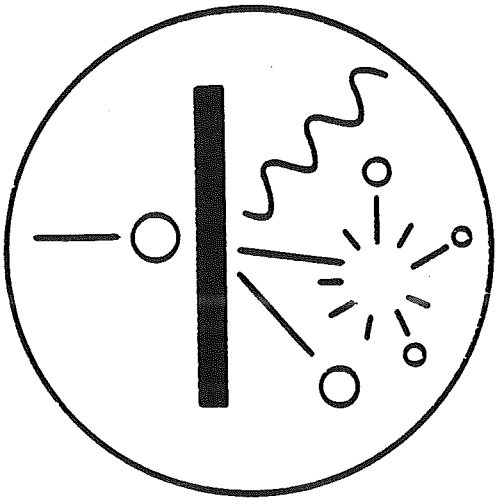
INTERNATIONAL NUCLEAR TARGET DEVELOPMENT SOCIETY

NEWSLETTER



December 1989

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Dear Colleagues,

I will probably leave the Central Bureau for Nuclear Measurements at the end of February 1990, taking the advantage of early retirement.

I wish to thank you all for the many years of support in publishing this Newsletter.

I would like to express my gratitude to Edith De Coninck who has proved to be an invaluable asset in putting the Newsletter together and polishing up the presentation over the the past 10 years. Her dauntless efforts in this important area of the publication is worthy of our sincere appreciation.

It is the intention of the CBNM Direction to continue with the publication of the Newsletter and Chris Ingelbrecht will be taking over as Editor in the new year. I am sure that you will all give him your support and assistance in keeping the Newsletter alive and kicking!

Merry Christmas and a Happy New Year.

Jan Van Audenhove
EDITOR

INTDS Board Meeting
October 23, 1989
Oak Ridge National Laboratory
Oak Ridge, TN

The meeting was called to order at 1020 hours by President, Harold Adair. In attendance were: Joanne Heagney, Joe Heagney (guest), Hans Maier, Peter Maier-Komor, Jean Pauwels, George Thomas, and Bill Lozowski. Board Members Helmut Folger, Eugene Newman, and Geirr Sletten were unable to attend.

Actions and Resolutions

1. The Board was in agreement in expressing appreciation regarding the highly evident, superb work of Helmut Folger and many others at GSI which contributed greatly to the success of the 1988 Conference.

2. Future joint meetings of the IAEA-INDC and the INTDS will be encouraged; however, achieving better coordination between the two groups will be a priority.

3. Generally, it will be desirable to have shorter sessions and to add an additional day to future meetings with alike numbers of presentations (67 in 1988).

4. The Society will send a representative to a future meeting concerning Transient Applications of Thin Films (TATF). (The first was attended by Hans Maier and Peter Maier-Komor in Regensburg, FRG in the Spring of 1989.)

5. A representative of the Society will be sent to each Denton Accelerator Conference and to each European Conference on Accelerators in Applied Research and Technology. (The first of the latter was held September 5-9, 1989 in Frankfurt.)

6. A discussion involving the possibility of producing and maintaining a video tape library of target making techniques resulted in the decision to produce a sample tape for review. Joanne and Joe Heagney volunteered to make the tape, have it converted to the European video standard, and ship it to Jean Pauwels and Hans Maier for evaluation.

7. Requests for financial support to attend the Santa Fe Conference should be submitted to Harold Adair.

8. Several event dates associated with the Santa Fe Conference were agreed upon:

    - Preregistration deadline - February 1, 1990
    - Second announcement mailing - mid-February
    - Third announcement mailing - July 5
    - Abstract submission deadline - July 1, 1990

9. Harold Adair sent a reply expressing acceptance and gratitude to the Lab Naz. Di Legnaro in Padova, Italy and Ruggero Pengo for their offer to host the 1992 INTDS Conference.

10. Peter Maier-Komor and Hans Maier agreed to formulate recommendations regarding guidelines for reviewers of INTDS conference papers. these will be given to Harold Adair and he will decide whether or not to circulate them to the Board before the meeting in Santa Fe.

11. C. Ingelbrecht of CBNM has volunteered and was accepted for the position of editor of the INTDS Newsletter in the event that Jan Van Audenhove retires from CBNM in 1990.

12. Henceforth, the host of the next conference will be invited to the board meeting held in the year preceding the conference.

13. Ten soft-bound copies of the 1988 Proceedings will be ordered from NIM, and made available to any INTDS member on a cost recovery basis.

14. The subject of formulating guidelines for travel was tabled.

The meeting adjourned at 1555 hrs.

Respectfully submitted,

Bill Lozowski

Bill Lozowski,
Recording Secretary

I.N.T.D.S. TREASURER'S REPORT FOR PERIOD JULY 1, 1988 THROUGH OCT. 19,1989

BALANCE ON HAND JULY 1, 1987		$33,115.02
RECEIPTS:		
INTEREST	3,411.67	
DUES	$2,910.00	
PROCEEDINGS SALES	35.68	
TOTAL	6,357.35	+6,357.35
DISBURSEMENTS:		
2 YRS SEC-TREAS. FEE (1986-87, 1987-88)	1,000.00	
BOARD EXPENSES	113.81	
INTDS & IAEA-INDC CONF. EXPENSE	100.00	
MISC.	84.28	
TOTAL	1,298.09	-1,298.09
BALANCE ON HAND OCT. 19, 1989		38,174.28

ACCT. BALANCES THROUGH OCT. 19, 1988

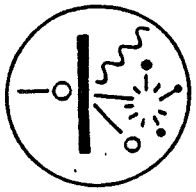
CHECKING ACCOUNT	259.46
MONEY MARKET SAVINGS	3,311.54
CERTIFICATE OF DEPOSIT	34,603.28
TOTAL	$38,174.28

RESPECTFULLY SUBMITTED,

Joanne M. Heagney

DATED: OCTOBER 19,1989

JOANNE M. HEAGNEY
TREASURER



FIRST CONFERENCE CALL FOR THE

15TH WORLD CONFERENCE OF THE INTDS

"Special High-Purity Materials and Targets"

Santa Fe, New Mexico, USA, September 10-14, 1990

The 15th World Conference of the International Nuclear Target Development Society will be held in Santa Fe, New Mexico, USA, September 10-14, 1990. Conference contributions will describe methods used in providing rare and precious research materials and in preparing, characterizing, and applying these materials in various fields of scientific investigations. Specific emphasis will be placed on techniques used for the preparation and characterization of enriched isotopic materials for atomic and nuclear physics research and the discussion of the influence of sample properties on nuclear measurements and the interpretation of results from accelerator experiments. Contributions are especially encouraged in the following areas:

1. preparation and sampling of high purity and special materials,
2. tritium target processing and fabrication,
3. preparation and characterization of both light and heavy ion targets,
4. heavy-ion and laser fusion targets,
5. stripper and neutralizer foils, heavy-ion window foils,
6. oxide reductions and electrolytic target processes,
7. impact of target parameters on experimental results, and
8. production of stable and radioactive isotopes and targets, etc.

Conference Chairman

P. Gobby — Los Alamos National Laboratory, MS-E549, Los Alamos, NM 87545 USA
Telephone 505-667-6009, FAX 505-665-2104, Telex 660-495 Los Alamos Lab

Program Committee: S. Aaron, ORNL, Oak Ridge, Tennessee, USA
H. Folger, GSI, Darmstadt, FRG
P. Gobby, LANL, Los Alamos, New Mexico, USA
J. Gursky, LANL, Los Alamos, New Mexico, USA
J. Pauwels, C.E.C.-J.R.C., CBNM, Geel, Belgium

Conference Secretary

Ms. Debra Vigil — Los Alamos National Laboratory, MS-E549, Los Alamos, NM 87545
Telephone 505-667-6887, FAX 505-665-2104

Deadlines:		
	Preregistration	February 1, 1990
	Hotel Reservation	June 1, 1990
	Submission of Abstracts	July 1, 1990
	Submission of Papers	September 1990

Conference Language: English

Publication of Proceedings: Nuclear Instruments and Methods in Physics Research

FIFTEENTH WORLD CONFERENCE OF THE INTERNATIONAL NUCLEAR TARGET DEVELOPMENT SOCIETY

SEPTEMBER 10-14, 1990 SANTA FE, NEW MEXICO, USA

Preregistration Form for the

15TH WORLD CONFERENCE OF THE INTERNATIONAL NUCLEAR TARGET DEVELOPMENT SOCIETY

Name _____

Address _____

_____

_____

Telephone _____ Telex/FAX _____

I plan to attend the conference _____ Yes _____ No

I wish to present a paper(s) _____ Yes _____ No How many? _____

Subject(s) _____

_____

_____

I expect to be accompanied by _____ person(s).

I expect to need accommodations for _____ person(s).

Please provide me with information on _____

Date _____ Signature _____

Please return this form **before February 1, 1990** to either P. Gobby or D. Vigil:

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中国原子能科学研究院
INSTITUTE OF ATOMIC ENERGY
P.O.BOX275,BEIJING,PEOPLE'S REPUBLIC OF CHINA

The third National Symposium of NTSC

Xu Guoji

The third national symposium of Nuclear Target Sub-society of China,NTSC, was held at Institute of Modern Physics, Lanzhou, 11-15 October 1989. About 40 parcitipats and reqistrants from 10 laboratories and universities attended this meeting. Remarks of welcome were extended to the meeting by prof, Shen Wen qing, vice director of Institute of Modern Physics. Thirty three papers have been presented in four sessions which covered topics including:

1. target user's comments,
2. trium processing,
3. carbon foils,
4. electro depositions,
5. rolling,
6. sputter depositions,
7. electro-beam-gun evaporator and
8. thickness measuerment.

The board of directors of NTSC includes:
Dr. Xu Guo ji, president, Mrs. Chang Fu hua, Vice president, Mr.Wang Xiu ying and Dr. Peng Xiu feng. Chengdu was chosen as the site of the next symposium which will be held in 1992, with Mrs. Chang Fu hua of South-West Institute of Nuclear Physics and Chemistry as hostess.

DENSITIES OF EVAPORATED CARBON FILMS

John O. Stoner, Jr.
Department of Physics
The University of Arizona
Tucson AZ 85719

and

ACF-Metals
The Arizona Carbon Foil Co., Inc.
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We have measured the mass densities of arc-evaporated carbon foils in three different thickness ranges. The results show little consistency. In some cases, foils have voids that are more than fifty percent of their total volume.

Relatively few measurements of the mass density of carbon foils can be found in the literature. Until a few years ago, we used the results of Kennedy et al.(1), who measured the mass density by immersion of fragments of foils in mixtures of carbon tetrachloride (specific gravity = 1.59) and bromoform (specific gravity = 2.98), obtaining a value of 1.82 +/- 0.10 grams per cubic centimeter. Consistent with this, we have observed that thin sheets of commercially available graphite have densities in the range 1.6 - 1.8 grams per square centimeter.

We did flotation measurements of carbon-foil densities to confirm these results. Initially we used solutions of potassium iodide (KI) and zinc chloride (ZnCl), which gave us a range of specific gravities up to 1.71 and 1.93 respectively. We produced carbon foils having nominal surface densities of about 20 micrograms per square centimeter by arc evaporation (2) onto soaped microscope slides at a distance from the arc of 20 cm. The vacuum was better than 3 x 10(-5) torr. Using a sharp razor blade, we scraped foil fragments into the solutions, agitated the mixtures and allowed them to settle. Our foils sank in these solutions; hence the foils had densities greater than 1.93 grams per cubic centimeter.

To reach higher densities, we mixed bromoform-carbon tetrachloride mixtures in 25-ml volumetric flasks and weighed

them to determine the densities of the liquids. Again, we scraped carbon fragments from foils having nominal surface density of 20 micrograms per square centimeter into the solutions, agitated the mixtures and allowed them to stand overnight. Only if fragments stayed suspended for several hours in the solutions did we claim that the density of the foil was close to that of the liquid. In each case, we corrected the density of the liquid for changes in room temperature. In one run, we kept the flasks on a shelf in the lighted laboratory, and observed continuous slow turbulence in them. In a second run we kept the flasks in dark storage, and observed them only briefly, minimizing any local heating by preferential absorption of light by the carbon flakes. In the latter run, we observed no turbulence. In both cases, the density of these carbon foils was always conservatively in the range 1.97 - 2.10 grams per cubic centimeter. The value 2.00 +/- 0.02 (probable error) grams per cubic centimeter fitted our data well.

We obtained an independent estimate of the density of a similar foil from an electron-microscopy measurement of the physical thickness of an arc-evaporated carbon foil (3). This placed the density in the range 2.0 +/- 0.4 grams per square centimeter. Although this was not a particularly accurate measurement, it does have an important implication (see below).

Carbon builds up to thicknesses of 1 mm or more on surfaces 5 cm from the arc in our evaporator, over a period of several months. We removed a piece of this material and measured its density by conventional gravimetric methods (weighing in air and water) and obtained a density of 1.83 +/- 0.03 (limit of error) grams per cubic centimeter. This is consistent with the density of commercial graphite but is not consistent with our flotation measurements of thin foils.

We make carbon foils in the surface-density range of 200-1000 micrograms per square centimeter by successive evaporations at a distance from the arc of about 20 cm. Such foil are baked at 300 degrees Celsius before use. We measured the geometrical thicknesses of multiple layers of such foils with a conventional micrometer that could be read to 0.0025 mm. We found as expected that for one to ten layers, the geometrical thickness was proportional to the number of layers, but that the thickness was much greater than expected. The densities resulting from these measurements ranged from about 0.6 grams per cubic centimeter at a surface density of 200 micrograms per square centimeter, to 0.85 grams per cubic centimeter at a surface density of 1000 micrograms per square centimeter (Figure 1). It is not known whether the unbaked foils had the same density.

Although the apparent macroscopic density of these foils was less than 1 gram per cubic centimeter, they nevertheless sank quickly

when immersed in water. Thus they must have had voids that filled with water when the foil was immersed.

All evaporated foils (including target foils) have voids produced by the evaporation process (4,5). The fact that the density of foils having a thickness of only 100 nm (corresponding to 20 micrograms per square centimeter) is somewhat above the bulk value may be due to some filling of the interstices of the foil by adsorbed gases from the atmosphere. Combustion measurements (2) on such foils, however, show impurities to be less than about 10% by weight. It may be that compression in the scraping process created fragments that were denser than the foil as originally deposited.

We hypothesize that as foils are made thicker, to 10-100 micrometers, the voids naturally produced in evaporation remain unfilled and the macroscopic density becomes substantially less than that of the bulk material. A density of 0.6 gram per cubic centimeter corresponds to a filling factor of only about 33%, which is consistent with the formation of a very loose columnar structure, expected for such a high-melting-point material (6) if little diffusion of the evaporant occurs after it arrives at the foil surface. Such foils sink when immersed in water because their pores fill.

The fact that the density of our very thick sample approaches the bulk value may be provisionally explained by the fact that it is much closer to the arc than are our conventional foils. The resulting higher temperature of production may permit sufficient diffusion to develop the denser structure. It is clear, however, that verification of these hypotheses is going to require more research, some of which is under way.

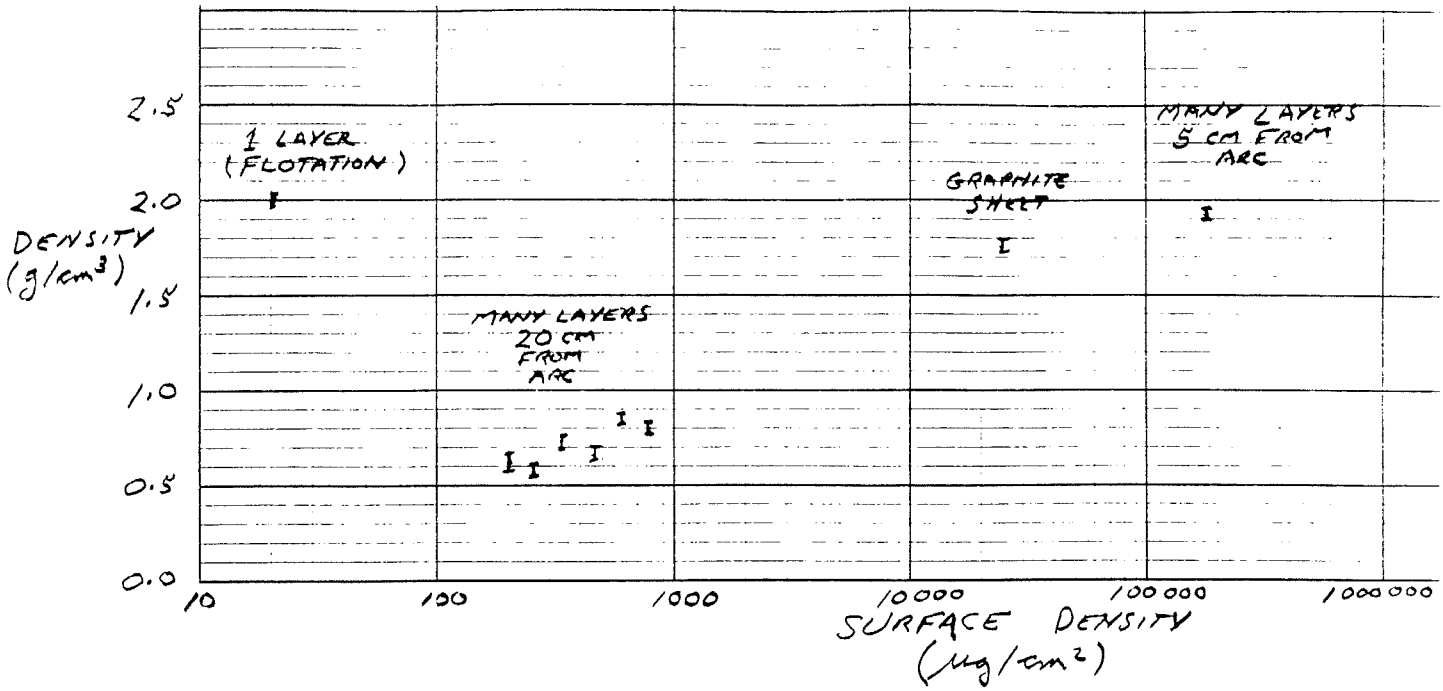

Figure 1. Densities of arc-evaporated carbon films.

References:

1. E.f. Kennedy, D.H. Youngblood, and A.E. Blaugrund, "Lifetimes of the first two levels in phosphorus-30", Phys. Rev. 158, 897-900 (1967).

2. John O. Stoner, Jr., "Accurate determination of carbon-foil surface densities", J. Appl. Physics 40, 707-709 (1969).

3. John O. Stoner, Jr., and Robert B. Stoner, "Laminar structure in strained evaporated carbon films", INTDS Newsletter, August, 1988, pps 13-16.

4. B.J. Bartholomeusz, K.-H. Muller, and M.R. Jacobson, "Computer simulation of the nucleation and growth of optical coatings", in Modeling of Optical Thin Films, M.R. Jacobson, ed., Proc. SPIE 821, 2-35 (1988).

5. John O. Stoner, Jr., "Properties of evaporated target foils studied by computer simulation of ballistic aggregation", World Conf. INTDS, Darmstadt, 1988, Nucl. Instrum. Methods. A282, 242-246 (1989).

6. J.A. Thornton, "Structure-zone models of thin films", in Modeling of Optical Thin Films, M.R. Jacobson, ed., Proc. SPIE 821, 95-104 (1988).

ISTITUTO NAZIONALE DI FISICA NUCLEARE

SEZIONE DI FIRENZE
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TELEX 572570 INFNFI I

ROLLING OF LITHIUM FILMS

A. Cecchi[1], R. Pengo[2], L. Pieraccini[3]

1) - INFN, Firenze, Italy
2) - INFN, Legnaro, Italy
3) - Dipartimento di Fisica, Firenze, Italy

The apparatus described in ref. 1 has been employed in order to roll films of lithium in metal form. The experimental set-up includes a rolling mill operating in a glove-box and in dry argon atmosphere.

The lithium metal was stored in an oil bath and the necessary quantity was introduced in the glove-box. The atmosphere inside was of $\leq$ 0.1 ppm of O_2 and $\leq$ 2 ppm of H_2O. Once the metal was cut and mechanically scrabbed in order to obtain the shining surface all over, the usual pack-rolling procedure was started.

Every few steps, the adding of a little drop of silicon oil[2] is necessary on the inside of the stainless steel, when the thickness is below 4 mg/cm^2 in order to prevent the sticking of lithium on the surface.

The final thickness obtained, using the balance which is inside the glove-box, was of about 500 μg/cm^2 as requested.

This value was necessary for detailed study of reaction mechanism, avoiding complications arising from the presence of different nuclear species in targets like lithium halid.

1) Nucl. Instr. Meth. A282 (1989) 180

2) Nucl. Instr. Meth. A282 (1989) 140.

PRESS FOR SMALL QUANTITIES OF ISOTOPE

F. KUNTZ and A. MEENS

**CENTRE DE RECHERCHES NUCLEAIRES/PNPA, IN2P3-CNRS/UNIVERSITE LOUIS PASTEUR
BP 20, F-67037 STRASBOURG CEDEX, France**

We would like to describe a small, cheap, and perfectly functioning powder press that we built a couple of years ago for the specific purpose of compacting very small quantities of isotope. Our inspiration came after studying the press of the Darmstadt Target Laboratory and the one described in Michielsen's communication.[1] We introduced an important modification to these basic models by using standard commercial machine shop parts in place of the two pieces (4 and 5 in the figure) that most often deteriorate.

As indicated in the figure the press is composed of the following parts :

1. A flat hardened steel base which can be re-milled when necessary.
2. Steel sleeve to hold the anvil guide (piece n°4).
3. Short tungsten carbide rod segment that serves as the lower anvil.
4. Anvil guide, which is a commercially available drill guide and which can be changed as often as necessary when it becomes eroded by abrasive powders. (It costs about 50 FF per piece.)
5. Commercially available hardened steel upper anvil which is usually found as a stamping die in workshops. Also changed easily when deformed. (Costs about 15 FF.)
6. Steel sleeve for holding the upper anvil.
7. Hardened steel top to furnish a flat solid surface and to ensure easy changing of the upper anvil.
8. Piece used for ejecting the pellet, similar to combined 6 and 7.

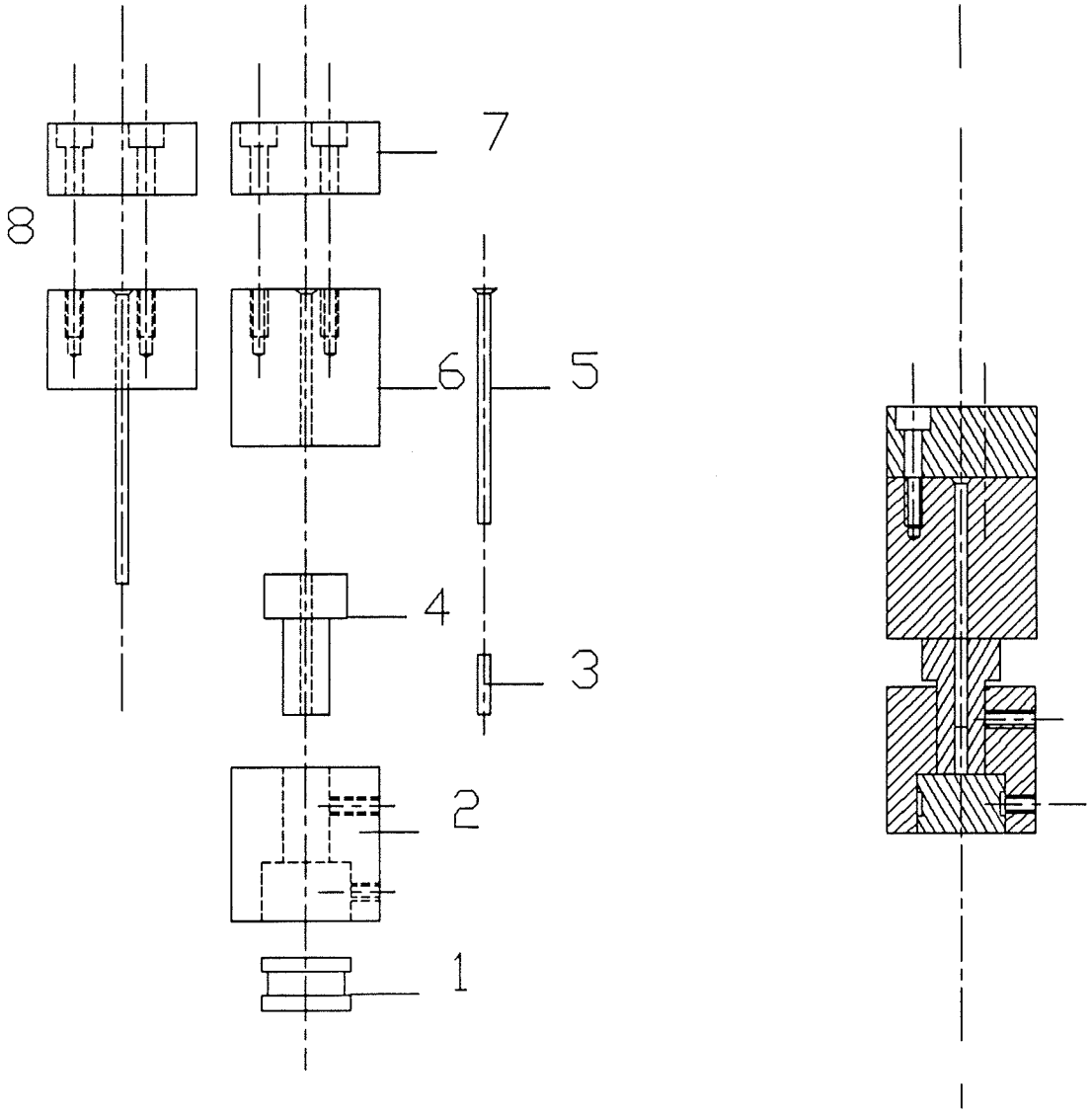
We have built three models with diameters 2, 3, and 5 mm. The maximum force we have put on the press is :

4000 N for ø 2 mm
10000 N for ø 3 mm
25000 N for ø 5 mm

As examples of applications, with the 2 mm diameter press we are able to make pellets with 10 mg of Ge, Si, or Cr and 4 mg of a rare earth like Gd.

[1] A. Michielsen, Newsletter, June 1986, p.11.

A. exploded view B. assembled



powder press

ACTIVITY REPORT

Department of Nuclear Physics
Research School of Physical Sciences
The Australian National University
GPO Box 4, Canberra, ACT 2601, Australia

A.H.F. MUGGLETON

The targets listed in Table F1 have been prepared in the target laboratory during the year. Over 200 targets have been produced by various techniques, including evaporation, ion beam sputtering, cold rolling and pressing.

TABLE F1. TARGETS PREPARED IN 1988

ISOTOPE	CHEMICAL FORM		BACKING	TARGET THICKNESS ($\mu g/cm^2$)	METHOD
	FINAL	INITIAL			
C	C	C	SS	2-130	a
^{164}Er	^{164}Er	$^{164}Er_2O_3$	SS	1000	d
Gd	Gd	Gd	SS	5500	c
$^{155,157}Gd$	$^{155,157}Gd$	$^{155,157}Gd_2O_3$	SS	2000	c
$^{155,156,157}Gd$	$^{155,156,157}Gd$	$^{155,156,157}Gd_2O_3$	Fe+Pb	150-950	c&d
In	In	In	Cu	300	a
^{24}Mg	^{24}Mg	$^{24}MgO_2$	C	50-100	e
Mo	Mo_2O_3	Mo_2O_3	C	5	a
^{144}Nd	^{144}Nd	$^{144}Nd_2O_3$	C	5-40	a
^{141}Pr	^{141}Pr	^{141}Pr	SS+Au+Pb	2000	b
^{195}Pt	^{195}Pt	^{195}Pt	C	5-25	d
^{196}Pt	^{196}Pt	^{196}Pt	SS	200	d
Sm	Sm	Sm	SS	1500	c
^{144}Sm	^{144}Sm	$^{144}SmO_3$	SS	500-1000	c
^{144}Sm	^{144}Sm	$^{144}SmO_3$	SS+Bi+Au	1000	d
^{149}Sm	^{149}Sm	$^{149}SmO_3$	SS+Au+Pb	3000	c
Th	Th	Th	C	1000	a
^{183}W	^{183}W	^{183}W	Gd+Pb	1500	d
^{184}W	^{184}W	^{184}W	SS	500	d
^{171}Yb	^{171}Yb	$^{171}Yb_2O_3$	SS	1200	c

a. Vacuum evaporation
b. Cold rolling between stainless steel plates
c. Reduction of the oxide using either Th or La and simultaneous vacuum evaporation of the resulting metal. Metal condensed, collected and rolled between stainless steel plates.
d. Sputtered using fine beam saddle field ion source.
e. Oxide reduced to the metal by heating in contact with Y powder and simultaneous vacuum evaporation of the resulting metal.

SAMPLES AND TARGETS FOR NUCLEAR MEASUREMENTS DELIVERED BY CBNM DURING 1989

J. Pauwels, C. Ingelbrecht, R. Eykens
CEC, JRC, CBNM, 2440 Geel, Belgium

Summary

CBNM supplied 870 samples to 14 customers during 1989, together with 76 samples in support of the CBNM specific programme. These were mainly thin deposits of actinides, metals and alloys or plastic films. There are also a number of collaborative projects requiring special targets or characterisation. These include the preparation of homogeneous hydrocarbon layers for the investigation of the neutron scattering effect of hydrogen, and the characterisation of ^{10}B and ^{6}LiF layers by the observation of neutron induced reactions with calibration carried out by IDMS. These layers are being used for a remeasurement of the neutron lifetime. Homogeneous U-Pu alloys are being prepared for candidate spike materials for U and Pu determinations by IDMS of the undiluted input solutions of reprocessing plants. A metallographic facility for these alloys has been designed and a homogeneity control method by γ-spectrometry is being developed. CBNM is preparing a range of reference materials for reactor neutron dosimetry. These are metals, alloys and oxides in various stages of certification. In 1989 51 units were sold. New candidate reference materials include Al-Au and Al-Co alloys and a V-Ti-Fe-Ni-Co alloy for high temperature applications.

SAMPLES AND TARGETS FOR NUCLEAR MEASUREMENTS DELIVERED BY CBNM DURING 1989

J. Pauwels, C. Ingelbrecht, R. Eykens
Central Bureau for Nuclear Measurements, Geel, Belgium

1. PREPARATION OF SAMPLES AND TARGETS ON REQUEST

870 samples and targets corresponding to 35 orders have been prepared, characterised and supplied to 14 customers in Belgium, Germany, The Netherlands, Switzerland, Yugoslavia, Algeria and China. Moreover, 76 samples and targets covering 23 requests were supplied in support of the CBNM specific programme. They consist mainly of thin deposits of actinides (^{233}U, ^{235}U, ^{232}Th, ^{239}Pu, ^{240}Pu) or other radioactive materials (^{36}Cl, ^{53}Fe), thin plastic films (polyimide and formvar), bulk metal samples ^{6}Li, ^{7}Li, ^{60}Ni, ^{207}Pb, ...) or alloys, generally prepared by high frequency levitation melting (AlAg, AlAu, AlU, AuCr, AuFe, NiCo, ...)

2. PREPARATION OF HYDROGEN STANDARD LAYERS

Elastic scattering on hydrogen H(n,n)H is an important standard reaction in neutron metrology, but up to now no homogeneous, stable and well characterised standard layers are available. Therefore, an effort is being made to examine the characteristics of potential candidate materials. Thin layers of various long chain (C22 to C28) hydrocarbons, alcohols, and carboxylic acids were evaporated onto several substrate materials. Microstructure, mass stability and homogeneity are being studied in comparison to layers of materials used previously (p-terphenyl and tristearine).

3. CHARACTERISATION OF ^{10}B AND ^{6}LiF STANDARD LAYERS

Standard ^{10}B and ^{6}LiF layers on silicon wafers prepared in the frame of a collaboration with Sussex University and NIST have been characterised by observation of neutron induced nuclear reactions calibrated by IDMS. The obtained accuracies on the number of atoms per cm^2 are 0.34 to 0.43 % for ^{10}B and 0.38 to 0.44 % for ^{6}Li. Presently an attempt is being made to improve the boron results by applying a chemical purification in the IDMS of boron.
Moreover, it was demonstrated that ^{10}B standard layers prepared previously are inaccurate by 2.5 %. This has a direct consequence on the neutron lifetime as determined by Byrne et al in 1980(1).

4. PREPARATION OF U-PU METALLIC SPIKES

Uranium-plutonium alloys containing 1 to 3 % ^{239}Pu are required as metallic spikes for the accurate assay by IDMS of U and Pu in undiluted input samples of reprocessing plants. However, problems still exist with both homogeneity and workability of these alloys. Therefore, a systematic study of the parameters of importance for their preparation has been started.

A facility for metallography of α-active alloys has been designed and is being installed, and a method for fast homogeneity control by γ-spectrometry was developed. For spikes ranging from 20 to 150 mg containing 1 and 3 % Pu precisions are comparable to those obtained via IDMS :

U-1 % ^{239}Pu	:	RSD = 0.53 %	(0.52 % by IDMS)
U-3 % ^{239}Pu	:	RSD = 0.27 %	(0.18 % by IDMS)

5. DEVELOPMENT OF HIGH-TEMPERATURE NEUTRON DOSIMETERS

The dosimeters currently used by ECN Petten for high temperature application (up to 700°C) consist of very small samples of pure metal wire (iron, titanium) or of alloys (Ni-Co), encapsulated in quartz. The encapsulation, manipulation and analysis of these dosimeters is difficult, and the weighing can lead to significant error. It was decided to prepare an alloy containing all the elements above and eliminate the need to handle separate small samples. A composition of V-6 % Ti-4 % Fe-0.4 % Ni-0.002% Co was selected. The vanadium matrix, with a very low tantalum content, is non-interfering and gives the alloy some ductility. A wire of this composition was prepared and 30 samples were sent to ECN Petten for test irradiations. The homogeneity and performance of this material will be assessed in cooperation with ECN.

6. REACTOR NEUTRON DOSIMETRY REFERENCE MATERIALS

CBNM is collaborating with the Euratom Working Group on Reactor Dosimetry (EWGRD) to produce a series of **reference materials for neutron metrology and reactor surveillance.** These are activation dosimeters of alloys or high purity metals or fission dosimeters of uranium or neptunium oxide. The preparation of the metallic reference materials is combined with co-ordinating and participating in the characterisation programme.

6.1 SALE OF REFERENCE SAMPLES

Although not all materials are officially certified yet (see Table 1), they have been put on sale on special request of EWGRD. During the last year 51 units have been sold to various customers France, Germany, The Netherlands, the United Kingdom and the United States of America.

A technical advertising brochure for all the dosimetry reference materials is being printed for worldwide distribution.

Table 1. CBNM reactor neutron dosimetry reference materials

NRM No.	Material	Status
501	$^{238}UO_2$	EC Certificate
502	$^{237}NpO_2$	Certification analyses ongoing
521	nickel	EC Certificate
522	copper	EC Certificate in preparation
524	iron	EC Certificate in preparation
525	niobium	EC Certificate in preparation
526	niobium	EC Certificate in preparation
527	Al-0.1% Co	CBNM Certificate
528	Al-1% Co	CBNM Certificate

6.2 PREPARATION OF NEW REFERENCE MATERIALS

The transformation of high purity rhodium powder (CBNM-529) into foil has been completed. The powder was initially melted into buttons and then rolled at 900°C under inert atmosphere to a thickness of 50 µm. The intention is to certify the platinum and iridium content and the certification analyses are being carried out by eight Member State laboratories.

The k_0 standardisation method for neutron activation analysis uses gold as a monitor material and to minimise self-shielding effects this should be in the form of a dilute alloy. In response to numerous requests for the alloy Al-0.1 % Au, a new reference material, CBNM-530, of this composition will be prepared and certified for gold content and homogeneity. A number of castings were made by levitation melting and wires of diameter 0.5 mm and 1.0 mm, and foil of 0.1 mm thickness were made. The analyses are being planned.

The two reference materials CBNM-527, Al-1.0 % Co and CBNM-528 Al-0.1 % Co were certified using minimum sample sizes of 10 mg. However, there are applications where smaller quantities of cobalt are required and the certification of a Al-0.01% Co alloy is being planned.

7. REFERENCE

(1) J. Byrne et al., Phys. Lett. 92B (1980) 274

Argonne National Laboratory - Recent Activities

John P. Greene and George E. Thomas

A new Temescal 4-pocket E-gun was installed and is now in use. It employs a 8 kW power supply from Innotec which allows continuous voltage adjustment from 2 to 10 kV and longitudinal and latitude positioning of the beam.

Some of the more difficult targets produced included:

Mo 100 and 200 $\mu g/cm^2$ self-supporting
W films of 1000 Å thickness
Y 200 $\mu g/cm^2$ self-supporting
Zr 100 and 200 $\mu g/cm^2$ self-supporting

A "mini-workshop" on electron beam sources was held in October at Argonne National Laboratory. Participants included Peter Maier-Komor of Technical University of Munich, Robert Leonard of Florida State University and John Greene and George Thomas of Argonne. The characteristics of various electron beam guns, emitters, filaments and focussing mechanisms were studied. These investigations are continuing.

Have upgraded our Veeco evaporator by replacing the diffusion pump with a CTI cryopump system also, a 2nd electronically controlled target storage chamber is now in routine use.

New electronic mail address "TARGETS@ANLPHY".