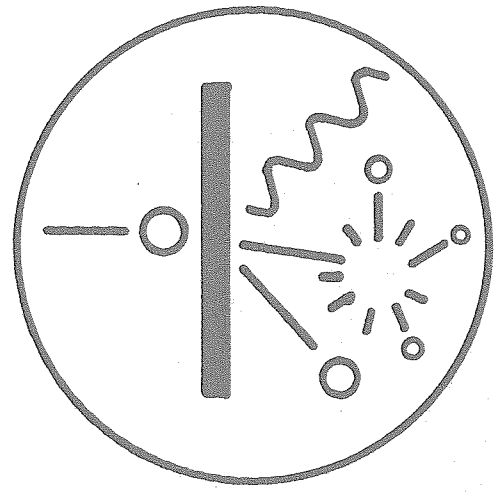


Handwritten symbol resembling a stylized 'T' or 'H' with a curved bottom.

INTERNATIONAL NUCLEAR  
TARGET DEVELOPMENT  
SOCIETY

NEWSLETTER



JANUARY 1979

INTDS Newsletter

January 1979

We are again putting out the Newsletter. The response for contributions has been gratifying and much appreciated. Just a reminder that the Newsletter is an informal method of communication to let each other know what we are doing and other items of general interest.

I would like to express my thanks to Dr. G. T. Garvey, Director of the Physics Division at Argonne National Laboratory, for his support and encouragement in our putting out the Newsletter. Also to Bonnie Kazich for its typing, assembly and mailing and to Dave Kurth for its cover and drawings.

W. D. RIEL, PRESIDENT  
PHYSICS DEPARTMENT  
STATE UNIVERSITY OF NEW YORK  
STONY BROOK, NEW YORK 11794

München, 1978

I should like to take this opportunity to thank Hans Maier and Peter Maier-Komor, their Universities, and all those people who worked so hard to produce a splendid meeting. Unofficially, there were ~80 in attendance with the following represented: BELGIUM 4, CANADA 1, CHINA 7, DENMARK 1, ENGLAND 8, FRANCE 10, GERMANY 22, HOLLAND 1, ISRAEL 1, ITALY 3, JAPAN 1, POLAND 1, SOUTH AFRICA 1, SWEDEN 2, SWITZERLAND 2, and USA 15 — truly international representation. Forty papers were presented in three days and the Proceedings will be published in Nuc. Instruments and Methods.

INTDS 1979 Meeting

I am pleased to announce, and as you will see in another part of the Newsletter, Jozef Jaklovsky and New England Nuclear have agreed to host our 1979 Conference.

From the President's Desk -- Requests, Comments, and Thoughts

We expect to receive our Articles of Incorporation in final form very shortly. At that time, we must give serious thought to fund raising methods to help finance attendance at International meetings. I would like to hear from anyone who would like to be on a committee to handle financial ways and means.

At the meeting, the ORNL people made it clear that a serious shortage of isotopes is near and it is my guess that it will become critical within five years. We are demanding more of the isotopes of less natural abundance. Let's start considering schemes for the interchange of isotopic targets which will soon be impossible to obtain any other way. Speak to the physicists in your lab about the isotope problem shortage.

Needed is someone to write a description of the Society and its aims, to send out to new members. Also, I have received many inquiries on how a target laboratory should be equipped. Your suggestions would be appreciated.

Our Society is uniquely equipped to coordinate research on carbon stripper foils. Who out there is willing to write a proposal?

Point out to the others the increasing reference material now available on targetry. We should encourage authors to cite target makers and their techniques in their papers. Remember to supply the experimenter with a reference when you have employed a technique presented in a paper.

The next meeting is already in the planning state; any suggestions you wish to make should be sent along now.

MRS. K. M. GLOVER

APPLIED RADIATION CHEMISTRY GROUP

BLDG. 10.30

AERE HARWELL

DIDCOT, BERKS. OX11 0RA

ENGLAND

The work of the stable isotope unit at A.E.R.E. HARWELL is concerned with the preparation of a wide range of isotopes, isotopic compounds, alloys and targets. Targets are fabricated for customers at home and overseas. They are prepared individually to customers' specifications subject to the limitations of the target making techniques. The techniques involved are vacuum evaporation, cold rolling, electroplating, pressing and settling.

Also made are an extensive range of thin carbon foils for use as targets for nuclear research, beam stripper foils and specimen mounts for electron microscopy.

Mossbauer absorbers of iron-57 and tin-119 are also prepared either as compounds or thin annealed foils.

The actinide orders section prepares and calibrates alpha active sources and californium 252 spontaneous fission fragment energy calibration sources, to customer specification. Activities in the range 0.001 $\mu$ Ci to 100mCi. The activity is deposited uniformly usually by vacuum evaporation over a precisely defined area on either a thick or thin backing foil (e.g. Vyns, Mylar, nickel or carbon < 50 $\mu$ g/cm<sup>2</sup> thickness). Uniform deposits up to a few mg/cm<sup>2</sup> are prepared on rigid backing foils by painting on many layers to ensure uniformity and adhesion. The alpha particle energy resolution is frequently required to be < 10 keV full width half maxim peak height (FWHM). Infinitely thin high resolution sources must be free from radio-active and inactive contaminants, the necessary chemical purifications are carried out immediately prior to source preparation upon request. The total activity can be measured in an absolute low geometry counter to an accuracy of  $\pm 0.1\%$  when required. Standard backings always available are 1 1/16 diameter 0.015" thickness polished stainless steel discs and 0.000006" thickness nickel foil.

G. E. THOMAS  
PHYSICS DIVISION  
ARGONNE NATIONAL LABORATORY  
9700 S. CASS AVENUE  
ARGONNE, IL 60439, USA

Unusual targets made recently include:

Self supporting  $150 \mu\text{g}/\text{cm}^2$ ,  $^{40,42,44}\text{Ca}$  and  $^{24,26}\text{Mg}$ .

Also  $70 \mu\text{g}/\text{cm}^2$  self supporting Ni.

During one evaporation producing 10, 50, and 100 mono-layer Al on Carbon and another set on Si.

Targets of  $^{120,122,124}\text{Sn}$  for heavy ion experiments.

New equipment:

We are designing an apparatus which will allow us to evaporate many targets at one time and transfer them in vacuum to a storage chamber.

J. PAUWELS AND J. VAN AUDENHOVE  
CENTRAL BUREAU FOR NUCLEAR MEASUREMENTS

STEENWEG OP RETIE

2440 GEEL

BELGIUM

Nuclear Target Preparation and Assaying at the Central Bureau for  
Nuclear Measurements

The CBNM set up sample preparation facilities in 1960 not only to cover its own requirements but also to meet the needs of nuclear research and industry in the European Community.

Preparation Techniques

Electrospraying, vacuum deposition, cathodic sputtering, rolling, powder metallurgy, melting and casting, mechanical shaping.

Definition Methods

Mass definition in air and vacuum; thickness determination by oscillating quartz monitor; isotope dilution mass spectrometry; alpha-counting.

Some Typical Samples

vacuum deposits of:  $^{233,235,238}\text{UF}_4$   
 $^{239,240,242}\text{PuF}_3$   
 $^{232}\text{ThF}_4$ ;  $^{237}\text{NpF}_3$   
 Bnat,  $^{10}\text{B}$ ,  $^{11}\text{B}$ ;  
 $^6\text{LiF}$ ,  $^7\text{LiF}$

electrospraying of:  $^{233,235,238}\text{U}_3\text{O}_8$ ;  
 $^{239,240,241}\text{PuO}_2$ ;  
 $^{237}\text{NpO}_2$   
 $^{232}\text{ThO}_2$   
 $^{241,243}\text{AmO}$   
 $^{180}\text{W}$

spray-painting of:  $^{235}\text{U}_3\text{O}_8$  and  $^{233}\text{U}_3\text{O}_8$ .

rolling of: U in thicknesses from 20 mg/cm<sup>2</sup> up.

thin backings: Vyns, formvar, polyimide, carbon in thicknesses from 10 to 200 μg/cm<sup>2</sup>.

powder samples: All kinds of stable isotopes or elements self-supporting or canned.

#### Certified Alloys

Al alloys with  $^{238}\text{U}$ ,  $^{235}\text{U}$ ,  $^{239}\text{Pu}$ ,  $^{232}\text{Th}$

Al alloys with B, Li

$^{235}\text{U}$  alloys with  $^{239}\text{Pu}$

V alloys with  $^{238}\text{U}$ ,  $^{235}\text{U}$ .

#### Special Assemblies

Li,  $^6\text{Li}$ ,  $^7\text{Li}$ , Na and K samples in form of tubes, rods and slabs prepared by precision casting.

DONALD RAMSAY

PHYSICS DEPARTMENT

STANFORD UNIVERSITY

STANFORD, CALIFORNIA 94305

When floating a thin film from the substrate, the initial lifting step is often the most critical. I have found it useful to dip the long axis of the microscope slide  $\sim 1/16''$  into formvar dissolved in dichloroethane (1 gm/100 ml.). The solution dries quickly and then the substrate may be scribed and scraped around the edges. The slide is placed sideways so that the water contacts the long axis first. The light plastic coating lifts readily and the target film, once started, floats off more evenly.



PROCEEDINGS OF THE 1974 ANNUAL CONFERENCE  
OF THE INTERNATIONAL NUCLEAR TARGET DEVELOPMENT SOCIETY  
CHALK RIVER NUCLEAR LABORATORIES - 1-3, OCTOBER 1974

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COMMISSARIAT A L'ENERGIE ATOMIQUE  
CENTRE D'ETUDES DE BRUYERES LE CHATEL

Service CONTROLE QUALITE

B.P. 561

92542 - MONTROUGE CEDEX - FRANCE

Submitted by: C. GENTY

Target lab responsables: MM. J. KWINTA, C. BERGEY

Activities: Actinide targets for metrology and Nuclear Physics Research

Materials deposited: Th, U, Np, Pu, Am, Cm, Cf isotopes on a variety of substrates: thick metallic foils and thin films (plastic or carbon)

Methods: Electrolysis, electrospraying, electrophoresis, vacuum evaporation, focused ion beam sputtering

Controls: non destructives: interferometry, gravimetry, quartz monitor, alpha and gamma counting  
destructives: isotopic dilution and mass spectrometry, coulometry

Other facilities: hot laboratory for chemical separations and analysis

D. W. L. TOLFREE  
DARESBUURY LABORATORY  
SCIENCE RESEARCH COUNCIL  
WARRINGTON WA4 4AD  
ENGLAND

New Carbon Stripper Foil Development Work

In support of the development program for the construction of the new 30 MV Tandem Van de Graaff at Daresbury Laboratory, a collaboration jointly funded by Daresbury and Harwell is being carried out to investigate the behavior of carbon stripper foils under heavy ion bombardment. Preliminary work has resulted in the preparation of a carbon foil with a lifetime increased by at least a factor of 25 over foils produced by conventional evaporation techniques (DL/NSF/P86).

Foils were prepared by the following method. Clean glass slides were coated with a thin layer of evaporated sodium chloride as a release agent and then clamped to a shielded cathode plate situated about 15 mm from a plane parallel electrode inside a vacuum chamber. After the vacuum chamber had been evacuated to a pressure of about  $10^{-4}$  -  $10^{-5}$  torr a mixture of ethylene and 10% argon gas was flowed through the chamber at a pressure of  $\sim 0.1$  torr. A glow discharge was struck by applying a potential of 2 kV to the cathode. The carbon films were floated off the coated slides, thoroughly washed and mounted on foil holders. The technique is simple but care has to be taken to avoid pin holding in the films and breakage during mounting.

The carbon foils were tested in a clean line irradiation facility using a 4.8 MeV  $A^{++}$  ion beam of charge current 0.65 - 0.8  $\mu A$  and lifetimes compared with foils produced by the carbon-arc evaporation method. It was only possible to test two hydrocarbon cracked foils in the time available, because of the long lifetimes. After exposure times of about 1100 and 500 minutes for each foil respectively, the foils did not break, compared with  $\sim 40$  minutes needed to break carbon-arc type foils. Although only two foils were tested the longer lifetime

is associated with fundamentally different behavior under irradiation, for example a much slower shrinkage rate was observed. The reason for this is not understood and careful studies are currently being made of the physical and mechanical properties of this new type of foil.

MARIE-ANTOINETTE SAETTEL  
LABORATOIRE DE SPECTROMETRIE NUCLEAIRE  
CENTRE DE RECHERCHES NUCLEAIRES  
67037 STRASBOURG CEDEX  
FRANCE

I have no new information this reporting period. However, I will be glad to help anyone having difficulty producing a particular target.

M. WEISHAAR  
CENTRE DE RECHERCHES NUCLEAIRES  
67037 STRASBOURG CEDEX  
FRANCE

The following is a list of targets which I have made since I am a target maker:

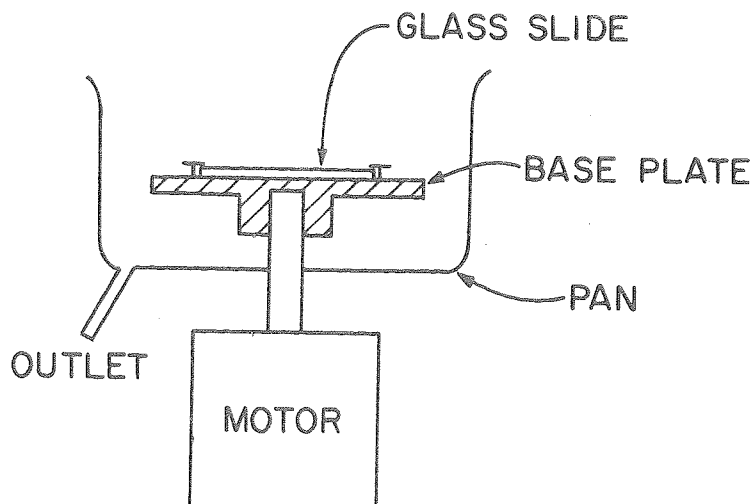
thin self supporting  $^{12,13}\text{C}$ ,  $^{10,11}\text{B}$ ,  $^{18}\text{O}$  (anodic oxidation),  
rolled targets,  
reduction of metals.

Preparation of Self Supporting Formvar Foils

A simple device for the preparation of thin (up to  $25 \mu\text{g}/\text{cm}^2$ ) homogenous self supporting formvar foils. The centrifuge method itself is probably not brand new, but it has proven to be very useful in the last eight years. The advantage of this method is that there is not need for expensive and fancy equipment, and is reproducible. The apparatus consists of an electrical motor (rotations 3000/min) which is mounted in such a way, that the axle is in a vertical position. On top of the axle, a ban plate was mounted on which  $5 \times 5$  cm glass slides can be screwed. As a safety precaution, an ordinary pan was also mounted. After the motor is switched on, a few mb of diluted R.B.S. - 25<sup>(1)</sup> is spread on the glass and after 3 minutes, a few drops of formvar solution are added. Very thin and homogenous formvar foils have been made in this way, to be used as a backing or even as a "release agent"<sup>(2)</sup>. The thickness of the foil depends on the concentration of the solution. I found that 2 grams of formvar solved in 200 mb chloroform gave  $10 \mu\text{g}/\text{cm}^2$  foils while 4 grams formvar in 200 mb chloroform gave  $20 \mu\text{g}/\text{cm}^2$  foils.

(1) R.B.S. - 25, Pierce Chemical Company, Box 117, Rockford, IL 61105, USA

(2) A. H. Bennink, N.I.M. 146 (1977) 591.



ANDRÉE MÉENS

LABORATOIRE DE PHYSIQUE NUCLEAIRE ET DE PHYSIQUE DES ACCELERATEURS

CENTRE DE RECHERCHES NUCLEAIRES

67037 STRASBOURG CEDEX

FRANCE

Over more than 10 years of target making for Van de Graaff experiments, we have made a large variety of targets.

My present work is more oriented toward 1-10 mg/cm<sup>2</sup> targets using the following procedures:

- Reduction and rolling for all rare earths except E<sub>u</sub>.
- Reduction and rolling of Sn, Cd and Zn to 1 mg/cm<sup>2</sup> and sticking onto a thick substrate with Leo Sapir's technique.
- Fabrication and control of ferromagnetic targets.

Here is a tip to help avoid using too many expensive high-grade Cu foils. When making routine targets which require a soluble Cu substrate, I have found that inexpensive Cu sheeting as is used for electric screening, works very well when electropolished. To illustrate the savings involved:

- 1 roll of 200 m long and 12 cm wide 20 μ Cu, costs about 250 Francs.
- 1 liter of the electropolish solution, costs 100 Francs.
- 1 foil of 4" x 4" 0.0004" (10 μ) Cu foil, now costs \$33 or 150 Francs.

J. B. REYNOLDS

OLIVER LODGE LABORATORY

UNIVERSITY OF LIVERPOOL

P. O. BOX 147, LIVERPOOL L69 3BX

ENGLAND

Here are some brief notes on activities in Liverpool:

1. Nickel and iron isotopes onto plunger target ( $2\text{mg}/\text{cm}^2$  stretched gold) by electroplating.
2. Preparing selenium isotopes  $30\text{mg}/\text{cm}$  by evaporation with 90% recovery (on gold backings).

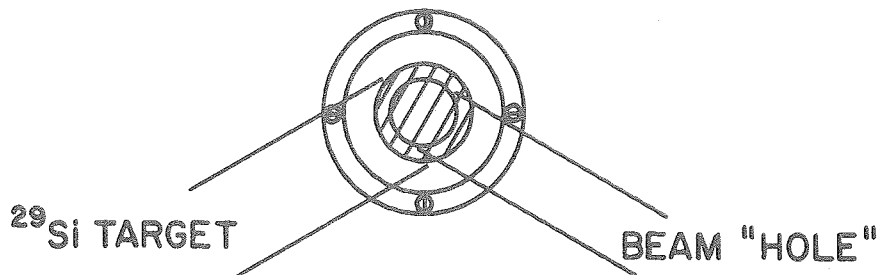
3. Silicon 29 Self Supporting Plunger Targets:

Required:  $300\mu\text{g}/\text{cm}^2$  S.S. Si29 plunger targets.

Method: Mount plunger in the usual way using formvar.

Ensure that the "beam hole" area is flat. Pick up a silicon 20 film prepared in the usual way and dry. Dissolve the formvar with 1.2 dichloroethane vapor.

Plunger



Y. K. PENG

TANDEM ACCELERATOR LABORATORY

McMASTER UNIVERSITY GSB105

HAMILTON, ONTARIO

CANADA L8S 4K1

Reduction of  $^{178}\text{HfO}_2$  to  $^{178}\text{Hf}$  for Target Preparation

50-100 mg of  $^{178}\text{HfO}_2$  has been successfully reduced to  $^{178}\text{Hf}$  metal using Magnesium as reducing agent. The yield of this process ranged from 70 to 80%. The temperature required for this process is  $\sim 1000$  °C.

The mixture of  $^{178}\text{HfO}_2$  and Mg powder was pressed to a pellet and placed in a Tantalum lined steel cylinder. The cylinder was closed with a Tantalum plug and a strip of Nickel was used to wrap around the plug at the joint. After pumping out the gas present in the cylinder, the joint was sealed under vacuum by melting the Ni strip. This completely sealed reaction vessel was then heated to 1000 °C in a continuously pumped tube furnace for 20 minutes. The charge which stayed as a pellet was removed from the reaction vessel by cutting the vessel open and treated first with diluted Hydrochloric acid to remove MgO obtained, i.e.  $^{178}\text{Hf}$  metal was dried, pressed to a pellet and melted down to a small shiny bead.

$^{178}\text{Hf}$  targets of  $200 \mu\text{g}/\text{cm}^2$  thick have been prepared and used in the  $^{178}\text{Hf}(t,p)^{180}\text{Hf}$  reaction. Any impurity present in the targets was found to be negligible.

This method has also been used successfully in reducing isotopically enriched  $\text{TiO}_2$  and  $\text{SiO}_2$  to Ti and Si respectively.



J. D. STINSON  
NATIONAL RESEARCH COUNCIL  
DIVISION OF PHYSICS  
MONTREAL ROAD  
OTTAWA, ONTARIO K1A 0R6  
CANADA

At N.R.C. most of the targets used are of the water cooled solid backed type. Until recently, the water/vacuum seal was obtained using an indium ring seal made from 0.5 mm wire. The fabrication of an improved target assembly which accepts a rectangular target needed a rectangular seal. Instead of the indium wire seal, an indium plated brass frame with the same outside dimensions as the target, provides a rigid seal that is easily handled. Several frames are given an overall 0.1 mm thick plate, at the same time, in a dextrose stabilized cyanide bath.\* The brass frames can be reclaimed from used seals by removing the indium in 0.5N hydrochloric acid. The improved method of sealing resolved the difficulties encountered in mounting reactive targets, in a glove-box, with its inherent loss of manual dexterity.

\* Espe, Werner, Materials of High Vacuum Technology (Vol. 1 - p 562), Pergamon, New York 1966.

JOZEF JAKLOVSKY  
NUCLIDES AND SOURCES DIVISION  
NEW ENGLAND NUCLEAR CORPORATION  
NORTH BILLERICA, MASSACHUSETTS 01862

THE MANAGEMENT OF NEW ENGLAND NUCLEAR  
CORPORATION HAS DECIDED TO SPONSOR THE WORLD  
CONFERENCE OF THE INTERNATIONAL NUCLEAR TARGET  
DEVELOPMENT SOCIETY, AT THE BOSTON FACILITIES, IN  
THE FALL OF 1979.

HAROLD L. ADAIR  
ISOTOPE RESEARCH MATERIALS LABORATORY  
OAK RIDGE NATIONAL LABORATORY  
OAK RIDGE, TENNESSEE 37830

The demand for both stable and radioactive targets prepared by the Isotope Research Materials Laboratory (IRML) at the Oak Ridge National Laboratory (ORNL) continues to increase. Most of the increased demand can be attributed to the fabrication and development work involving radioactive materials which accounted for approximately 70% of IRML's efforts in FY 1978. A large part of the radioactive sample preparation program is directed at the fabrication of actinide fission foil deposits for neutron cross-section measurements and the fabrication of vanadium encapsulated materials that are used for monitoring the neutron energy spectra flux and fluence at various locations in reactors.

During the past few months, a total of 70  $^{233}\text{UO}_2$  deposits ( $300 \mu\text{g}/\text{cm}^2$ ) have been prepared for precision neutron cross-section measurements which will be made at ORNL. The  $^{233}\text{U}$  material (3 g) used was the highest enrichment of  $^{233}\text{U}$  available. It contained  $\leq 11$  ppb  $^{233}\text{U}$ . Although the samples were prepared using a large electron beam gun, collection efficiencies of 12-15% were achieved.

Approximately 2600 vanadium encapsulated neutron monitors were prepared by IRML during FY 1978. Most of the monitors contained pure ceramic actinide oxide "wire" materials' however, development efforts during the past year concentrated on the preparation of uniform dilute mixtures or alloys for use in neutron monitors for very long or high power reactor runs.

An in-situ alpha thickness monitor has been fabricated and will be tested during the next few months. The monitor will be used to accurately measure evaporation rates and thickness of actinide deposits; design of the monitor is based on discussions with J. Pauwels during my visit to CBNM.

U. SANDER, H. H. BUKOW and H. V. BUTTLAR

INSTITUT FÜR EXPERIMENTALPHYSIK (III)

RUHR-UNIVERSITÄT

POSTFACH 10 21 48

D-4630 BOCHUM 1

WEST GERMANY

We use selfsupporting Carbon foils to populate excited atomic states in beam foil spectroscopy (BFS). As reported in Munich<sup>1)</sup> the foil properties are not constant but change under irradiation with light ions ( $H^+$ ,  $He^+$ ,  $Li^+$ ) at energies of (100-400) keV. A formula to estimate the lifetime of a foil was derived from these investigations. Applied to experiments with heavy ions (P) at high energies (20 MeV) the calculated lifetime is in good agreement with the experimental.

Actually, we are studying the details of energy distributions within an ion-irradiated carbon foil.

<sup>1)</sup> INTDS, Garching, September 11-14, 1978.

This first mailing of the Newsletter is going out to everyone. However, if you wish to remain on the mailing list and have not indicated so, please return the form below to:

Ms. Bonnie Kazich  
Physics Division, 203-F177  
Argonne National Laboratory  
9700 S. Cass Avenue  
Argonne, IL 60439  
U.S.A.

I wish to remain on the International Nuclear Target  
Development Society Newsletter mailing list.

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