SIXTH ANNUAL CONFERENCE OF THE

INTERNATIONAL NUCLEAR TARGET DEVELOPMENT SOCIETY

CONTENTS

Lawrence Berkeley Laboratory
Berkeley, California

Oct. 19-20-21, 1977

DISCLAIMER

Sixth Annual Conference of the INTERNATIONAL NUCLEAR TARGET DEVELOPMENT SOCIETY

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Lawrence Berkeley Laboratory
Berkeley, California
October 19, 20, 21, 1977

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*This work was supported by the U.S. Energy Research and Development Administration.

PROGRAM SUMMARY

Wednesday, October 19

8:30-9:15 a.m.	Registration, Bldg. 50 Auditorium
9:15 a.m.	Welcome
9:30 a.m.	Announcements
9:40 a.m.-12:10 p.m.	Session A Chairman, Edward Kobisk, Oak Ridge National Laboratory
10:00 a.m.	Coffee (30 minutes)
12:30 p.m.	Lunch
1:40-4:30 p.m.	Session B Chairman, Peter Maier-Komor, Techn. Universität München
3:10 p.m.	Coffee (20 minutes)

Thursday, October 20

9:00 a.m.-12:10 p.m.	Session C Chairman, Judith Gursky, Los Alamos Scientific Laboratory
10:00 a.m.	Coffee (30 minutes)
12:30 p.m.	Lunch
1:30-2:30 p.m.	Session D Chairman, Dan Riel, SUNY-Stony Brook
2:30 p.m.	Coffee (15 minutes)
2:45-3:45 p.m.	Business meeting of the International Nuclear Target Development Society
4:00-5:30 p.m.	Social Hour--Bldg. 50A, Director's Office
7:00 p.m.	Conference Banquet Speaker, Dr. Richard Lemmon, Lawrence Berkeley Laboratory

Friday, October 21

8:00 a.m.-12:00 p.m.	Tour of SLAC Facility
12:00-12:45 p.m.	Lunch
2:00-4:00 p.m.	Tour of LBL Facilities

GENERAL INFORMATION

Registration

Registration will begin at 8:30 a.m. on Wednesday, October 19, in the lobby of the Building 50 Auditorium. The registration fee is $35.00.

Transportation

Transportation by bus will be available on the following days and places:

Wednesday, October 19, 1977

8:00 a.m. - from Claremont Hotel to Bldg. 50 Auditorium
Close of afternoon session - return to Claremont Hotel

Thursday, October 20, 1977

8:30 a.m. - from Claremont Hotel to Bldg. 50 Auditorium
End of Social Hour - to Marriott Inn for Conference Banquet

Friday, October 21, 1977

8:00 a.m. - from Claremont Hotel to Stanford Linear Accelerator tour.
Lunch will be available at the S.L.A.C. cafeteria.
Bus will arrive back in Berkeley for the Lawrence Berkeley Laboratory tour at approximately 2:30 p.m.

Social Events

There will be a social hour, sponsored by the International Nuclear Target Development Society, at 4:00 p.m. Thursday, October 20, in Building 50A. This will be followed by the Conference Banquet at 6:00 p.m. The banquet is included in your registration fee. After dinner, Dr. Richard Lemmon of Lawrence Berkeley Laboratory will speak on Prebiological Synthesis.

SESSION A
Wednesday, October 19 at 9:15 a.m.

Chairman: Edward Kobisk

Opening Remarks: Dr. Bernard G. Harvey
Associate Director, LBL
Head, Nuclear Science Division

Approximate Time		
9:40 a.m.	A1	Preparation and Characterization of ^{241}Am and $^{3}_{1}H$ Targets H. L. Adair, Oak Ridge National Laboratory
10:00 a.m.		Coffee
10:40 a.m.	A2	Lifetimes of Carbon Stripping Foils George Thomas, Argonne National Laboratory
11:00 a.m.	A3	Rolling Thin Uranium Foils and Other Exotic Isotopic Metals Peter Maier-Komor, Techn. Universität München
11:20 a.m.	A4	A Simple, Efficient Technique for Reducing Small Quantities of Zinc Oxide Joanne Heagney, MicroMatter Co., Seattle
11:40 a.m.		Discussion

PREPARATION AND CHARACTERIZATION OF ^{241}Am AND $^{3}_{1}H$ TARGETS*

H. L. Adair

Oak Ridge National Laboratory
Oak Ridge, Tennessee 37830

ABSTRACT

In the past year the Isotope Research Materials Laboratory (IRML) at the Oak Ridge National Laboratory (ORNL) has prepared many ^{241}Am oxide or metal targets and tritium-containing targets for use in various areas of nuclear research. The americium targets were used in precision cross-section measurements or in the study of the physical properties of the metal. Tritium targets were used as a source of neutrons, according to the reaction $^{3}_{1}H(^{2}_{1}H, {}^{1}_{0}n)^{4}_{2}He$, for biological and materials damage studies.

Procedures for fabricating americium oxide, americium metal, and both small and large area tritium targets will be described. The performance of several 9-inch diameter tritium targets in terms of target lifetime and neutron yield during bombardment with 400 keV deuterons will be described.

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* Research sponsored by the U. S. Energy Research and Development Administration under contract with the Union Carbide Corporation.

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Lifetimes of Carbon Stripping Foils

G. E. Thomas, P. K. Den Hartog, J. J. Bicek, and J. L. Yntema

Argonne National Laboratory, Argonne, Illinois 60439*

Measurements have been made to determine the lifetimes of 5 $\mu g\ cm^{-2}$ carbon targets when bombarded by 3-MeV Kr^{+} ions. Stationary, orbiting, and heated targets were tested using both constant and intermittent beams. Preliminary results indicate some lifetime amplification by the use of these devices. There will be an informal discussion of these results.

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*Work performed under the auspices of the U.S. ERDA, Division of Physical Research and NSF.

ROLLING THIN URANIUM FOILS AND OTHER EXOTIC ISOTOPIC METALS

E. Kellner, P. Maier-Komor
Physik-Department, Techn. Universität München, Germany

ABSTRACT

Rolled target foils withstand due to their crystalline structure longer a heavy ion beam than evaporated targets. This fact is important for experiments with very heavy ions available now at the SUPER HILAC at Berkeley or at the UNILAC at Darmstadt, Germany. Because the crystalline disorientation of the targets by the heavy ion beam requires a frequent target exchange to prevent a deterioration of the energy resolution, we developed a method to produce large quantities of rolled targets with thicknesses below 1mg/cm^2.

As an example results of some new techniques for producing rolled uranium metal foils will be reported. The metal has been purified by zone melting using a well focused electron beam, a softer metal practically without local defects due to impurities has been obtained. Ductility, crystalline structure and low surface roughness of special stainless steel jackets lead to a more uniform pressure during the rolling process and therefore to a high homogeneity of the foils. The number of pinholes in the targets caused by dust particles is reduced using a laminar flow box. Humidity and oxygen content are decreased by using dry nitrogen in the laminar flow box to prevent oxidation of the foils.

With these techniques uranium targets below 1mg/cm^2 were obtained. First results about their behavior in a heavy ion beam will also be reported.

A SIMPLE, EFFICIENT TECHNIQUE FOR REDUCING SMALL QUANTITIES OF ZINC OXIDE

J. M. Heagney and J. S. Heagney
MicroMatter Co., Seattle, WA.

ABSTRACT

The requirement of reducing several small, separate batches of ^{70}ZnO for rolling thin metal foils led to the development of a technique which proved to be considerably more efficient than previous methods. A simple acetate plating bath was used. The metal was collected on a hard cathode and subsequently scraped free. Consolidation of the zinc metal into a bead for rolling was accomplished by melting under inert gas.

OPTIMUM COLLECTION TIME FOR SHORT-LIVED ISOTOPES

Jerry Lerner
Argonne National Laboratory,
Argonne, Illinois 60439

When the half-life of an isotope is comparable to the target-preparation time, it is not always clear at what point the processing should be terminated in order to obtain the maximum yield. The material is decaying both at the source and on the target, but at the same time more of the isotope is being deposited. The optimum collection time will be described for a variety of initial conditions.

HYDRIDING OF TITANIUM CONES FOR A SPUTTER ION SOURCE

Judith Gursky
Los Alamos Scientific Laboratory
Los Alamos, New Mexico

NITROGEN TARGETS PRODUCED BY REACTIVE SPUTTERING OF TANTALUM AND TITANIUM

J. D. Stinson
National Research Council
Canada

A method for the preparation of nitrogen targets by the reactive sputtering of tantalum and titanium is described. Targets in the range of 5 $\mu g/cm^2$ to 60 $\mu g/cm^2$ have been produced. A discussion of the equipment and electrical requirements is included.

URANIUM TARGETS

Helmut Folger and Joseph Klemm
G.S.I. Darmstadt, West Germany

Uranium sandwich targets of 0.1 mg/cm^2 to 20 mg/cm^2 prepared by electron bombardment.

A SELF-SUPPORTED ISOTOPIC URANIUM TARGET AND SELECTED NOTES ON DUCTILE SILICON TARGETS

Claude Ellsworth
Lawrence Berkeley Laboratory
Berkeley, California

Abstract

A HIGH DENSITY WINDOWLESS GAS JET TARGET

W. Tietsch, K. Bethge, E. Schopper

Institut für Kernphysik, Universität Frankfurt am Main, Frankfurt / Germany

A high density gas target has been developed making use of certain characteristics of supersonic flows. A gas jet underexpanding from a axisymmetric laval nozzle shows a beam focussing effect. Under constant pressure conditions the first density knot of the supersonic jet is spatially fixed and well confined and can be used as a gas target. Its length is about 5 mm and the cross section has an average diameter of 3 mm. By varying the inlet gas pressure of the nozzle a variation of the target density is obtainable from a few $\mu g/cm^2$ through over 100 $\mu g/cm^2$. Since window foils are avoided the secondary gas load is reduced by a three stage dynamic pumping system which is built concentrically around the gas jet and allows a 360^0 access to the target area.

SESSION C
Thursday, October 20 at 9:00 a.m.

Chairman: Judith Gursky

Approximate Time		
9:00 a.m.	C1	Gallium Rich Ga_2O Targets for Use at Room Temperature from Isotopic Ga_2O_3 Starting Material Dan Riel, SUNY-Stony Brook
9:20 a.m.	C2	Preparation of Isotopically Enriched Free Standing Chromium Targets Hans Maier, Universität München
9:40 a.m.	C3	A Dry Powder Technique for the Preparation of Carbon Foils W. R. Lozowski, Indiana University Cyclotron Facility
10:00 a.m.		Coffee
10:30 a.m.	C4	Vacuum Tight ^{208}Pb Foils A. Meens, Centre de Recherches Nucleaires
10:50 a.m.	C5	Preparation of Self-Supporting Platinum Targets by Electrodeposition M. A. Saettle, Université Louis Pasteur
11:10 a.m.	C6	Preparation of Rare Actinide Targets for Accelerator Bombardment Ron Lougheed, Lawrence Livermore Laboratory
11:30 a.m.	C7	Preparation of Targets by Electrodeposition of Various Elements T. L. Morgan, University of Manchester, England
11:50 a.m.		Discussion

GALLIUM RICH Ga_2O TARGETS FOR USE AT ROOM TEMPERATURE FROM ISOTOPIC Ga_2O_3 STARTING MATERIAL

W. D. Riel

Department of Physics
State University of New York
Stony Brook, New York 11794

ABSTRACT

The low melting point of Ga and its ability to super cool render it a difficult target for use in room temperature beam lines. Methods of reducing the sesquioxide are discussed and a technique for reduction-evaporation to obtain the suboxide which is rich in metallic Ga is described.

Preparation of Isotopically Enriched Free Standing Chromium Targets

H. J. Maier

Sektion Physik der Universität München, Abteilung Kernphysik, 8046 Garching bei München, W-Germany

The preparation of free standing chromium targets is described. Procedures involve the reduction of Cr_2O_3 to chromium metal as well as evaporation and rolling techniques for the target preparation.

A Dry Powder Technique for the Preparation of Carbon Foils

W.R. Lozowski

Indiana University Cyclotron Facility
Milo B. Sampson Lane
Bloomington, IN 47401

ABSTRACT

Two through eight mg/cm^2 carbon foils have been prepared from an air suspension of graphite powder which was allowed to settle and was subsequently pressed. Keys to the process are the use of: 1. a DeVilbiss medicinal power blower and 2. vacuum-evaporated carbon coated glass slides as the substrate for the settling and pressing operations. In all of several trials, the targets did not stick to the glass slides, could be handled with forceps, trimmed with a razor blade, and mounted over a 20 mm dia. hole. Uniformity was better than 10%.

Vacuum Tight ^{208}Pb Foils

by

A. MEENS

Centre de Recherches Nucleaires
67037 STRASBOURG Cedex, France

ABSTRACT

Targets of ^{208}Pb supported on bismuth grids, were required as vacuum tight windows for nuclear physics measurements. The foils had to be pinhole free over a surface of 0.5 cm^2. The fabrication of these pinhole free foils will be described in the first part of the paper. In the second part the results of some yield measurements, made in order to obtain the maximum number of targets from a given amount of isotope, will be given.

PREPARATION OF SELF-SUPPORTING PLATINUM TARGETS BY ELECTRODEPOSITION

M.A. SAETTEL

Centre de Recherches Nucléaires, Université Louis Pasteur

Strasbourg, France

ABSTRACT

The experimental set-up and conditions for preparing self-supporting metallic platinum targets by electrodeposition are described in this paper.

Results will be given on the influence of deposition time and current density. The yield of about 20%, is better than in the case of evaporated targets.

PREPARATION OF RARE ACTINIDE TARGETS FOR ACCELERATOR BOMBARDMENT

Ron Lougheed
Lawrence Livermore Laboratory
Livermore, California

PREPARATION OF TARGETS BY ELECTRODEPOSITION OF VARIOUS ELEMENTS

T. L. Morgan
University of Manchester
England

SESSION D
Thursday, October 20 at 1:30 p.m.

Chairman: Dan Riel

Approximate Time		
	D1*	A Method for the Preparation of Cadmium Isotopic Targets J. L. Gallant and D. Yaraskavitch, Chalk River Nuclear Laboratories
	D2*	Thin Carbon Foil Breakage Times Under Ion Beam Bombardment G. E. Thomas, A. E. Livingston, and H. G. Berry, Argonne National Laboratory
	D3*	Determination of the Angular Distribution of Carbon Evaporated From a Carbon Arc V. Olivas, John O. Stoner, Jr. and Stanley Bashkin, University of Arizona
	D4*	Mounting a Very Large Carbon Foil John O. Stoner, Jr. and Stanley Bashkin, University of Arizona
	D5*	Calibration of Surface Densities of Metal Films by Optical Transmittance Mark Rhoads, John O. Stoner, Jr. and Stanley Bashkin, University of Arizona
1:30 p.m.		Discussion
2:00 p.m.		Discussion
2:30 p.m.		Coffee
2:45-3:45 p.m.		Business Meeting of the International Nuclear Target Development Society
		* * *
4:00-5:30 p.m.		Social Hour--Bldg. 50A, Director's Office
7:00 p.m.		Conference Banquet--Marriott Inn, Berkeley Richard Lemmon, Lawrence Berkeley Laboratory, will speak on Prebiological Synthesis

* These papers are not being presented orally.

A METHOD FOR THE PREPARATION OF CADMIUM ISOTOPIC TARGETS

by

J.L. Gallant
and
D. Yaraskavitch

ABSTRACT

A technique that produces high quality self-supporting cadmium isotopic targets has been developed. Cadmium oxide is dissolved in dilute sulphuric acid and the metal extracted by the electrolysis process. It is then evaporated onto a glass substrate which has been previously coated with a thin film of cadmium chloride. The metal foil is released from its substrate by immersion in methyl hydrate.

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Thin Carbon Foil Breakage Times under Ion Beam Bombardment

G. E. Thomas, A. E. Livingston, and H. G. Berry*

Argonne National Laboratory, Argonne, Illinois 60439† and

*Department of Physics, University of Chicago, Chicago, Illinois 60637

The breakage times of thin carbon foils have been measured when bombarded by a beam of Ar^+ ions having energies of 1 to 3 MeV. This breakage time when using foils having areal densities of 2 to 22 $\mu g\ cm^{-2}$ is found to be independent of carbon foil thickness. From our results, which are in acceptable agreement with previous measurements, we propose the following empirical formula for foil breakage time τ in terms of the ion energy E:

$$\tau(p\mu A\ min\ mm^{-2}) = A(\sim 10) \cdot E^{1.15}\ (MeV \cdot amu^{-1}).$$

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† Work supported in part by U.S. ERDA, Division of Physical Research and NSF.

Determination of the Angular Distribution of Carbon Evaporated From a Carbon Arc

V. Olivas, John O. Stoner, Jr., and Stanley Bashkin
Physics Department, University of Arizona, Tucson, Arizona 85721

ABSTRACT

Tests of the angular distribution of carbon evaporated from a carbon arc indicate that such an arc behaves approximately as a cylindrical surface source (a cosine source) with its axis concentric with that of the carbon rods.

This work was supported by NSF and ONR.

Mounting a Very Large Carbon Foil

John O. Stoner, Jr., and Stanley Bashkin

Department of Physics, The University of Arizona, Tucson, Arizona 85721

ABSTRACT

We show pictorially a procedure by which a carbon foil having a surface density of 36 micrograms/centimeter was mounted with a clear unsupported aperture of 102 millimeters (4").

This work was supported by NSF and ONR.

Calibration of Surface Densities of Metal Films by Optical Transmittance

Mark Rhoads, John O. Stoner, Jr., and Stanley Bashkin

Department of Physics, University of Arizona, Tucson, Arizona 85721

ABSTRACT

For evaporated metal coatings (Al, Cr, Cu, Au, Ag, Sn, and Ti) we have developed curves of optical transmittance vs surface density that can be used to estimate surface densities to within about ±20%.

This work was supported by NSF and ONR.

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