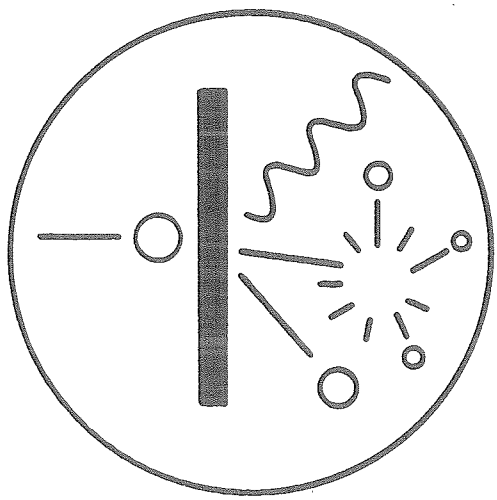
INTERNATIONAL NUCLEAR TARGET DEVELOPMENT SOCIETY

NEWSLETTER



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Editors Note

Dear Colleagues,

You will receive with this issue a copy of the INTDS publications database on 5¼" diskette for PC prepared by Piotr Robouch, and covering all INTDS publications (conferences and newsletters up until the end of 1992). Starting instructions are given on page 3 of this Newsletter.

Chris Ingelbrecht
EDITOR

Geel, June 1993

Dear INTDS Member,

You just got the PC database of INTDS publications !!

In order to be able to use this file you should proceed as follows:
1) create an "INTDS" subdirectory on your hard-disk
(i.e. MD C:\INTDS\ <ENTER>);
2) copy all the files contained on this floppy to \INTDS\
(i.e. COPY A:*.* C:\INTDS*.* <ENTER>);
3) go to the newly created INTDS subdirectory
(i.e. C: <ENTER>
then CD INTDS <ENTER>);
4) self-extract(*) the INTDS files; to do so type
INTDS <ENTER>
5) you will obtain the following files:
INTDS.WK1 (file to be used with EXCEL;QPRO;Lotus123;...)
INTDS.DBF (file to be used with PARADOX;DBASE;PCFILE;...)
INTDS.DIF (file to be used with VISICALC;...)
INTDS.RXD (file to be used with REFLEX;...)
Depending on the software you are using you will work with one of these files (you may delete the ones you do not need).

6) You will also find BROCHURE.TXT. This ASCII file contains:
- the publication presented at the 16th INTDS Conference organized by the Laboratori Nazionali di Legnaro (Padova - 21-25 September 1992);
- the list of the INTDS conferences;
- the list of the INTDS Newsletters;
- the list of keywords used in the database;
- the INTDS publication index (an ASCII version of the INTDS database).

We strongly recommend to print BROCHURE.TXT; this will be a handy document during the preliminary bibliographic search.

7) Now you are ready to start.
If you have any problems, look for a friend close to you that will help you to copy the INTDS files. Otherwise, feel free to give your comments (or corrections) to:

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Have a nice day,

.....Piotr

(*) PKSFX (R) FAST! Self-Extract Utility

ANNOUNCEMENT

17th World Conference of the INTDS

The Seventeenth World Conference of the International Nuclear Target Development Society will be held in Bloomington, Indiana, USA, on October 17-21, 1994. Conference contributions will describe methods used in the preparation, characterization, and application of targets for low, medium, and high energy accelerator experiments. Reports on preparation procedures for precious research materials used in various other scientific investigations will be included as well as presentations on techniques for particle detection devices. Thus, contributions are encouraged in the following areas:

1. Preparation and sampling of high purity and special materials,
2. preparation and characterization of both light and heavy ion targets,
3. stripper, neutralizer, and window foils,
4. oxide reductions and electrolytic target processes,
5. impact of target parameters on experimental results,
6. separation and chemical processing of stable and radioactive isotopes, and
7. thin film, surface and solid state properties of targets

The conference sessions and housing for the participants will be in the Indiana Memorial Union (IMU) building on the campus of Indiana University. A tour of the Indiana University Cyclotron Facility will be scheduled. Based on interest indicated by response to a questionnaire, tickets for cultural events on the campus, tours of campus attractions, and an after-conference trip will be possible.

If you are not certain you are on the INTDS mailing list and wish to receive mailings regarding the conference (beginning in Oct, 1993), contact the Conference Chair, Bill Lozowski or the Conference Coordinator, Marybeth Gasman:

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Preparation of thin Holmium targets on Aluminium backing

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Abstract : Holmium of 300 $\mu g/cm^2$ thickness has been evaporated on 100 $\mu g/cm^2$ thick Aluminium backing, resulting in easily manipulated targets.

1. Introduction

The first experiment to use the DEMON neutron multidetector[1] in Louvain-la-Neuve will be the Ar(315 MeV) + Ho reaction. Possible vibrations in the large volume scattering chamber (1.6 m^3) that will host the Ho target excluding the use of self-supporting targets, it was decided, in agreement with the physicists, to realize Ho targets on a very thin Al backing.

2. Set-up for the evaporations

The vacuum chamber is made of a vertical glass cylinder of 300 mm diameter and 400 mm height, closed on its upper part by a cover to which a rotating plate, a quartz thickness gauge and a vacuum gauge are attached. In its lower part, the cylinder is closed by a metallic ring holding the electron gun and the vacuum installation.

The chamber is pumped down by a 750l/s diffusion pump coupled to a liquid nitrogen trap ; the global conductance being of the order of 400 l/s. The evaporation source is an electron gun (maximal power 2.4 kW) heating a 22 mm diameter and 8 mm height cup-shaped crucible.

3. Procedure

3.1. Preparation of the Al substrate

Al is contained in a Boron Nitride crucible placed in the primary crucible of the electron gun. Under a pressure of about 1×10^{-6} Torr, Al is evaporated on glass plates of 10 x 10 cm^2 surface, covered either by a thin film of teepol (10 g per liter of water) or by a thin film of $BaCl_2$, and situated on a rotating plate at 25 cm from the evaporation source. Aluminium is first outgassed, then the evaporation is starting slowly (~ 15 Å/s) in order not to destroy the thin film on the glass plates. Once a 100 $\mu g/cm^2$ thickness has been obtained, Al foils are cut in 30 x 30 mm^2 pieces and floated on water over stainless steel target-holders (17 mm diameter hole). Foils are kept in open air during a few days to oxydize their surface : Holmium having a hexagonal crystalline structure must be evaporated on the same kind of structure.

3.2. Holmium evaporation

Pieces of Ho are placed directly in the crucible of the electron gun. Target holders covered with Al foils are placed on the rotating plate quoted above. Evaporation is starting under a vacuum better than 1 x 10^{-6} Torr ; a small amount of metal is first evaporated on a plate just above the gun, the vacuum being still improved by the getter effect. Holmium experiencing sublimation at about 1000°C, the high voltage of the gun has to be increased slowly in order to heat homogeneously a large metal surface and so to avoid crater formation in the crucible. In a stationary evaporation regime the requested power is 150 W. After evaporation targets are kept under vacuum.

4. Discussion

Some years ago, the making of self-supporting Ho targets (150-500 $\mu g/cm^2$ thick) had been reported[2] ; Ho was evaporated on a temporary Al foil (500 to 1700 $\mu g/cm^2$ thick), which was later dissolved chemically. At first hand, we have used this technique, which we have decided to give up shortly after for the following reasons ; i) many Ho targets could not withstand the Al removal procedure and were torn up and ii) the surviving Ho targets were very fragile and should never sustain the constraints reported in the introduction. Therefore the procedure described in the present paper was tempted and successfully developed.

References

1) The Demon project, Nuclear Physics News 1, n°5 (1991) p.15.
2) K.W. Scheu and Th. Gee, Proceedings of the 8th INTDS Conference, Boston (1979) (Plenum Press, NY, J. Jaklowsky ed., 1981) p.159.

Preparation of Rhenium targets on Aluminium backing

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Abstract : A method to produce Rhenium targets (300 $\mu g/cm^2$ thick) on thin (100 $\mu g/cm^2$) Aluminium backing is described.

1. Introduction

A request to prepare Rhenium targets for the measurement of the Ne (220 MeV) + Re reaction was received from physicists in Louvain-la-neuve. Rhenium having a very high fusion temperature, i.e. 3200°, the technique to produce Re targets had to face severe problems of possible overheating. Basically, the set-up was the same as the one described in another contribution[1], except for some important points that are described in the present paper.

2. Set-up for the evaporation

A tantalum crucible of 25 mm diameter and 2 cm^3 volume was used. The power input to the electron gun was 2.4 kW. The gun holder was water cooled. A tantalum window was placed above the gun in order to limit radiation from the source. Thermal shields protected the glass chamber as well as the viton o-rings.

Rhenium was available as pellets of about 7 mm diameter. A Rhenium ingot of density 21 g/cm^3 was obtained by melting slowly a dozen pellets in the tantalum crucible.

3. Evaporation procedure

Aluminium foils of 100 $\mu g/cm^2$ thickness were evaporated as described previously[1] and used as backings. To evacuate heat during the Rhenium evaporation, backings of 25 x 25 mm^2 surface are placed on the rotating plate, sandwiched between two Al foils, the front one having a 17 mm diameter hole. Backings should not be stretched during evaporation. Before the evaporation, backings had been preheated with a 500 W quartz lamp.

The Rhenium evaporation proceeded at a temperature of about 3600°C. The Rhenium ingot was placed in the crucible on top of a few pellets. The rotating plate was placed at 25 cm from the crucible.

4. Results

Rhenium was evaporated on 12 Aluminium backings ; of those 8 survived the evaporation ; 4 targets were torn up during the separation from the sandwich foils and the positioning on the target holder. Four Rhenium targets are thus available for physics experiments.

A much larger survival percentage was obtained when using 300 $\mu g/cm^2$ thick Aluminium backings.

Reference

1) P. Demaret, Contribution to this newsletter.

TARGET LAB TECHNICAL STATUS

Prepared for the IUCF Scientific and Technical Report, May 1992-April 1993

W. LOZOWSKI

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Production of various targets and diagnostic foils for the accelerators required 30 technician and 21 professional man-weeks. The balance of the lab effort was applied to the target development projects summarized below.

An unfortunate consequence of the funding shortage for the current year was that Jeffery Hudson, the target lab FTE for the past five years, was placed on lay-off status in April of 1993. To manage the target workload as well as possible, another technician in the Experiment Support Group, Alan Eads, has begun training in target techniques and will be available as his other duties allow.

• Micro-ribbon development[1] for the Cooler produced a carbon ribbon 23 nm thick × 3.3 μm wide × 25 mm long for CE-06. This ribbon, and one slightly wider, survived the Cooler beam and loading/unloading cycles of at least three separate runs of CE-06. The fact that "The thinner one hardly perturbed the beam at all." (Peter Heimberg), seems to be evidence that the ribbons can now be made sufficiently thin to be used as substrates for Cooler targets of solid separated isotopes. In preliminary vacuum-coating tests[1], Mn, Co, Fe, Pb, and Ru layers of 0.8-1.5 μg/cm^2 were condensed onto deposits of C micro-ribbons, with excellent results. Such targets of higher Z elements may have only limited use, however, if the optimum luminosity is found to scale with Z^{-2} as noted by Przewoski, *et al.*,[2] for C versus H_2 in the Cooler beam.

• Comparably thin and resilient Cooler stripper foils were made and used in a beam-skimming mode as targets for CE-06. A rougher glass surface (textured with 12.5 μm size particles) was found to produce films with more resistance to tearing[1] than surfaces textured with the 5 μm size particles currently used for the micro-ribbons.

• A method was sought to produce self-supporting films of Teflon FEP (for CE-35) of of ~350 μg/cm^2 with areas of 8 × 30 cm^2. Spraying, dipping, and curing skills associated with FEP were brought to the level of producing films at the desired thickness, but they were not pinhole free nor as large as needed. Hot rolling of 800-1000 μg/cm^2 films (commercially obtained) between 125 μm thick Teflon film was found to be much more promising. A few large films of 450 μg/cm^2 were produced tediously by this method. Further tests, conducted using the jog control on the rolling mill, suggest that hot rolling at reduced speed will greatly improve the process. Thus, for this application, and to improve the rolling of other soft materials, an adjustable frequency ac drive is currently being installed on the mill.

• Rolled foil targets of the tin isotopes: 112, 114, 116, 118, 119, 120, and 122 were made in thicknesses of ~2.5 and 6 mg/cm^2.[3] The difficult requirement of the experiment was that the foils be contaminate free in every respect, with particular emphasis on the hydrogen content. It was met by rolling high-vacuum-fused beads of the the enriched isotopes between packs made of chemically pure Tin foil of normal isotopic composition.

• A high-temperature, high-vacuum oven was developed for hardening 2 cm diameter pressed-powder targets of ^{10,11}B at about 1800 K. The resistance-heated oven may be assembled in a vacuum evaporator relatively quickly and it is suitable for annealing and sintering many other target materials. During the heat treatment, as many as three pressed-powder pellets of 2 cm diameter are sandwiched between Poco Graphite sheets (typically 250-500 μm in thickness).

This assembly is suspended by a fork-shaped Ta support centered between 25 mm × 130 mm × 40 μm thick, horizontal foil strips of Ta.

• Vacuum condensed potassium metal targets were made in an areal thickness of 100 $\mu g/cm^2$ on backings of 40 $\mu g/cm^2$ C. To prolong the useful life of the foils, gold was flashed onto the exposed potassium surface and the targets were placed remotely in a jar which sealed as the vacuum coater was cycled to room pressure with Argon.

• Test coatings of aluminum onto the outer surface of hemispherical-shaped stretched polypropylene shields ($\sim$5 μm thick, for the ISiS 4π detector) were conducted. Although the shields (11.5 cm radius) were rapidly rotated during the evaporation, the condensed layers ($\sim$80 $\mu g/cm^2$) were not uniformly electrically conductive, indicating that more wobble must be built into the rotating mechanism. The evaporation source used was a tungsten wire helix, 5 cm in length and heavily loaded with flattened, abraded Al wire.[4]

1. W^{m} Lozowski and J. Hudson,"Improved Carbon Micro-Ribbon Targets and Stripper Foils for the IUCF Cooler Ring", to be released summer, 1993, by Nucl. Instr. and Meth. as: Proceedings of the 16th World Conference of the INTDS, Padova, Italy, September 21-25, 1992.

2. B. Prezewoski, H.O. Meyer, *et al.*, "Interaction of Stored, Cooled Proton Beams with Fiber Targets", Nucl. Instr. and Meth. A328 (1993) 435.

3. W^{m} Lozowski and J.Hudson, "Solid-Target Technology at the Indiana University Cyclotron Facility", to be released spring, 1993, by Nucl. Inst. and Meth. as: Proceedings of the Twelfth International Conference on the Application of Accelerators in Research and Industry, Denton, TX, November 2-5, 1992.

4. W. Lozowski and J. Hudson, "Maximum loading of Resistance-Heated Tungsten Helical Coils with Aluminum", INTDS Newsletter, June 1992, vol. 19, no.1.

A Spray Gun to Texture Glass Substrates for Carbon Micro-ribbon Targets *

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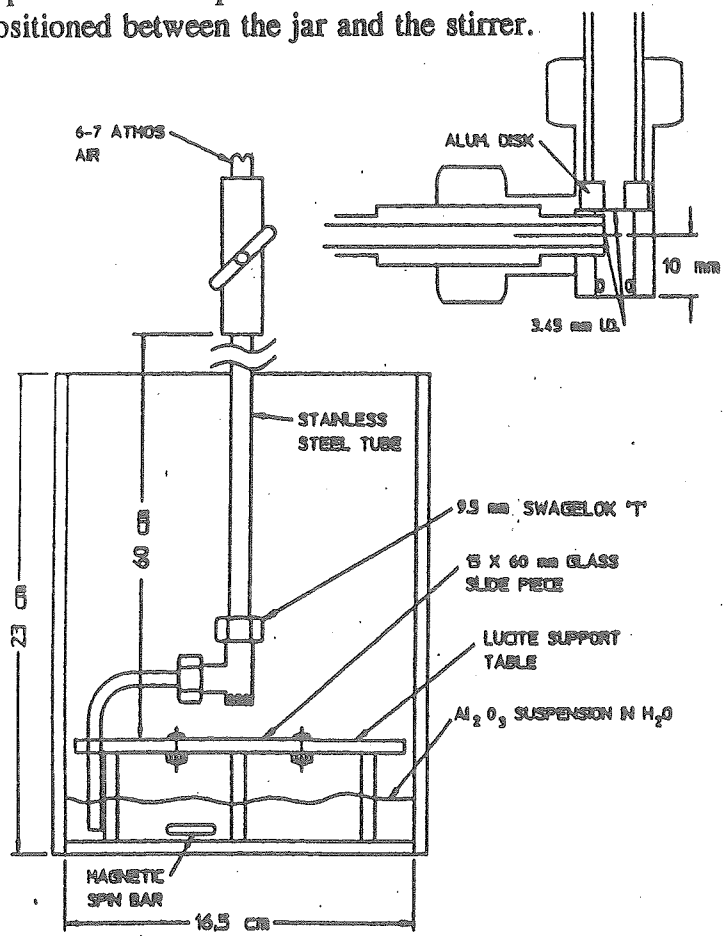
Hand grinding techniques have been used for several years at IUCF to texture the surface of glass pieces onto which carbon is subsequently vacuum condensed to make self-supporting carbon micro-ribbon targets and stripper foils. The early results from tests of glass substrates textured with a simple spray gun indicate that the tedium and high rejection rate (due to scratches in the abraded surface) associated with hand grinding can be avoided. The spray gun produces surfaces in 5 min. which are adequately abraded and virtually free of long scratches.

Levigated Alumina of 5 μm particle size (Buehler no. 40-6435-080) has performed well with the spray gun. During operation, the gun draws and accelerates slurry from a constantly stirred reservoir consisting of 75 g of the powder in 250-275 ml of de-ionized water. The modification of the Swagelok 9.5 mm tubing"T" necessary to form the gun nozzle was accomplished by shortening one end with a metal lathe and drilling side vent holes (6 @ 2.2 mm diam.). While the most uniform etching of glass samples has been achieved by maintaining the nozzle at a distance of 2 $\pm$ 1 mm, thus far, a distance-setting jig has not been fitted to the gun. As evidenced by examination of textured samples at a magnification of 1000, one seems to be able to maintain the position of the gun well enough by holding the gun as close as possible to the glass without forcing the slurry to exit through the side holes or draw tube. Throughout the entire etch time (5 min.), the gun is moved perpendicular to the plane of the glass (15 mm wide $\times$ 60 mm long) and back-and-forth along the length at a rate of about 1 mm/s.

To lower significantly the amount of slurry mist which escapes to the room, the magnetic stirrer (not shown) and the jar shown in the drawing are placed in the bottom of a 51 cm deep $\times$ 37 cm wide container. Cleanup is quick if a thin plastic trash can liner is used in the container with the bottom of the liner positioned between the jar and the stirrer.



* Work supported by the National Science Foundation grant NSF PHY 9015957 and Indiana Univ.