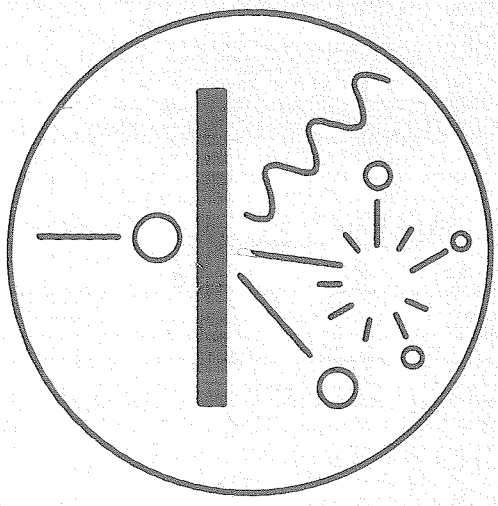
INTERNATIONAL NUCLEAR TARGET DEVELOPMENT SOCIETY

NEWSLETTER



DECEMBER 1993, vol. 21, no. 2

Vol. 21 - N°. 2 - December 1993

International Nuclear Target Development Society
c/o Mrs. Joanne M. Heagney
P.O. Box 123
123 Madrona Lane
Deer Harbor, WA 98243
USA
Tel.: (206) 376 - 4007
Fax: (206) 376 - 5356

Editor: Chris Ingelbrecht
Institute for Reference Materials and Measurements,
Joint Research Centre,
European Commission
Retieseweg
B-2400 Geel, Belgium

Tel.: +32-14-571 211 or 571 602
Telex: 33586 EURAT B
Telefax: +32-14-584 273
E-mail: SPROB@CBNM.JRC.RTT.BE

CONTENTS

Editors Note

Dear Colleagues,

Important news in this issue is the call for candidates for election to the INTDS Board. Page 7 includes a response slip to be cut out or copied and returned to the Corresponding Secretary-Treasurer. The Election Committee of R. Pengo (Chairman), J. Heagney and G. Thomas specifically suggest that members should give special consideration to proposing candidates who could help extend the field of target preparation in countries newly opened to the outside world.

The Thirteenth International Conference on the Application of Accelerators will take place on November 7 - 10, 1994, see conference announcement on page 8. The organizer, Jerome Duggan is especially keen to hold a target making session, as in previous conferences, and INTDS members are urged to consider making contributions on specific topics or very general in nature in order to support this conference (see INTDS Board meeting minutes, page 3).

Seasons greetings and happy new year to all.

Chris Ingelbrecht
Editor

P L E A S E P O S T

FIRST ANNOUNCEMENT SEPTEMBER 22, 1993

THIRTEENTH INTERNATIONAL CONFERENCE
on the
APPLICATION OF ACCELERATORS IN RESEARCH AND INDUSTRY
set for
November 7, 8, 9, 10, 1994
University of North Texas, Denton, Texas USA

The Thirteenth International Conference on the Application of Accelerators in Research and Industry will be held at the University of North Texas in Denton, Texas, November 7-10, 1994. Please note that this conference is four (4) days in length. The proceedings of the conference will be published in Nuclear Instruments and Methods in April 1995. The editors of these proceedings will be Jerome L. Duggan, The University of North Texas and I. L. Morgan, IDM, Inc. The Abstracts of the manuscripts will be published in September, 1994 by the University of North Texas Press. The conference is being organized by The University of North Texas.

The purpose of the conference is to review research, and the wealth of industrial applications that are in progress with accelerators throughout the world. The conference is composed of two symposia which run in parallel. These are the Research Symposium and the Industrial Applications of Accelerators. Some of the sessions which are of general interest will be held common to both groups. Participants can easily interchange between the two symposia. Three hundred and fifty invited papers will be given at these symposia and contributed papers will be accepted in the following areas: Atomic Physics and Related Phenomena, Trace & Surface Analysis with Ion Beams, Electron Beam Processing, Nuclear Physics, CTR & Related Phenomena, Neutron Activation Analysis & Bulk Analysis with Accelerators, Radiological Safety Aspects of Accelerators, Ion Implantation with Particular emphasis on Semiconductors & Metallurgical Applications, Geosciences & Related Phenomena, Charged Particle Microprobes, Super SIMS, Carbon Dating, Computed Tomography, Synchrotron Light Source Experiments, Insitu Beams, Radiation Interaction with Ion Beams, Accelerator & Component Design & Automation, Targetry, Detectors & Electronics, Medical Applications with Accelerators, Biological & Chemical Applications, Material Analysis with Ion Beams, Channeling, Stopping Power & Radiation Effects.

Most of the contributed papers will be presented in poster sessions. An abstract (invited and contributed) in APS format is required by 1 July, 1994. Designated times will be assigned for the participants to be present at their poster station.

We are planning workshops on November 5 and 6 (Saturday and Sunday) prior to the accelerator conference. Suggested topics in the past for these workshops have been: Radioactive Ion Beams, Positron Sources, Problems Associated with Low Energy Ion Implantation, Technology Associated with Radiation Damage Studies, Ion Sources for Tandem Accelerators, the New Handbook on Modern Ion Beam Materials Analysis being developed at Los Alamos National Laboratory, Experimental Opportunities at the SSC, and Teaching with Accelerators. Please let us know if you have other suggestions for workshops and/or if you would like to give a workshop.

Further information, application blanks, poster information, manuscript materials, American Airlines/Avis Car rental discount travel, and other conference information can be obtained by contacting:

Jerome L. Duggan
The University of North Texas
Department of Physics
P. O. Box 5368, Denton, Texas, 76203-5368
Telephone: (817)-565-3252 or (817)-565-3250
Fascimile or FAX: (817)-565-2227
FC66@UNTVAX.BITNET.

INTDS Video tapes

Videos are an excellent medium for conveying the intricacies of target preparation and it has long been the ambition of the INTDS to build up a video tape collection of different target making techniques. The first title is now available:

"Production of Self-Supporting ^{24}Mg foils"
G.E. Thomas and J.P. Greene, Argonne National Laboratory

This 45 min. film gives a very thorough description of a technique for the reduction of magnesium oxide using zirconium filings, the collection of the distilled magnesium on a glass plate, and floating and collection of the metal foil on a target ring.

Copies of the tape in NTSC, PAL or SECAM versions can be ordered from Joanne Heagney, price US $ 20 including postage.

The appearance of future titles depends on the efforts of INTDS members. Do you have some special or routine techniques that you could film? Why not take a camera on a guided tour of your laboratory? Technical perfection is not required, although the INTDS would reserve the right to ask for further editing. Tapes would be distributed by the INTDS for a nominal price to cover copying and shipment.

Physikalisches Institut der Universität Erlangen-Nürnberg

Physikalisches Institut · Erwin-Rommel-Str. 1 · D 8520 Erlangen

D 8520 Erlangen, 09.12.93

Erwin-Rommel-Str. 1
Telefon 09131/85
Telefax 09131/15249

Sachbearbeiter:

Unser Zeichen

Dear members of INTDS,

when I started my job in 1973 I only knew how to handle a vacuum apparatus and to evaporate gold on slides.

At our institute there was hardly any literature to inform but always a long list of target orders. So I had to muddle through as nobody was available to give me a hint. I only was told where all over the globe this targets were made very well but never how to do so. Once in 1979 one of my "customers" said: "In Berlin they make C-foils you only can dream from". This was the break-trough, I insisted to have a look at this "Berliners" of my own. So I got contact to Klaus Grabisch at HMI, who was the first member of INTDS I met. He and his fine staff were open to all my questions and gave me many a good advice to improve our equipment - there was not even a thickniss monitor in our lab - .

Otherwise I realized my foils hadn't been so worse at all. This knowledge also supported my self-assurance facing our physicists.

From then life was much easier, it was on me to find communication to other target makers, first in Germany and then at the Conference of INTDS (in 1984) at Antwerp.

Going to the Conferences at Darmstadt (1988) and Padua (1992) I looked forward to meet good friends again ant felt part of the large family of INTDS, though I never presented a paper but only came for learning.

Very valuable for me were the continuous informations about what's going on in target making by the Proceedings and the Newsletters.

For all this help I want to thank before I shall retire at the end of this year and wish good luck to all of you furthermore success to INTDS and their members.

Thanks

Ilsa Schmidt

A.J. Michielsen
Dept. of Subatomic Physics
R.J. van de Graaff laboratorium, Utrecht University
P.O. Box 80.000
3508 TA Utrecht
The Netherlands

H. Fraiquin
K.V.I.
Zernikelaan 25
9747 AA Groningen
The Netherlands

Titanium Targets

1. Introduction

Titanium targets of areal densities in the range of 200 to 500 $\mu g/cm^2$ had to be used in heavy-ion experiments with the accelerator facility of Ganil in Caen, France. In this article the preparation of these targets by pack rolling will be described.

2. Procedure

A Titanium foil, with a thickness of 3 μm, bought from Goodfellow Ltd., Cambridge, England, has been used as starting material. The pack rolling of Ti can be performed between polished stainless steel down to an areal density of 300 $\mu g/cm^2$. When the Ti foil will be rolled thinner, it will ignite as reported earlier [1]. In our case it occurred with a Ti foil, which was rolled down to 180 $\mu g/cm^2$. The rolling of thin Ti foils and the mounting of them on the Ganil target frames, is quite difficult to perform because the thin foils float easily in the argon stream of an argon filled glove box.
An alternative is the vapour or sputtering condensation of Ti on a substrate with a parting agent, followed by floating of the Ti layers in water and mounting them on the frames. However, this method delivers targets with a much higher oxygen content than the rolled targets [2]. Sputter deposition yields 16.6 at.% O in a Ti target, to be compared to 1.0 at.% O in a rolled Ti target. These oxygen contents were determined by Elastic Recoil Detection analysis. The lowest oxygen content in a Ti foil (areal density of 300 $\mu g/cm^2$), obtained by rolling was 0.2 at.%, based on scattering of a 20 MeV C beam delivered by the Utrecht Tandem Accelerator. This foil was prepared in the Utrecht target laboratory. An oxygen content, comparably high as in the Ti layer made by sputter deposition, can be expected in a Ti layer prepared by means of vapour condensation since Ti vapour is well known as a getter. Consequently, only the pack rolling of Ti results in a Ti layer with a low oxygen content.
Assuming that the ignition of the Ti foils is caused by electrostatic charging, we decided

to ground the person who performed the rolling procedure by means of a grounding kit (delivered by 3M, USA). All objects, which were used during the rolling procedure such as Ti foils, stainless steel envelope, foreceps, scissors and frames, were just as well connected to the grounding kit.
Six Ti foils, with areal densities of 298, 258, 249, 232, 206 and 187 $\mu g/cm^2$ were prepared without problems by pack rolling of a 3 μm thick Ti foil (2,5 $\times$ 2,5 cm^2). These foils were mounted on a Ganil frame with a hole of 16 mm $\emptyset$. The five thickest foils appeared to be pinhole free by eye control with the help of a TL lamp. A few pinholes were visible in the 187 $\mu g/cm^2$ Ti foil. Consequently one can conclude that it is possible to roll pinhole free Ti foils in the above described way down to about 200 $\mu g/cm^2$ without danger for spontaneous ignition.
This ignition has also been observed during the preparation of some rare earth elements by means of pack rolling [3]. A 2 mg/cm^2 Terbium (Tb) foil, pack rolled in the K.V.I. target laboratory, ignited spontaneously. When the pack rolling was combined with the above described grounding method, the preparation of a Tb foil of the same areal density was performed without ignition- and other problems.

References

[1] Frank J. Karasek, Proceedings of the seminar on the preparation and standardisation of isotopic targets and foils, Harwell 20 and 21 october 1965, p.111.

[2] H.J. Maier, Nucl. Instr. and Meth. A303, No.1, (1991) 172.

[3] L. Westgaard and S. Bjørnholm, Nucl. Instr. and Meth. 42, (1966) 77.

ALTERNATIVE PREPARATION OF S.S. DEUTERATED POLYETHYLENE TARGETS

H. Fraiquin

KVI, University Groningen, The Netherlands

To make s.s. deuterated polyethylene targets with the thickness of 100 μgr/cm^2, boil 4 mg C_2D_4 in 1 gr. xylene for several minutes in a covered beaker. Then the near boiling solution is poured on a clean polished stainless steel (or quartz) plate of 8 x 5 cm^2.
Evaporation can be accelerated by the use of a blower (it takes a few minutes).
After the evaporation is completed, heat the plate at the bottom side with the blower until the polyethylene becomes transparent (polymerisation). Now immerse it in cold water immediately.
The polyethylene foil can easily be removed by the use of a piece of adhesive tape on the small side of the foil. Other foils can be made by changing the amount of C_2D_4 in the solution. Use a release agent for thinner foils.

Preparation of Samples and Targets at IRMM during 1993

J. Pauwels, C. Ingelbrecht, P. Robouch, R. Eykens, A. Moens, F. Peetermans, A. Dean, H. Mast, S. Palmeri, J. Van Gestel, D. Egan, R. Scott*, D. Gilliam**

In total 805 samples corresponding to 119 requests were supplied in support of the IRMM nuclear data programme and to external customers in 14 countries (Table 1 - 3). They comprise thin deposits, special plastic films, metals, alloys, compounds and encapsulated samples for reactor flux and temperature monitoring.

Among the thin deposits prepared by vacuum deposition are a number of lithium fluoride and boron reference deposits prepared for various calibration purposes. The ^{36}Cl deposits were prepared by vacuum deposition of AgCl. Deposits of ^{17}O were prepared either by vacuum deposition of tungsten oxide or by suspension spraying of aluminium oxide. First attempts at preparing thin metallic lithium-7 deposits to be used as neutron producing targets were successfully carried out by vacuum deposition in a special set-up. Finally, the development of electrolysis in aqueous and organic ("molecular plating") medium were investigated further with the aim to set-up a useful method for the preparation of ^{244}Pu-deposits on gold coated polyimide foils.

Twelve reference materials for reactor neutron dosimetry are currently available, including metals, alloys and actinides. During 1993 219 units were ordered by customers in 11 countries.

Materials currently being studied are titanium metal to be certified for scandium traces, a range of Al-Co alloys and uranium doped glass for fission track dating.

Under an agreement with NIST aimed at achieving close to 0.1 % accuracy in absolute neutron counting, a series of ^{10}B and ^{6}LiF deposits on silicon wafers were prepared. These were characterized by various destructive and non-destructive techniques to establish surface densities and gradients.

The development of U-Pu based metallic spikes for IDMS determinations of uranium and plutonium in spent fuel solutions is continuing with a production batch of samples prepared for characterization by IDMS and gamma spectrometry.

* SURRC, Glasgow
** NIST, Gaithersburg

Table 1. Supply of thin deposits, films and bulk samples in support of the IRMM programme

Preparation	Number of Requests	Number of Samples	Preparation Methods[1]
Thin deposits			
Au	2	6	VD
B	1	3	VD
^{10}B	13	44	VD
$^{36}Cl(AgCl)$	2	3	VD
^{6}LiF	4	17	VD
^{7}Li	1	3	VD
^{17}O (metal oxides)	2	2	VD-SU
MgF_2	1	5	VD
$^{233}UF_4$	3	9	VD
Films			
C	2	11	FL
Mylar	1	5	FL
Polyimide	3	17	CE
Polysulphone	1	3	CE
Bulk samples			
Al	3	45	MA
Al_2O_3	1	6	MA
Au	1	1	MA
^{138}Ba	3	3	CAN
Be	1	1	MA-CAN
^{113}Cd	1	1	M-R-MA
In	1	1	M-MA
^{6}Li	2	2	MA-CAN
Na	3	3	R-MA-CAN
P	1	1	CAN
^{208}Pb	1	1	M-R-CAN
Pd	1	1	M-R-MA
Pt-20 % Ag	1	1	M-MA
^{238}Pu-nitrate	1	1	SOL
Rh-40 % Cu	1	1	M-MA
^{232}Th	2	2	MA-CAN
^{238}U	2	2	MA-CAN
V	1	1	MA

(1)
CAN canning
CE centrifuging
FL flotation
MA machining
M melting
PR pressing
R rolling
SOL solution
SU suspension spraying
VD vacuum deposition

Table 2. Supply of thin deposits, films and bulk samples to external customers

Preparation	Customers' countries	Number of Orders	Number of Samples	Preparation Methods[1]
Thin deposits				
CaF_2	D	1	1	VD
^{nat}LiF	D	5	12	VD
^{10}B	D, USA	3	9	VD
$^{235}U_3O_8$	B, F	2	2	SU
$^{238}UF_4$ or $^{238}U_3O_8$	D, F	2	7	VD, SU
Films				
Formvar	USA	1	10	CE
Polyimide	D	1	15	CE
Bulk samples				
^{7}Li	B	1	1	R-CAN
Bi	CS	1	20	M-CAN
Pb-In	CS	2	40	M-MA-CAN
^{235}U	B	1	10	CAN

(1) CAN canning; CE centrifuging; M melting; MA machining; R rolling; SU suspension spraying; VD vacuum deposition

Table 3. Supply of special dosimetry preparations to external customers

Preparation	Customers' countries	Number of Orders	Number of Samples	Preparation Methods[1]
Metals				
Al	IAEA	1	1	M-R-MA
Co	NL	1	2	MA
Cr	IAEA	1	1	MA
Fe	I	1	24	M-R-MA
In	IAEA	1	1	MA
Ni	I, NL	3	128	M-R-WD-MA
Nb	IAEA	1	39	MA
Rh	IAEA	1	10	MA
^{235}U	JAP	1	20	R-MA
^{238}U	F, JAP	2	150	R-MA
Al-Alloys				
1 % Ag	HUNG	1	1	LM-R
0.1 % Au	HUNG	1	1	LM-R
1 % Au	IAEA, HUNG	3	3	LM-R-WD
1 % Co	IAEA	1	1	LM-WD
2 % Co	IAEA	1	1	LM-WD
5 % Dy	IAEA, HUNG	4	4	M-R
5 % La	IAEA, HUNG	2	2	LM-R-WD
0.1 % Lu	SLO	1	3	LM-R-WD
1 % Mn	SLO, IAEA	2	2	LM-R-WD
4 % Mn	IAEA	1	1	LM-R-MA
5 % Mn	I	1	63	LM-R-MA
2 % Ni	S	1	1	LM-R-WD
1 % ^{232}Th	SLO	1	1	LM-R-MA
5 % ^{235}U	NL	1	4	LM-R-MA
0.2 % ^{238}U	SLO	1	1	LM-R-MA
Dosimetry Sets				
Nb, Ti, Fe, Co	NL	1	11	MA-CAN

(1) CAN canning; LM levitation melting; M melting; MA machining; R rolling; WD wire drawing

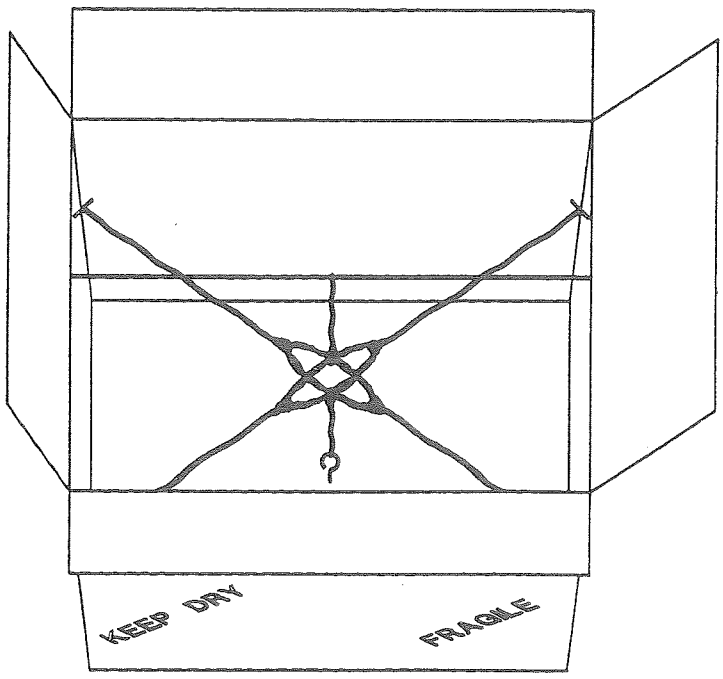
A Packing Method for Shipment of Thin Pressed-Powder Targets *

Wm Lozowski
Indiana University Cyclotron Facility, Bloomington, IN 47408

A method of packing pressed-powder targets for shipment from IUCF consists of placing them in light weight metal cans (62 mm diam × 15 mm high, fitted with slip-on lids) and then pushing the cans into a stretched cage of two latex rubber bands suspended in a box by six other equally elastic rubber bands in tension. In the center portion of the drawing below, the cage is shown ready to accept a metal can(s). This arrangement has provided safe passage for fragile target pellets in all of ≈ 15 uses. The most fragile pellets (4-8 mg/cm^2 $^{12\&13}$C of 19 mm diam) are shipped unmounted, held firmly between glass slide pieces by a small compressive force provided by open-celled foam pieces in the metal can.

The rubber bands are obtained from an assortment of common natural-colored latex rubber bands intended for office use. The ease by which these can be linked to adjust the size and cushioning of the suspension system facilitates the use of a wide range of band sizes. To support loaded target cans weighing up to ≈ 90 g within sturdy cardboard shipping boxes of ≈ 250 mm xyz dimensions, a simple construction has been assembled using bands having pre-stretched dimensions of 88 mm length, 6 mm width, and 1.3 mm thickness.

To make the suspension system, one band is twisted in the middle and folded to make a loop half the original size. Then, two bands are tied separately to it in opposing positions using pass-through knots (simple interweaving). This three-band element is stretched between lengths of stiff copper bus wire (2.6 mm diam) pushed through the box at half its depth and near diagonally opposite corners (to minimize sensitivity to external crushing forces). An identical three-band element is stretched along the other box diagonal in the same plane. The cage is completed and drawn open with the addition of vertically positioned bands which are tied with pass-through knots at the crossover points of the three-band elements and anchored with pieces of the same bus wire, as shown in the drawing. At each point of penetration on the outside of the box, the ends of the wire pieces are bent to follow the plane of the side of the box and taped over with duct tape.



* Work supported by the National Science Foundation grant NSF PHY 93-14783 & Indiana University