.

GSI supports the vocational development of women. Therefore, women are especially encouraged to apply for the position.

Handicapped persons will be preferentially considered when equally qualified.

Information about FAIR and GSI is available at www.gsi.de/en and www.fair-center.eu.

For further information please contact Dr. Bettina Lommel (b.lommel[at]gsi.de).

If you find this position interesting, please send all application documents (a CV, a list of publications, including a commented selection of the three most significant ones, a research interest and achievements statement, names of at least two colleagues willing and able to provide qualified assessments of the candidate) stating the **Posting-ID 23.39 6260** above until **16.06.2023** to:

bewerbung[at]gsi.de

or to:

GSI Helmholtzzentrum für Schwerionenforschung GmbH
ABTEILUNG PERSONAL
PLANCKSTRASSE 1
64291 DARMSTADT

Advertising

We are happy to announce the EURO-LABS Basic Training School 2023 – BTS23, Sep. 13 - 23, 2023 at IFIN-HH Bucharest- Magurele, Romania.

EURO-LABS Basic Training School 2023 – BTS23

Sep. 13 - 23, 2023 at IFIN-HH Bucharest- Magurele, Romania

First circular

EURO-LABS is a network of 33 research and academic institutions from 18 countries (25 beneficiaries and 8 associated partners) from European and non-EU countries, involving 47 Research Infrastructures (RI) in the Nuclear Physics, Accelerators and Detectors for high energy physics pillars. The project brings together, for the first time, the three research communities of nuclear physics, accelerator, and detector technologies for high energy physics, in a pioneering super-community of sub-atomic scientists. Within it, EURO-LABS ensures diversity and actively supports researchers and research groups to use its RIs.

Its main goal is to provide effective access to a network of 47 Research Infrastructures (including 3 RIs with Virtual Access) to conduct curiosity-based research, addressing fundamental questions and technological challenges and advancing projects with broad societal impact, fostering knowledge sharing between scientific fields and enhancing Europe's potential for successfully facing future challenges.

To fulfill this goal, the community recognizes that it needs to pay attention to improve the efficiency of use of RIs and to increase its human and institutional basis. It was decided, therefore, to organize a system of training activities, at various levels, starting with annual Basic Training schools and Advanced Training schools, organized by members of the project.

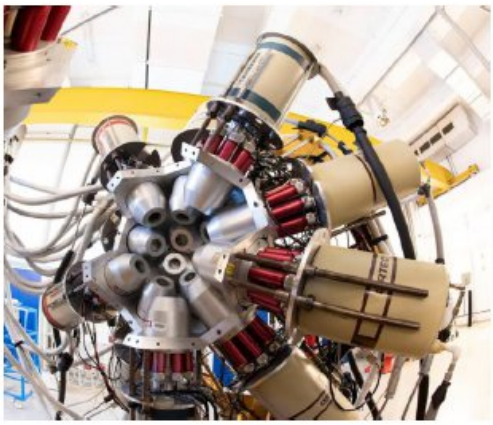
Here we announce the **Basic training school of 2023 BTS23, Sept. 13-23, 2023**, to be organized at **IFIN-HH, Bucharest-Magurele, Romania**. It will involve hands-on activities around the tandem accelerator complex of IFIN-HH:

1. Target preparation laboratory.
2. Vacuum technology for accelerators and special detectors.
3. Use of some of the most widely employed gamma-ray and particle detectors: HPGe, $LaBr_3(Ce)$ in ROSPHERE, neutron detectors, scintillators, simple and multistrip Si detectors.
4. DAQs; types of accelerator experiments.
5. Manning experiments at the 9 MV and 3 MV tandems (3+3 days around the clock)
6. Calibration of the accelerator and of detectors used.
7. De-activation measurements in an ultra-low background laboratory of IFIN-HH located in a salt mine 125 km North of Magurele.
8. Dedicated detectors and electronics for large hadron physics experiments.
9. Guided visits to other major facilities of IFIN-HH: the RoAMS tandetron, HPD, IRASM, old Reactor, ELI-NP, etc.

Beamtime at the 3 MV and 9 MV tandems was reserved through PAC applications for use during school. Up to 15-20 students (trainees) will be selected for a period of 12 days.
Trainees' participation will be financed by EURO-LABS: travel with economy class within Europe, accommodation, and subsistence support. Trainers will be local and international.

Organizers:
Razvan Lica (chair), Mihai Straticiuc, Mihai Constantin, Dana State, Livius Trache et al.

To apply register online at https://indico.nipne.ro/event/246/ or write to bts23@nipne.ro, including a letter of recommendation from your advisor.




This project has received funding from the European Union's Horizon Europe Research and Innovation programme under Grant Agreement No 101057511.

For further information on the INTDS, please refer to our website on www.intds.org.