INTDS NEWSLETTER

International Nuclear Target Development Society

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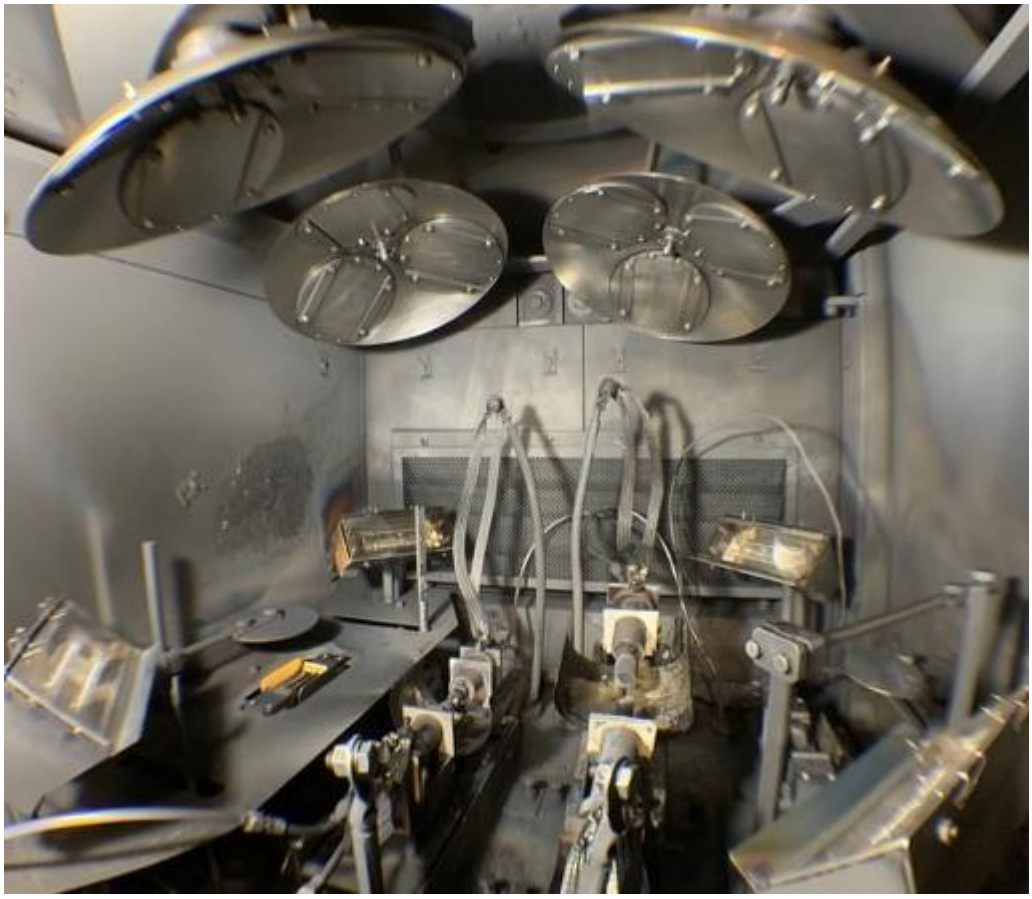


AC/DC arc discharge evaporation device at RIKEN, Japan

Content

1 Editorial

Dear Members of the INTDS,

This year Covid-19 whirled around all of us – all around the world. The virus is a threat nearly everywhere and most probably, every one of us is affected more or less.

Still it could teach us some things: We live in a global world – for the best and the worst of it! I think this is expressed wonderful in this poem from John Donne you may perhaps know …

No Man Is an Island
John Donne

No man is an island,
Entire of itself.
Every man is a piece of the continent,
A part of the main.
If a clod be washed away by the sea,
Europe is the less.
As well as if a promontory were.
As well as if a manor of thy friend's
Or of thine own were:
Any man's death diminishes me,
Because I am involved in mankind.
And therefore never send not to know
For whom the bell tolls,
It tolls for thee.

In this issue you will find a technical contribution from the GSI Target lab on pellet production, which perhaps is interesting for you and hopefully will inspire some of you, sending your contribution for the next issue. The editors heartily thank Hiroo Hasebe for his contribution to the series **Target Laboratories of the World** from which also the title photo of this issue originates. Additionally, we inform on the latest news from the INTDS Board and on the INTDS conference, which was planned to take place at PSI in September.

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.

Birgit Kindler and Bettina Lommel

2 Target Laboratories of the World

"World's smallest long-lived carbon foil laboratory"

RIKEN Nishina Center for Accelerator-Based Science, Saitama, Japan

by Hiroo Hasebe

The RIKEN Nishina Center operates the RI Beam Factory (RIBF), the world's highest performing heavy ion accelerator facility. The RIBF artificially creates radioisotopes that do not exist in nature and promotes the researches on the synthesis of super-heavy elements such as Nihonium (113Nh), researches on magic numbers, nucleosynthesis in the universe, and reducing radioactive waste, as well as theoretical study. Since its full operation started in 2007, the RIBF produced many research results that attracted researchers from all over the world.

As you can see in Fig.1, our target laboratory is a small room with a size of only 6 m x 6 m, which is the self-proclaimed "world's smallest long-lived C-foil laboratory". The room temperature is controlled to 25-30° C and the humidity to 30% or less.

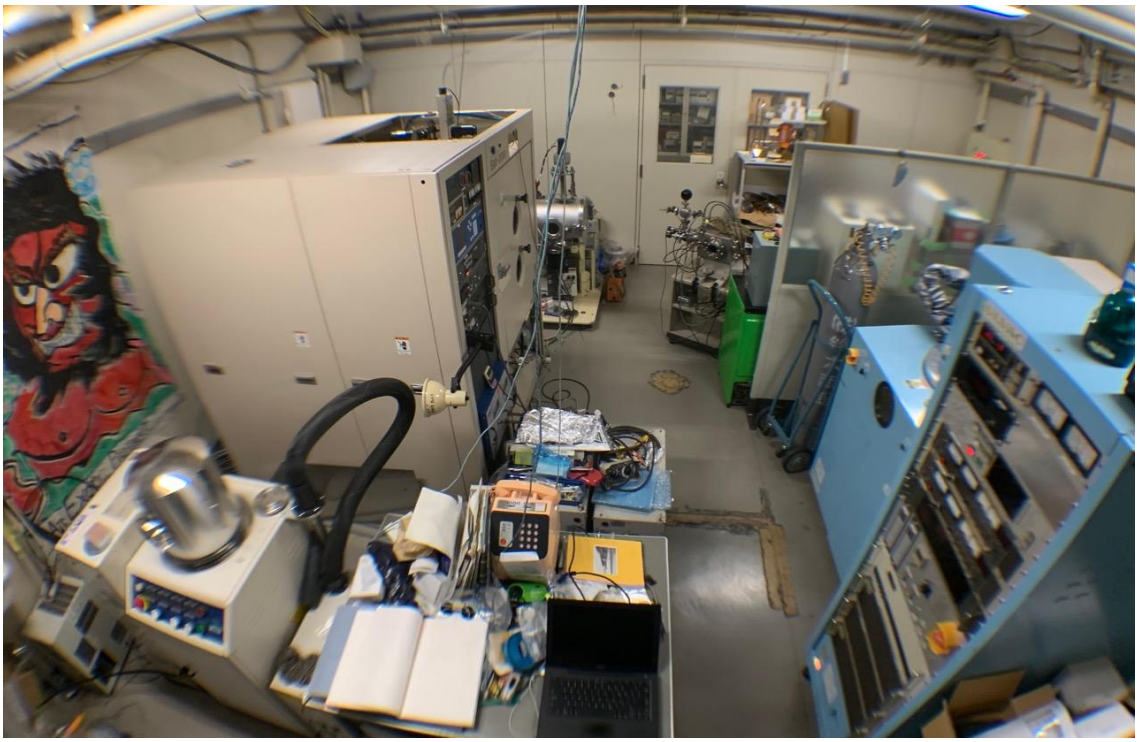


Fig.1: Cabon-foil laboratory in RIKEN

We started the research and development of the long-lived stripping carbon foils (C-foils) in 1999 with RIBF construction start.

At first, we set up the large deposition device with the AC/DC arc discharge evaporation source according to Dr. Isao Sugai's instruction.

For example, the backing films for the $_{113}$Nh production target were fabricated by the AC/DC arc discharge evaporation device and were supplied in large quantities for a long term. Fig.1 shows a view in the impressive rotating large substrate holder on which 48 pieces of slide glasses can be mounted and which enables mass production of the carbon films.

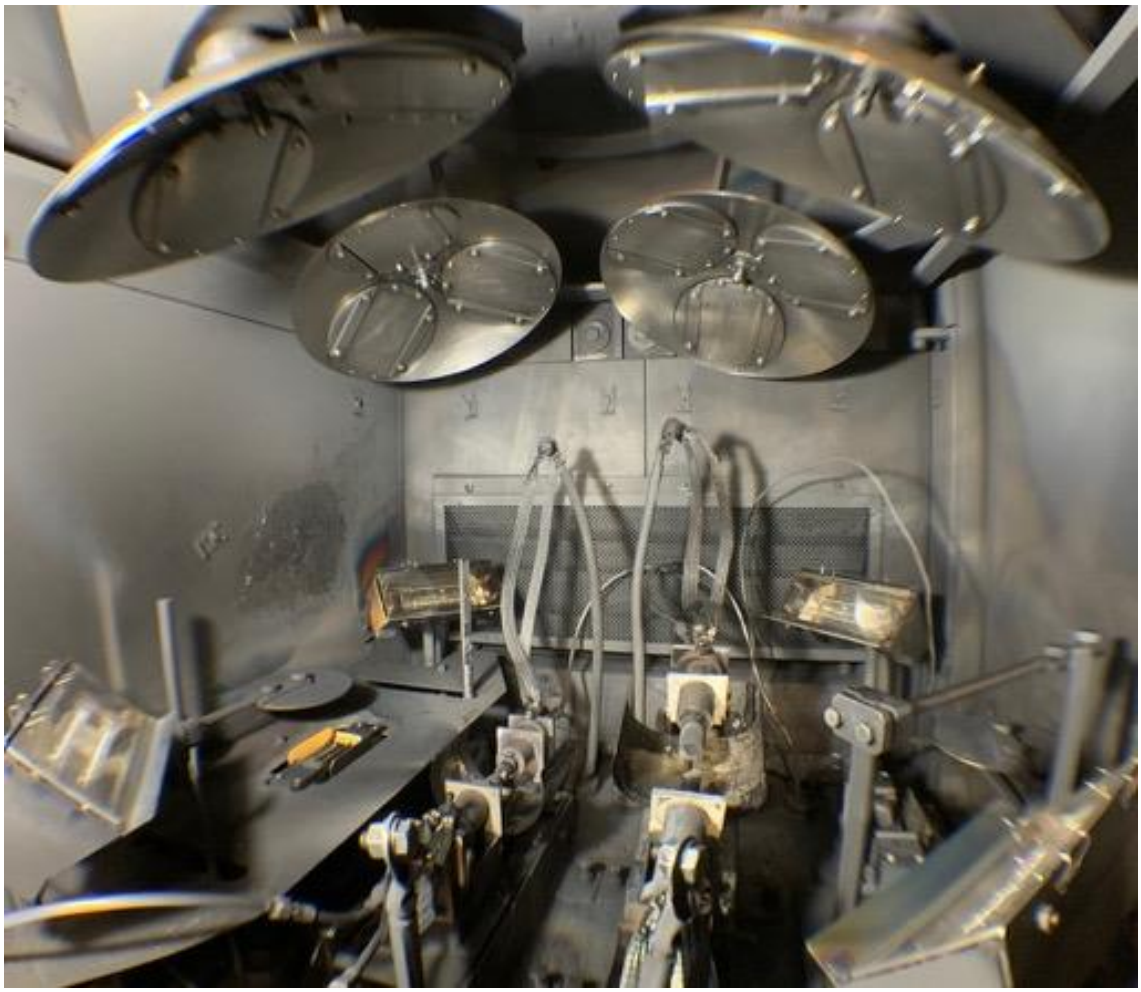


Fig.2: AC/DC arc discharge evaporation device for large-scale C-foil production

Next, a compact evaporation device with a 3-inch-diameter magnetron sputtering source and a polymer (Parylene) CVD device were installed to fabricate thicker and larger-area multi-layer C-foils.

Single-layer C-foils thicker than 100 μg/cm^2 were fabricated using the evaporation device with a 6-inch-diameter magnetron sputtering source.

In addition to the above-mentioned, a thermal cracking CVD device, ultra-micro balances, a freezer, an oven, a grinding and polishing machine, etc., are installed in the laboratory.

The research and development will continue in future here.

3 Technical Contributions

Pellet-fabrication for Ni- and Zn-Targets

Vera Yakusheva, Elif Celik Ayik, Annett Hübner, Birgit Kindler, Bettina Lommel, Jutta Steiner; GSI Target laboratory, Germany

Depending on the form of our starting material, we describe different approaches for producing pellet targets for two separate experiments.

1. 62-Ni and 68-Zn with Ø 20 mm

Originally, the experiment asked for tablets of each material with a net weight of about 3 g. However, from the beginning the main issue was that the targets of both isotopes should have the same thickness!

62-Ni:

The starting material of the enriched isotope was a coarse powder. We tried two different procedures with natural material.

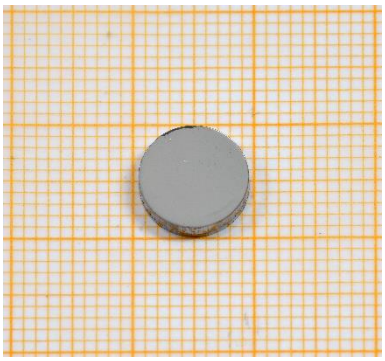
Direct pressing: At first, we pressed the starting powder from natural Ni directly with a hydraulic press in an Ø 20 mm tool to a tablet. In principle, this worked very well, but the maximum thickness we could reach for a stable tablet was ~ 1.7 mm, meaning a net weight of only 1.7 g.

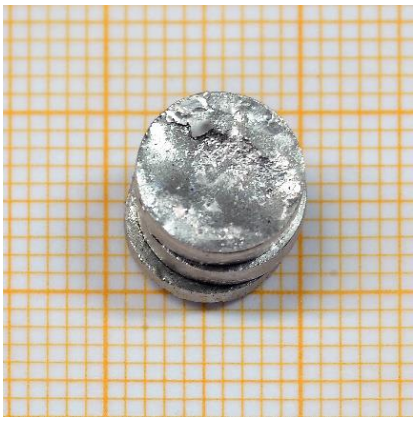
Melting:

From the starting powder of natural Ni, we pressed three pellets with an initial weight of ~ 1000 mg and Ø 9 mm each, with a hydraulic press in a press tool.

With an electron-beam gun, we melted each pellet separately in a crucible of vitreous carbon from both sides.

Then we piled the three metal cylinders closely to a stack and fused them together with an electron-beam gun several times from both sides (see Fig.1).





Pressed starting powder *Molten tablet* *Stack of 3 tablets before fusing*

Fig. 1

In the hydraulic press, we squeezed the molten metal lump to an oval piece and then rolled the sheet with the cold roller to a thick foil.

Our machine shop then punched the thick foil was to a diameter of 20 mm (see Fig.2).



C-crucible with molten lump *Thick metal foil* *Punched tablet of nat. Ni*

Fig. 2

The different steps each took significant time for preparation and resulted in a material loss of about 20% for the whole process, which is a bad yield when working with an enriched isotope.

Solution:

Since the direct pressing of the starting powder worked perfect with nearly no loss of material, the scientists decided to reduce the net weight of the target to 1.7 g. Therefore, we pressed the target of 62-Ni, as depicted in Fig. 3 directly from the enriched material:

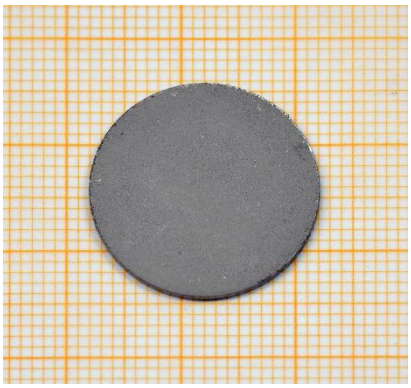


Fig. 3: Pressed tablet of enriched 62-Ni

68-Zn:

Since the 62-Ni target was prepared with 1.7 g net weight this was also the prerequisite for the 68-Zn target.

In the case of 68-Zn, the starting material consisted of small metal pieces. We fused the metal pieces in a porcelain crucible to one lump. For this process, we used an oven with ambient air.

We then pressed the lump flat, rolled it to the wanted thickness and the machine shop punched the foil to a diameter of 20 mm to the ready target in Fig. 4.

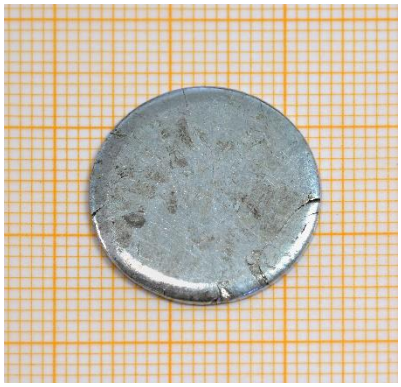


Fig. 4: Metal tablet of enriched 68-Zn

2. 64-Ni with Ø 19:

For a different experiment, we had to prepare a tablet of 64-Ni with a diameter of 19 mm and 1.5 g net weight.

In this case, the enriched starting material was directly available as a metal sheet. Therefore, we rolled the target directly from the sheet to the calculated thickness and the machine shop punched the foil to the required diameter, see Fig. 5.

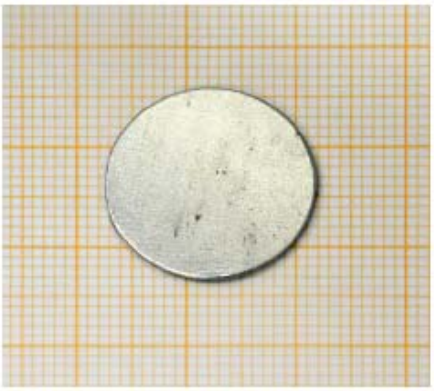


Fig. 5: Metal tablet of enriched 64-Zn

The clue to the success with the targets described was to explore different possible process routes and keep in close contact with the customer to find the best compromise for the experiment!

4.3 I.N.T.D.S. MEMBERSHIP REPORT Dec. 31, 2019

	Oct. 2018	Dec. 2019
Paid Member	59	56
Emeritus	13	14
Total	**72**	**70**
Paid Membership by Continent:		
Europe	22	20
North American	26	27
Asian	10	8
African	1	1
Australian	0	0
South American	0	0
Middle East	0	0

Respectively submitted,

Dannie Steski — David Gilliam

INTDS Corresponding Secretary/Treasurer — INTDS Assistant Treasurer

4.4 Status of the INTDS Newsletter 2019

- Newsletter #43, the first hosted by GSI, was sent on 3rd of December 2019.
- We installed the contact address INTDS-Newsletter@gsi.de , the e-mails both of us.
- The NL was sent to 105 addresses (members, emeriti, participants of 2016 conference) and to Atsushi Yoshida (author of the technical contribution); 6 mailings were undeliverable, the addresses were deleted from the mailing list.
- The NL was well received, we got some nice comments!
- The next NL is planned for March 2020.
- Contributions, comments, proposals ,.. are welcome!

Bettina Lommel and Birgit Kindler

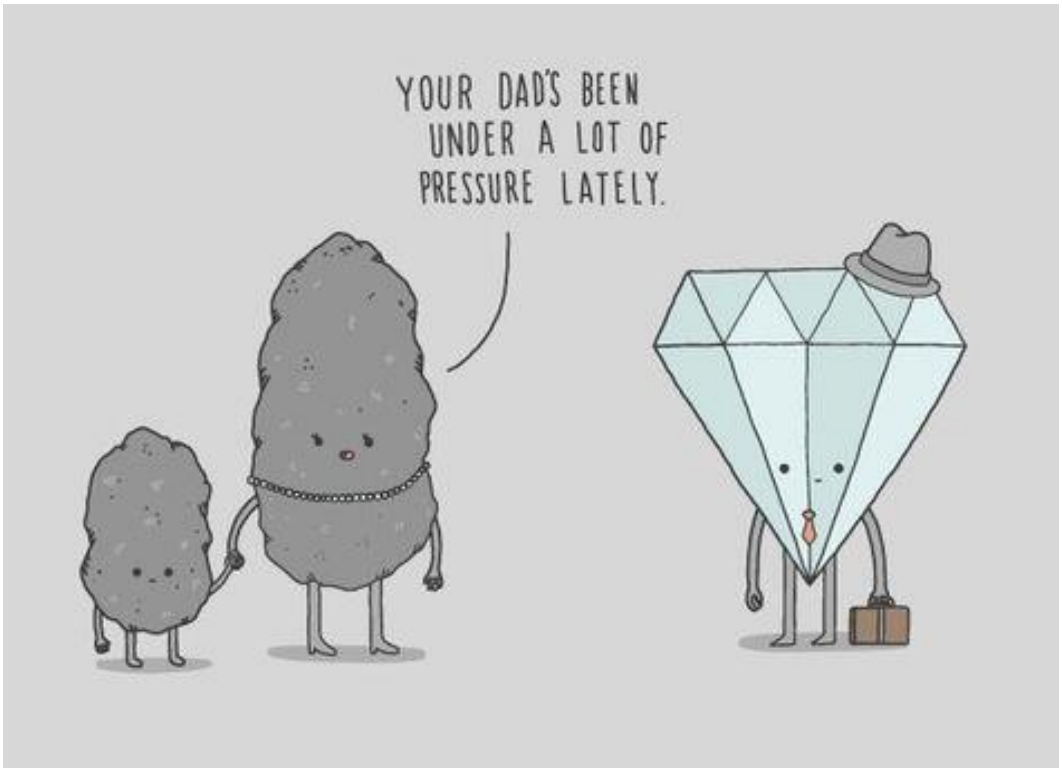
5 INTDS-conference news

In the last issue of the INTDS Newsletter, the 30th Conference of the International Nuclear Target Development Society INTDS 2020 was announced to take place at PSI, Switzerland, in September 2020.

Since due to the Corona-pandemic international travelling from some countries will remain difficult or even impossible for quite a while, the organizers decided to cancel the conference for this year and postpone it for two year to 2022. The exact date will be fixed soon.

For further information, please refer to the conference https://indico.psi.ch/event/7834/ that will be updated regularly or contact intds2020@psi.ch.

7 Laughs for Target Makers



Source: www.cplabsafety.com or CP Lab Safety

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