Sputtering Data

W. Eckstein, C. Garcia-Rosales,
J. Roth, W. Ottenberger

IPP 9/82 February 1993

MAX-PLANCK-INSTITUT FÜR PLASMAPHYSIK

85748 GARCHING BEI MÜNCHEN

„Dieser IPP-Bericht ist als Manuskript des Autors gedruckt. Die Arbeit entstand im Rahmen der Zusammenarbeit zwischen dem IPP und EURATOM auf dem Gebiet der Plasmaphysik. Alle Rechte vorbehalten."

"This IPP-Report has been printed as author's manuscript elaborated under the collaboration between the IPP and EURATOM on the field of plasma physics. All rights reserved."

MAX-PLANCK-INSTITUT FÜR PLASMAPHYSIK

GARCHING BEI MÜNCHEN

Sputtering Data

W. Eckstein, C. Garcia-Rosales,
J. Roth, W. Ottenberger

IPP 9/82 February 1993

Die nachstehende Arbeit wurde im Rahmen des Vertrages zwischen dem Max-Planck-Institut für Plasmaphysik und der Europäischen Atomgemeinschaft über die Zusammenarbeit auf dem Gebiete der Plasmaphysik durchgeführt.

Contents

1. Introduction 1

2. Experimental 1

3. Calculations 7

4. Data fitting 8

5. Results 12

5.1 Energy dependence of the sputtering yield for normal incidence 12

5.2 Angular dependence of the sputtering yield 171

6. Discussion 324

7. Acknowlegments 338

8. References 339

IPP 9/82

W. Eckstein
C. Garcia-Rosales
J. Roth
W. Ottenberger

Sputtering Data
February, 1993

Abstract

The energy and angular dependence of measured and calculated sputtering yield data is presented for a large number of projectile-target combinations. The target materials include elements, compounds and alloys. Most data are given for *H*, *D* and *He* bombardment but also data for selfsputtering and nobel gas bombardment are presented.

The data for normal incidence as a function of projectile energy are fitted by a revised *Bohdansky* formula, and the angular dependence for a given projectile energy is fitted by the formula given by *Yamamura*. The fit parameters obtained for the energy and angular dependence of the different materials are compared in order to deduce empirical universal formulae for these parameters.

Finally, a table is given which includes the fit parameters for the energy dependence of the sputtering yield calculated with the deduced empirical formulae for a large variety of projectile-target combinations.

1. Introduction.

In 1979 an IPP-report by Roth et al. [1] gave a survey of the experimental sputtering yield data measured at IPP. The choice of target materials as well as ion energies ranging from about 100 eV to 10 keV was made with respect to plasma-wall interaction in fusion experiments. This data collection included yield data for metals, compounds and alloys mainly for hydrogen and helium isotopes as incident ions and most data were for normal incidence.

In the time since 1979 a large number of data have accumulated which were not all published. In addition many yield data were calculated by computer simulation. Therefore it seemed reasonable to collect all these data in a new IPP-report. This new report gives data for the energy and angular dependence of the sputtering yield for a large number of projectile-target combinations. The data are presented in numerical and graphical form both for elemental materials and compounds. In contrast to the previous report, the data for normal incidence as a function of ion energy are fitted by a formula derived by *Bohdanaky* [2], which was modified in the present report, and for the case of the angular dependence by *Yamamura's* formula [3]. The fit parameters obtained for the energy dependence are used to deduce empirical scaling laws for the threshold energy of light and heavy projectiles.

Only data measured at IPP as well as some data for heavy ions obtained in collaboration with E.Hechtl at the Technische Universität München (TUM) are presented. No comparison of the presented data with published results of other groups will be made.

2. Experimental.

The experiments were performed on a high-current ion source for light ions like H, He, 0 and C at energies between 20 eV and 8 keV. A schematic of the experimental setup is shown in fig.l. The main components of the system are the ion source, the differential pumping stages, the magnet for mass separation and the target chambers I, II and III. A high current injector of the Oak Ridge type is used as an ion source [4]. As the ion

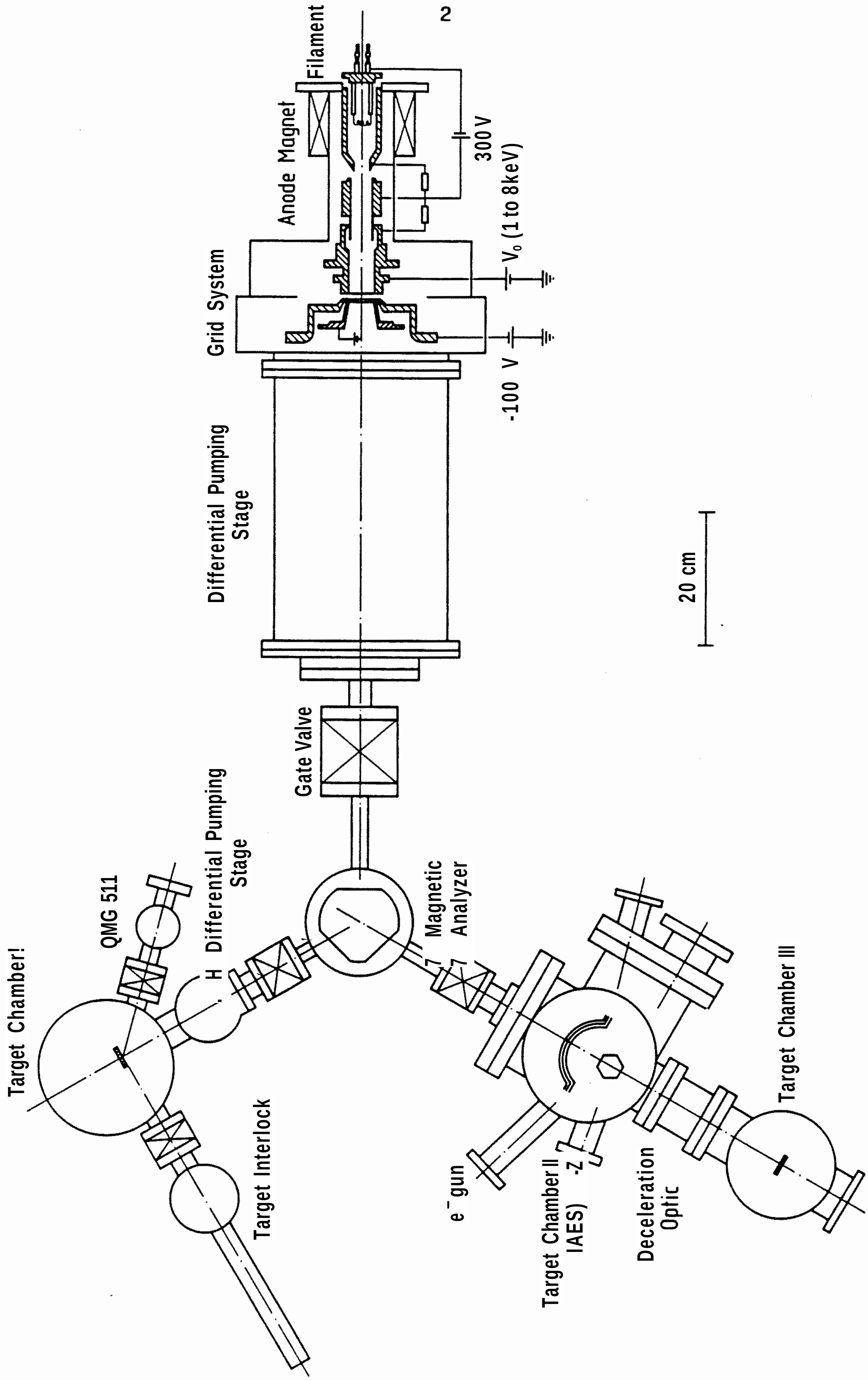


Fig. 1: Experimental setup.

source operates at a rather high gas pressure (3-5 Pa) differential pumping is necessary to prevent excessive neutralization of the beam as well as a high partial pressure of the working gas in the target chamber. There are three differential pumping stages. The first one is equipped with a turbomolecular pump (Leybold 500) together with a roots pump (Leybold 205). The pressure in this differential pumping stage is about 1 x 10^{-2} Pa. The target chamber I is evacuated with a turbomolecular pump with 500 1/s pumping speed. A pressure of about 1 x 10^{-6} Pa is reached. During bombardment it rises to 7—10 x 10^{-5} Pa, mainly due to the partial pressure of the working gas. The target chambers II and III are evacuated with a turbomolecular pump (500 1/s) reaching pressures better than 1 x 10^{-7} Pa. During bombardment the pressure increases to 7—10 x 10^{-5} Pa.

At extraction voltages below 3 kV the current density falls rapidly causing inconveniently long irradiation times. Therefore, in the case of low energy irradiation, a 6 keV ion beam is extracted from the ion source, magnetically analysed and.decelerated directly in front of the target by a positive target bias. For H and D bombardment the current density can be further increased by using molecular ions H^* and D^* (for example, in order to obtain a 1 keV deuterium ion beam, the bombardment is performed with 6 keV molecular ions which were decelerated to 3 keV). For these light ions (H_3^+, D_3^+), collision spikes from overlapping cascades do not occur [5, 6], and the yield defined as sputtered target atoms per incoming atomic species is equal for atomic and molecular ions [7]. At low energies, where the sputtering yield decreases strongly, the fraction of neutral particles in the beam is very important. These neutrals are not decelerated by the target bias and reach the target with the full extraction energy. The ratio of neutrals in the beam for a 4 keV $^4He^+$, D_2 and ion beam has been determined in previous work to 2.6, 1.3 and 1.6%, respectively [8, 9]. At ion energies where the yield after deceleration decreases more than a factor of 50 of the undecelerated value, the sputtering due to neutrals is taken into account.

As a source for carbon and oxygen ions, CO_2 with minor additions of hydrogen is used. For oxygen sputtering the use of mass 16 may lead to simultaneous bombardment with O^+ and CH^*. Therefore for oxygen sputtering often mass 18 (J O^{4-}) is used [10]. Under conditions where the fraction of methane is negligible, the sputtering yield is found to be similar for H_2O^+ , OH^+ , and O^+ projectiles. From this fact the H_2O^+ values can be considered relevant to oxygen sputtering [11].

The sputtering yield measurements are performed in the target chambers I and III. The target chamber II is used to measure the composition change of multicomponent targets during bombardment by means of Auger electron spectroscopy and will not further described here. In the target chamber I the ion beam is decelerated by biasing the target. This is surrounded by a double cylinder, the outer one being at -50 V with respect to the target potential (in order to prevent secondary electrons generated on the beam defining apertures from entering the target chamber) and the inner one at ground potential, such that the deceleration of the beam is effectively done between inner cylinder and target, see fig.2. A beam spot of 0.3 cm^2 is obtained. This arrangement does not allow grazing angles of incidence to be used during deceleration due to angular deflection of the beam. The target current is about 1 X10^{-4} A for and D , 5 X10^{-5} A for He^+ and 2 x 10^{-5} A for C^+ and O^+. The fluence at the target is determined by integrating the current. The targets can be heated by electron bombardment up to 1200° C and the target temperature is monitored by an infrared pyrometer. The target temperatures are accurate within ±25° C. The analysis of the sputtering yield is determined in situ by the weight change of the irradiated samples measured by a Mettler 22 vacuum-microbalance with a sensitivity better than ±l/n/. Additionally, reaction products can be analysed with a Balzers 511 quadrupole mass analyser which is separated from the target chamber by a liquid nitrogen- cooled tube aperture of 6 mm diameter directed onto the beam spot on the target. To reduce especially the residual $H2O$ levels, the quadrupole ion source is separately pumped and surrounded by a Equid nitrogen-cooled copper shield.

In the target chamber III ions can be decelerated to low energies (down to 60 eV) through an optical system [12], see fig.3. With this arrangement it is possible to measure sputtering yields at low energies and oblique angles of incidence. The target is also surrounded by a double cylinder at target potential. The target current is about 5 x IO^{-5} A for and , 3 x 10^{-5} A for $He+$, and 1 x 10^{-5} A for C^+ and O^+ at ion energies of 300 eV. The target can be ohmically heated up to 1700° C and the temperature is measured with an optical pyrometer. For measurements in this chamber the target has to be removed from the chamber for weighing by a Sartorius Supermicro balance (absolute accuracy better than ±l/nj).

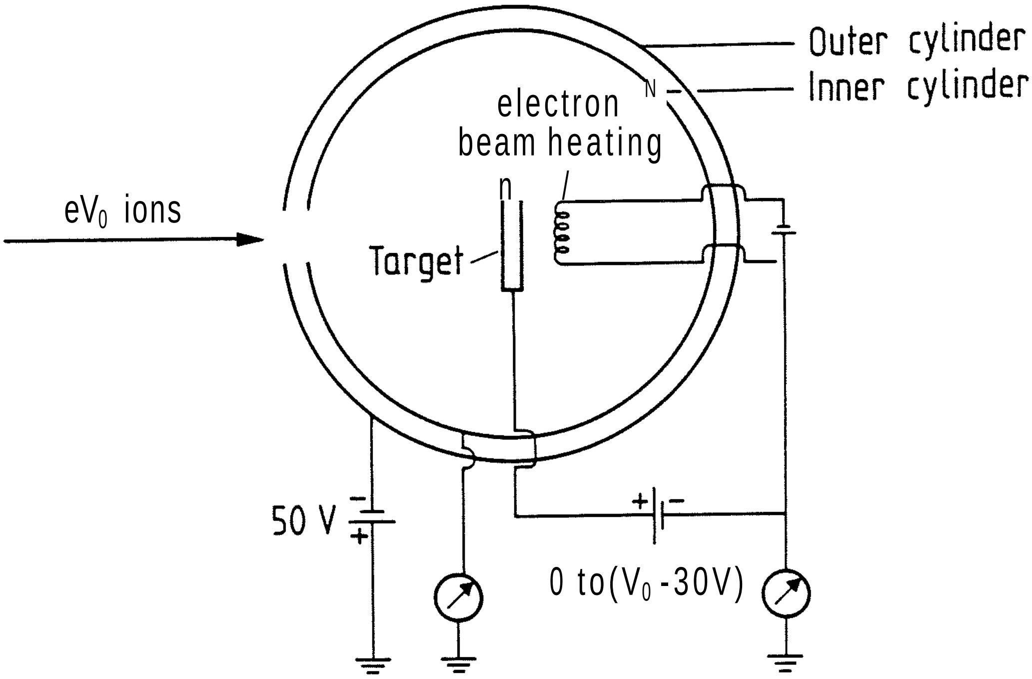


Fig. 2: Deceleration system in target chamber I for ions with energy eV_0 *at* normal incidence.

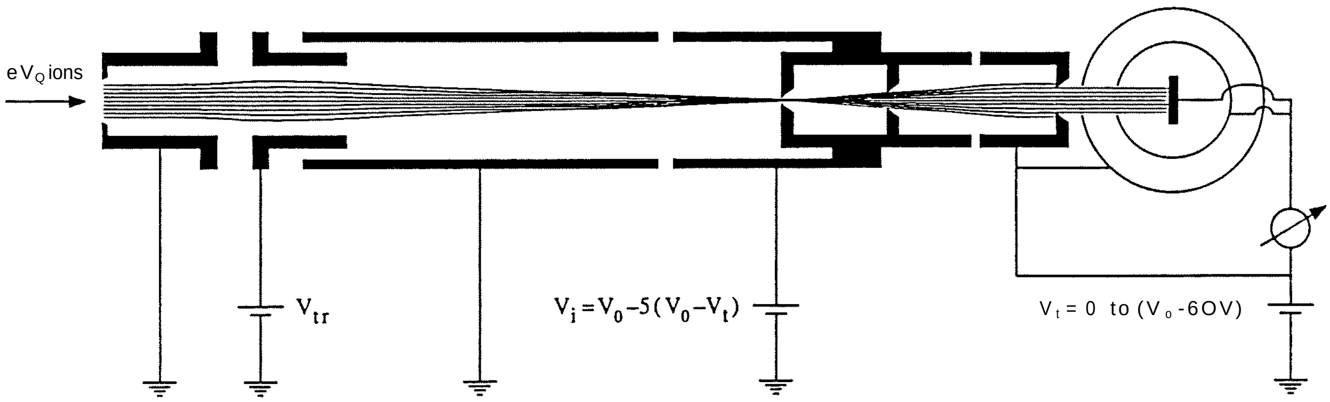


Fig. 3: Deceleration optics. The appropiate voltages are indicated. The given ion trajectories are calculated for 6 keV decelerated to 300 eV.

The amount of sputtered material is determined by the mass change of the target. The total sputtering yield is calculated using the equation

,, mNn ... .Mi
K= (Ä j +X1-ÄN) M2 , (1)

where m is the mass change (in g), N_o Avogadro's number, Ni is the number of incoming ions, Mi and M2 are the projectile and target atomic masses (g/atom), respectively, j their trapping coefficient, and the particle reflection coefficient. For compounds the average atomic mass is used for M_2. For large fluences trapping may be neglected for gaseous projectile ions and one has

$$Y = \frac{mNo}{M_2 N_1} \quad . \tag{2}$$

For selfsputtering the projectiles are identical with the target atoms. The selfsputtering yield is calculated from

$$Y_{„ lf} = \frac{mNo}{M_2 N_x} - 1 \quad . \tag{3}$$

This equation implies that all incident ions stick to the surface. The particle reflection coefficient is neglected.

In order to determine the angular distribution of the sputtered flux, the sputtered particles have been collected on a silicon collector or an organic foil on which an Al film (about 2000 Ä) is evaporated. The collector is analysed with RBS or nuclear reaction techniques [13]. To obtain absolute data the method has been calibrated to weight loss measurements assuming that at normal incidence the observed angular distribution has a rotational symmetry around the beam direction. The angular resolution is limited by the size of the beamspot and is about 3° for both chambers.

For measurements at energies above 8 keV the 150 keV ion accelerator PHARAO was used [14].

3. Calculations.

All sputtering yield data have been caculated with program versions derived from TRIM.SP [15], predominately with vectorized versions TRSP1CN (one component systems) and TR-SPVMC (multicomponent systems). These programs are based on the binary collision approximation but taking simultaneous collisions into account. The target is assumed to be amorphous, the surface is randomly rough in a depth of about half a monolayer.

The main input is the interaction potential. Here the krypton-carbon potential [16] is used for all calculated data. The inelastic energy loss due to electrons is simulated by an equipartition of the continuous Lindhard-Scharff model [17] and a local loss due to Oen and Robinson [18], for hydrogen the Andersen-Ziegler data [19] are chosen above incident energies of 10 keV, for helium the Ziegler data [20] are used for incident energies above 50 keV. A planar surface potential is assumed with the heat of sublimation [21] as the surface binding energy. Calculated data using other surface binding energies are not included. While this surface potential decelerates sputtered atoms, it accelerates incident ions in the case of selfsputtering. For hydrogen ions a chemical binding energy of 1 eV is applied for all targets. A possible bulk binding energy is taken as zero, and the cutoff energy to which the target atoms are followed is taken slighty less than the surface binding energy. More information about the Monte carlo programs can be found in [22].

No efforts are undertaken to get agreement with experimental data by adjusting the screening length in the interaction potential or changing the inelastic energy model. The reason of this procedure is to get a systematic dataset. Furthermore the reproducibility of the experimental results and the differences in the calculated results by applying different input values are often smaller than the deviations between experimental and calculated data. It has been shown experimentally that surface roughness may have a stronger influence on the yield than the inaccuracies of the measurements, especially at oblique incidence [23].

The statistical errors are smaller than 3 % and therefore negligible. Systematic errors which originate from input assumptions (as the interaction potential) are certainly larger. Agreement with experimental data can be as good as a few percent but deviations may go up to a factor of about two in some cases. Near the threshold larger discrepancies may occur.

4. Data fitting

The experimental and calculated data are fitted with the *Bohdansky* formula [2]

$$m \;\; >a = o°) = Q s p W i - (\ £jo y /3 W i - A) y \quad , \tag{4}$$

where *Eq* is the projectile energy, $s_n(g)$ the nuclear stopping cross section, and *e* the reduced energy

$$£ = £<> \frac{M_2}{Mi+M_2} \frac{a_L}{ZiZ_2e^2} = {}^e \ «/^e \ tf \quad \text{with} \quad g_{TF} = \frac{Z1Z2_o2M1}{a.L} + \frac{JVf;}{M_2} \tag{5}$$

Zi and Z_2 are the nuclear charges, and and M_2 the masses of the projectile and the target atom, respectively, e is the electron charge. The *Lindhard* screening length *ai* is given by

$$aL = (iS) \ ‘ \ aB \left(Z1^{2/3} + Zz^{2/3}\right)''^{1/2} = 0{,}4685 \left(Z1^{2/3} + Z_2^{2/3}\right)''^{1/2} Å \quad > \tag{6}$$

where ag is the *Bohr* radius. The energy *Etf* can be written

$$E_{TF}\ (eV) = 30.74 \frac{M_1 + M_2}{M_2} Z_X Z_2 \ (zf^{73} + Z_2^{2/3})^{V2} \quad . \tag{7}$$

The values *Q* and $E_t h$ are used as parameters to fit the data.

For the nuclear stopping cross section $s_n(g)$ in (4) the following analytical expression based on the *Thomas —Fermi* potential [24, 25] was previously used

$$s_n^{TF}(\,) = \frac{3.441\, yfe \ln(g + 2.718)}{1 + 6.3557? + g(6.8827? - 1.708)} \tag{8}$$

The *Thomas—Fermi* potential is too strong at larger distances. In the calculations always the *Kr —C* potential was applied. Therefore it seemed reasonable to replace s^{FF} by the nuclear stopping cross section based on the *Kr —C* potential. s_n^{rC} can be approximated by

$$s_n^{KrC}(\epsilon) = \frac{0.5 \ln(1 + 1.2288c)}{e + 0.17287? + 0.008g^{0.1504}} \tag{9}$$

The differences between the two nuclear stopping cross section formulae (8) and (9) are shown in fig. 4; the differences increase below g = 0.1 down to lower reduced energies.

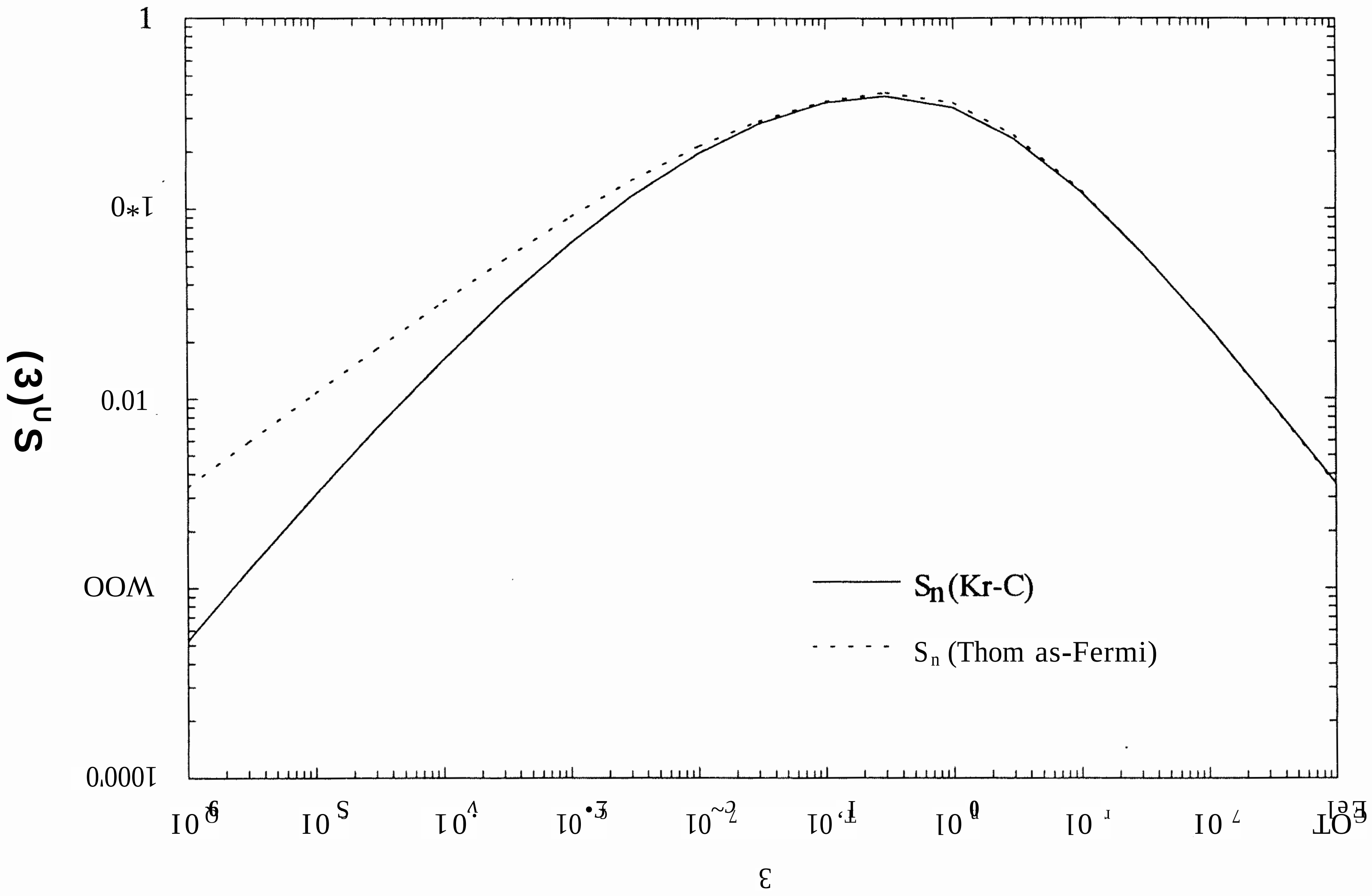


Fig. 4: Nuclear stopping cross section based on the *Kt* - *C* potential (solid line, calculated with formula (8)) and on the *Thomas* - *Fermi* potential (dashed line, calculated with formula (9)).

The case of tungsten selfsputtering, see fig. 5, demonstrates the better fit with the revised *Bohdansky* formula

$$Y(E_0, a = 0°) = Qs^{\text{“}rC}(\pounds) \left(1 - \left(\frac{Z?}{}\right)^{2/3}\right) \left(i - Tt\frac{ip}{}\right)^2 > \qquad (10)$$

which includes the new stopping cross section formula (9). The revised *Bohdansky* formula (10) gives better agreement with experimental and calculated data than the original *Bohdansky* formula (4) but still exhibits deviations in the high keV range. Besides, the best fit to the data in the low keV range differs from calculated data in the energy regime near the threshold. The threshold energy shows an universal behaviour which can be described by the fit formula

$$E_{th} = \begin{cases} 7(\ -7) & \text{f° r} < 0{,}2 \\ 8E_s \left(\frac{M_1}{M_2}\right)^{\frac{2}{5}} & \text{for } \frac{M}{\#} > 0.2 \end{cases} \qquad (11)$$

given by Bohdansky [2]. 7 is the maximum energy transfer factor, $7 = 4Afi M_2/(M_1 + M2)^2$ and E_a the surface binding energy (heat of sublimation). There exist a number of calculated data below the threshold energy (11). Taking these values into account for fitting leads to deviations of the fit with the available data also at larger energies. Therefore, in order to reduce the influence of yield data in the threshold regime on the entire fit, data at energies below the threshold energy (11) were not taken into account for fitting. This demonstrates that the threshold terms in (4) and (10) do not correctly describe the threshold behaviour.

The angular dependence of the sputtering yield is described according to Yamamura et al. [3] by

$$Y(E_0, a) = Y(E_0, a = 0^0)(\cos a)^{f} \exp\left(/[1 - (\cos a) \quad \cos a \quad)\right), \quad \text{where} \qquad (12)$$

$$/ = \sqrt{}\,(0.94 - 1.33 \times 1O^{-} \quad /Mj) \quad , \qquad (13)$$

$$a_{opt} = tt/2 - aLn^{l}\, l\backslash\text{‘}2z\backslash/E \quad_{i}\, l\sim fEQ)\sim^{x} l^{2} \quad . \qquad (14)$$

The values f and a_{opt} are used as fitting parameters, n is the density of the target material (in atoms/Ä^3). The sputtering yield has a maximum at an angle of incidence a_{opt}. As the yield at normal incidence is fixed, uncertainties in $Y(E_0, a)$ enter the fitting procedure for f and a_{opt} strongly.

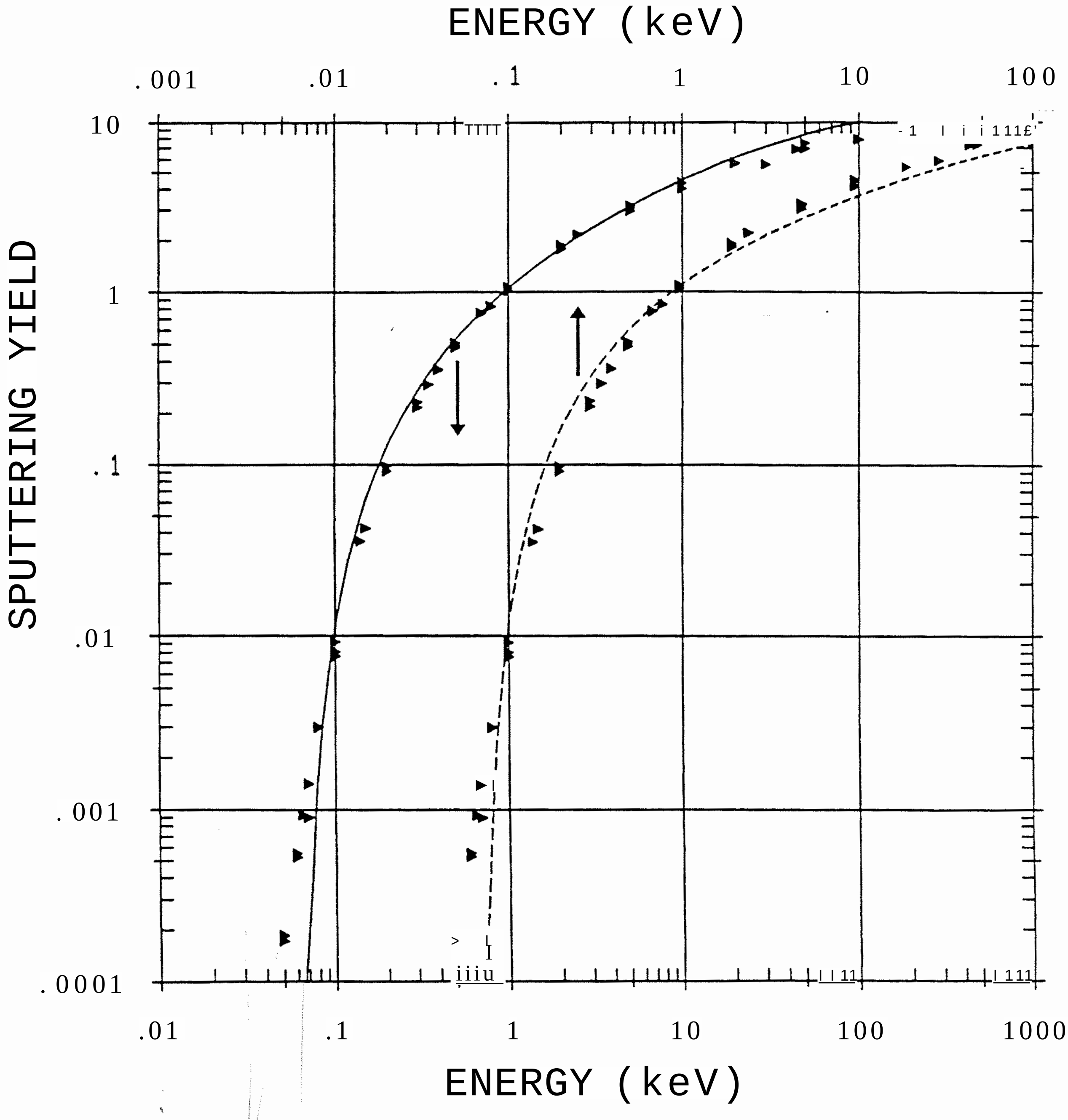


Fig. 5: Energy dependence of the tungsten selfsputtering yield fitted with the *Bohdansky* formula (4) (dashed fine) and with the revised *Bohdansky* formula (9) (solid line).

5. Results.

5.1 Energy dependence of the sputtering yield for normal incidence.

Experimental and/or calculated data for the sputtering yield at normal incidence versus ion energy are presented for the ion target combinations given in table 1. The data for elemental materials are listed in alphabetic order due to their symbol. Separated from the the elemental materials are the data for compounds, which are listed again alphabetically. The results are presented in numerical and graphical form in figs. 6 - 67. Open data points correspond to experimental values, solid points to calculated values. Experimental and calculated data are fitted separately with the revised *Bohdansky* formula (10). The dashed curves indicate the fit of experimental data and the solid curves the fit of calculated data. References to the original publications are given in the figure captions. *Temp,* gives the temperature in °C, *N* is the number of the atoms in the projectile ion, *Book* mentions the laboratory book, the energy is given in keV.

Table 1: Sputtering Data at normal incidence for the following ion-target combinations

targets	*H*	*D*	*T*	^3He	^4He	*C*	*0*	*self*	*Ne*	*Ar*	*Kr*	*Xe*	*Hg*	*Rn*
Ag	x	x			x					x		x		
Al	x	x			x			x	x	x				
Au	x	x		x	x					x		x		
B		x			x		x	x						
Be	x	x	x		x		x	x	x	x	.			
C	x	x	x		x	x	x	x	x	x	x	x		
Cu	x	x			x			x		x		x		
Fe	x	x			x			x						
Ga		x	x					x					x	
Ge										x				
Hg											x			
In		x	x					x						
Li		x	x					x						
Mo	x	x	x	x	x		x	x	x	x	x		x	
Nb		x												
Ni	x	x		x	x		x	x	x	x	x	x		
Si	x	x		x	x			x	x	x	x	x		
Sm											x			
Ta	x	x			x				x	x	x	x		
Ti	x	x			x			x	x					
U					x			x	x	x	x	x		x
V					x									
W	x	x	x		x	x	x	x	x	x	x	x		
Zr		x			x							x		
AI2O3	x	x			x									
b_4C	x	x			x	x	x		x					
Be_4B	x	x			x									
BeO	x	x			x		x							
SiC	x	x			x		x		x					
SiO_2	x	x			x									
TaC	x	x			x									
$Ta_2$0fi	x	x			x									
TiB_2	x	x			x									
TiC	x	x			x		x		x					
WC	x	x			x									
ZrC	x	x			x									
Inconel	x	x			x									
SS316	x	x			x		x							
USB15		x												

Experimental Data

Target	Projectile	Angle	Symbol	Eth(eV)	Q(atoms/ion)
					0.0860
Ag	D	0	0	49.1	0.224

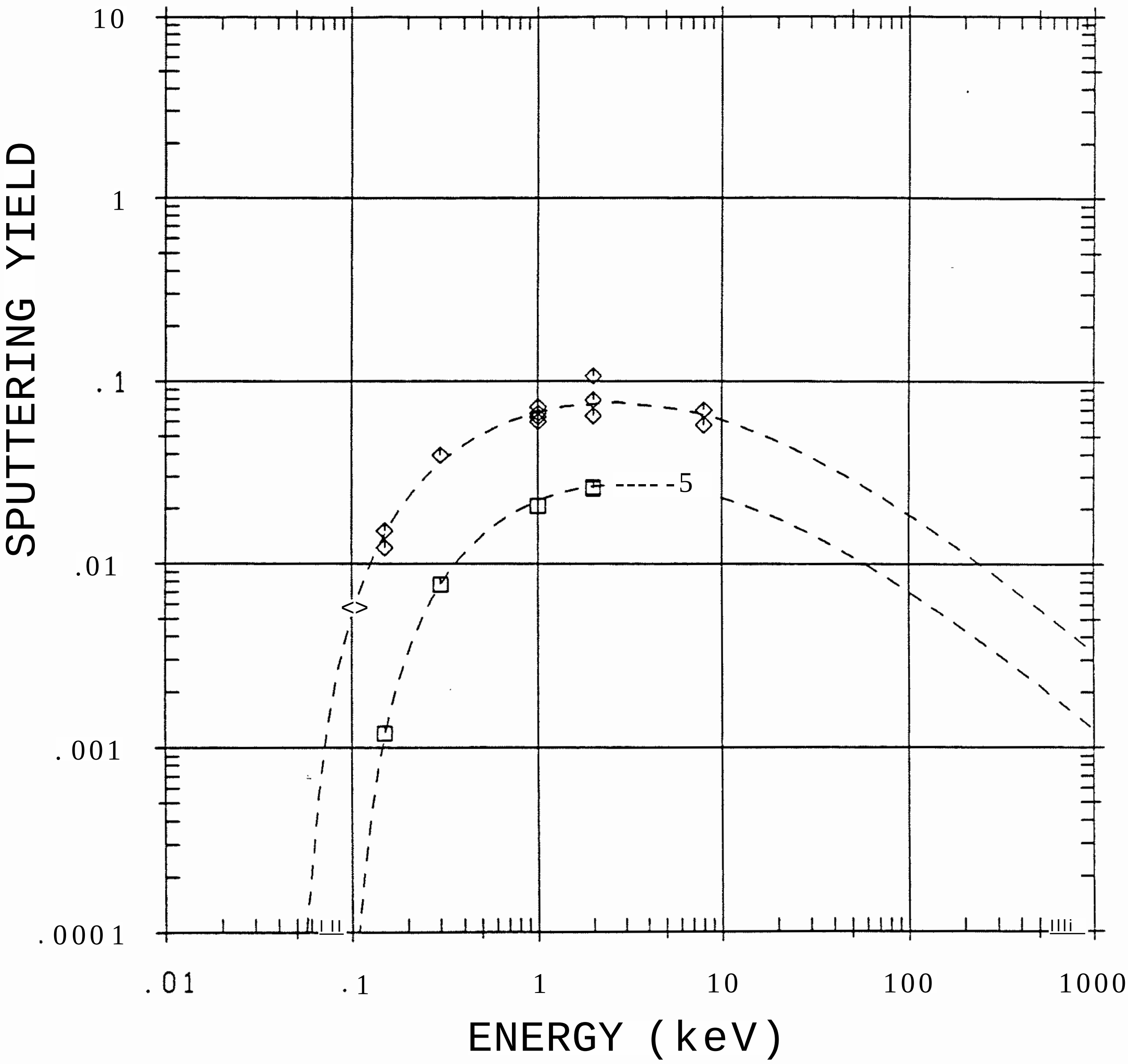


Fig. 6: Energy dependence of the sputtering yield of Ag with H and D. Data measured at temperatures > 700°C show higher yields due to evaporation and are not included here. These results are published in [26].

Experimental Data

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
Ag	H	0.150	0	0.00120	20	3	IV	182	5.3.80
Ag	H	0.300	0	0.00770	20	3	IV	181	5.3.80
Ag	H	1.000	0	0.02060	100	3	IV	172	2.3.80
Ag	H	2.000	0	0.02620	120	3	IV	172	0.3.80
Ag	H	2.000	0	0.02570	20	3	V	29	3.7.80
Ag	H	8.000	0	0.02800	150	1	IV	172	2.3.80

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
Ag	D	0.100	0	0.00570	20	3	IX	9	3.9.86
Ag	D	0.150	0	0.01510	20	3	V	27	2.7.80
Ag	D	0.150	0	0.01220	20	3	V	27	2.7.80
Ag	D	0.300	0	0.03910	20	3	IV	180	4.3.80
Ag	D	1.000	0	0.06660	20	3	IV	180	4.3.80
Ag	D	1.000	0	0.06370	20	3	V	26	1.7.80
Ag	D	1.000	0	0.05980	20	3	V	27	1.7.80
Ag	D	1.000	0	0.07190	20	3	IX	19	4.10.86
Ag	D	2.000	0	0.07880	100	3	IV	175	7.3.80
Ag	D	2.000	0	0.07890	20	3	V	26	.7.80
Ag	D	2.000	0	0.10700	20	3	V	26	1.7.80
Ag	D	2.000	0	0.06450	20	3	V	28	2.7.80
Ag	D	8.000	0	0.06940	130	1	IV	176	7.3.80
Ag	D	8.000	0	0.05750	20	1	V	28	2.7.80

Experimental Data

Target	Projectile	Angle	Symbol	$E_{th}(eV)$	Q(atoms/ion)
Ag	He	0	&	23.0	0.791

Calculated Data

Target	Projectile	Angle	Symbol	£<h(eV)	Q(atoms/ion)
Ag	He	0	A	23.0	0.583
Ag	Ar	0	♦	17.4	18.3
Ag	Xe	0	▲	29.8	47.6

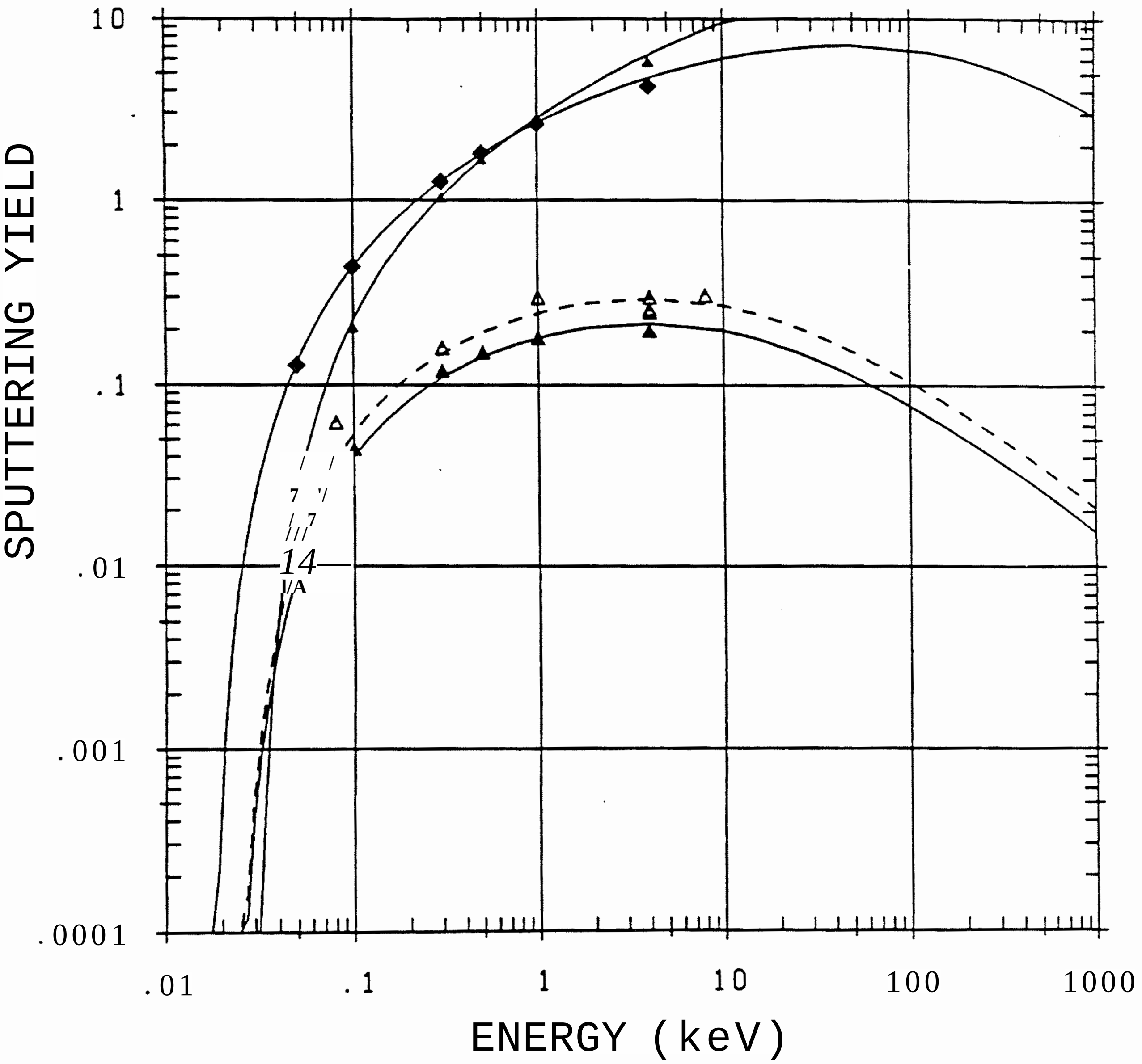


Fig. 7: Energy dependence of the sputtering yield of Ag with ^{4}He, Ar and Xe. Only experimental data measured at temperatures < 700°C are plotted (compare Fig. 6). The threshold energy of the ^{4}He experimental data was taken from calculated data for fitting. The experimental data are partly published in [26].

Experimental Data

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
Ag	He	0.080	0	0.06240	20	1	IV	168	5.3.80
Ag	He	0.300	0	0.16100	20	1	IV	182	6.3.80
Ag	He	1.000	0	0.30000	20	1	IV	168	6.3.80
Ag	He	4.000	0	0.30200	20	1	IV	165	4.3.80
Ag	He	4.000	0	0.25000	400	1	IV	166	4.3.80
Ag	He	4.000	0	0.26100	20	1	V	28	3.7.80
Ag	He	8.000	0	0.30800	20	1	IV	169	6.3.80

Calculated Data

Target	Proj.	Energy	Angle	Yield	Temp.	P	SBE
Ag	He	0.050	0	0.008620	20	10.47	2.97
Ag	He	0.100	0	0.044300	20	10.47	2.97
Ag	He	0.300	0	0.120000	20	10.47	2.97
Ag	He	0.500	0	0.151000	20	10.47	2.97
Ag	He	1.000	0	0.182000	20	10.47	2.97
Ag	He	4.000	0	0.200000	20	10.47	2.97

Target	Proj.	Energy	Angle	Yield	Temp.	P	SBE
Ag	Ar	0.050	0	0.127000	20	10.47	2.97
Ag	Ar	0.100	0	0.437000	20	10.47	2.97
Ag	Ar	0.300	0	1.280000	20	10.47	2.97
Ag	Ar	0.500	0	1.830000	20	10.47	2.97
Ag	Ar	1.000	0	2.640000	20	10.47	2.97
Ag	Ar	4.000	0	4.220000	20	10.47	2.97

Target	Proj.	Energy	Angle	Yield	Temp.	P	SBE
Ag	Xe	0.050	0	0.027500	20	10.47	2.97
Ag	Xe	0.100	0	0.206000	20	10.47	2.97
Ag	Xe	0.300	0	1.050000	20	10.47	2.97
Ag	Xe	0.500	0	1.710000	20	10.47	2.97
Ag	Xe	1.000	0	2.850000	20	10.47	2.97
Ag	Xe	4.000	0	5.790000	20	10.47	2.97

Target: Al

Experimental Data

Target	Projectile	Angle	Symbol	$E_{th}(eV)$	Q(atoms/ion)
Al	H	0	□	93.0	0.0450
Al	D	0	0	36.0	0.0970

Calculated Data

Target	Projectile	Angle	Symbol	Ft h(eV)	Q(atoms/ion)
Al	D	0	♦	14.0	0.122
Al	Al	0	▶	22.0	3.41

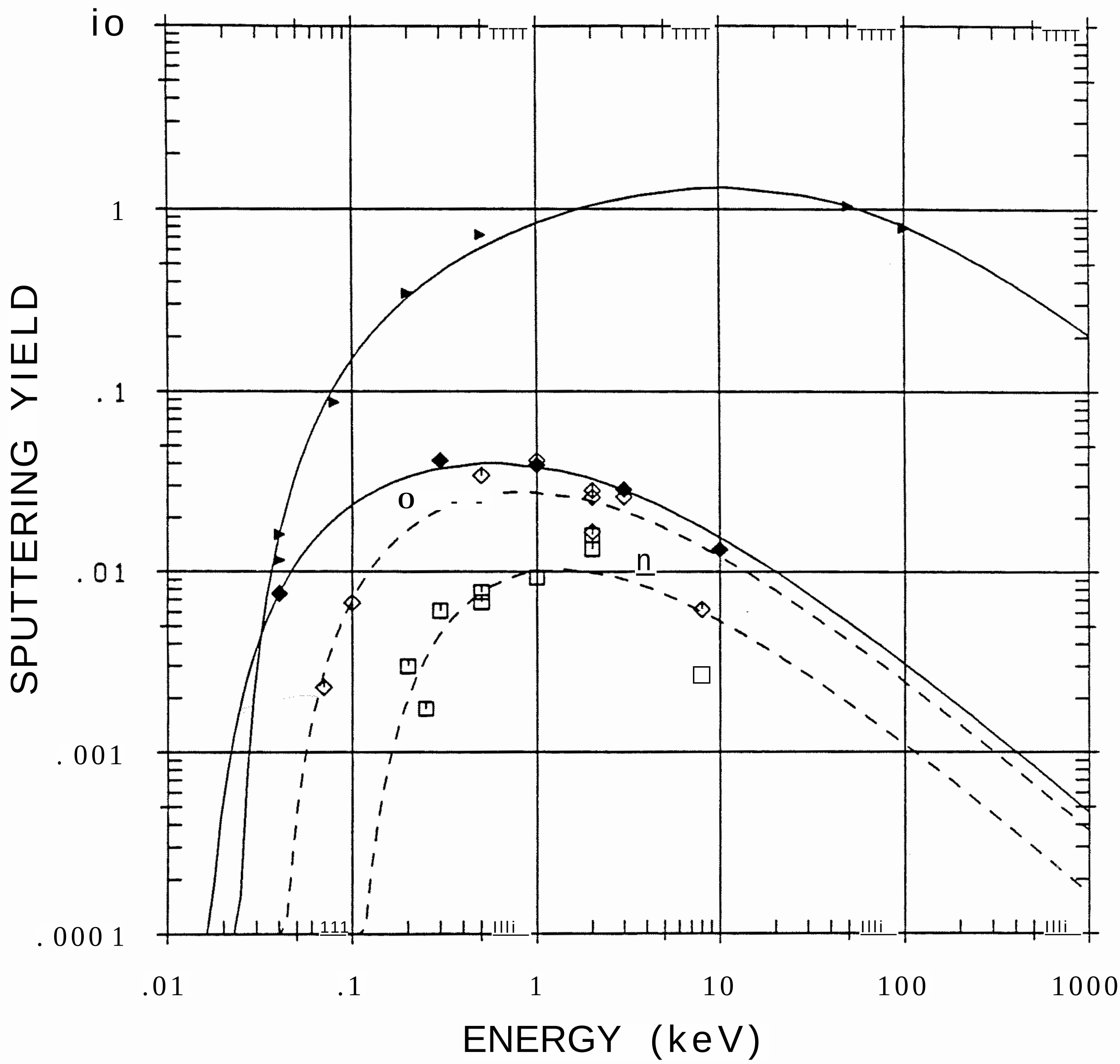


Fig. 8: Energy dependence of the sputtering yield of Al with H, D and Al. The experimental data for II and D show a higher threshold energy as the calculated data. This might be due to oxide formation during sputtering of Al. The experimental data are published in [27].

Experimental Data

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
Al	H	0.200	0	0.00300	20	3	III	62	03.04.78
Al	H	0.250	0	0.00174	20	3	V	8	18.06.80
Al	H	0.300	0	0.00610	20	3	III	62	04.04.78
Al	H	0.500	0	0.00680	20	3	III	64	06.04.78
Al	H	0.500	0	0.00772	20	3	V	8	18.06.80
Al	H	1.000	0	0.00930	20	3	III	63	05.04.78
Al	H	2.000	0	0.01600	20	3	III	63	05.04.78
Al	H	2.000	0	0.01340	20	3	V	9	20.06.80
Al	H	4.000	0	0.01130	20	2	III	63	05.04.78
Al	H	8.000	0	0.00270	20	1	III	65	10.04.78

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
Al	D	0.070	0	0.00229	20	3	III	58	10.03.78
Al	D	0.100	0	0.00674	20	3	III	58	10.02.78
Al	D	0.200	0	0.02550	20	3	III	59	13.03.78
Al	D	0.500	0	0.03440	20	3	III	62	3.04.78
Al	D	1.000	0	0.04150	20	3	III	60	13.03.78
Al	D	2.000	0	0.01670	20	3	V	1	12.05.80
Al	D	2.000	0	0.02600	20	3	V	13	30.06.80
Al	D	2.000	0	0.02830	20	3	V	14	1.07.80
Al	D	3.000	0	0.02610	20	2	III	59	13.03.78
Al	D	8.000	0	0.00622	20	1	III	59	13.03.78

Calculated Data

Target	Proj.	Energy	Angle	Yield	Temp.	*P*	SBE
Al	D	0.040	0	0.007550	20	2.70	3.36
Al	D	0.300	0	0.041500	20	2.70	3.36
Al	D	1.000	0	0.039100	20	2.70	3.36
Al	D	3.000	0	0.028700	20	2.70	3.36
Al	D	10.000	0	0.013300	20	2.70	3.36

Target	Proj.	Energy	Angle	Yield	Temp.	*P*	SBE
Al	Al	0.040	0	0.016100	20	2.70	3.36
Al	Al	0.040	0	0.011600	20	2.70	3.36
Al	Al	0.080	0	0.087500	20	2.70	3.36
Al	Al	0.200	0	0.346000	20	2.70	3.36
Al	Al	0.500	0	0.722000	20	2.70	3.36
Al	Al	50.000	0	1.040000	20	2.70	3.36
Al	Al	100.000	0	0.792000	20	2.70	3.36

Target: Al

Experimental Data

Target	Projectile	Angle	Symbol	*Eth(eV)*	Q(atoms/ion)
Al	He	0	A	12.0	0.440

Calculated Data

Target	Projectile	Angle	Symbol	$E_{th}(eV)$	Q(atoms/ion)
Al	He	0	A	12.5	0.450
Al	Ne	0	■	18.2	3.18
Al	Ar	0	♦	26.6	5.38

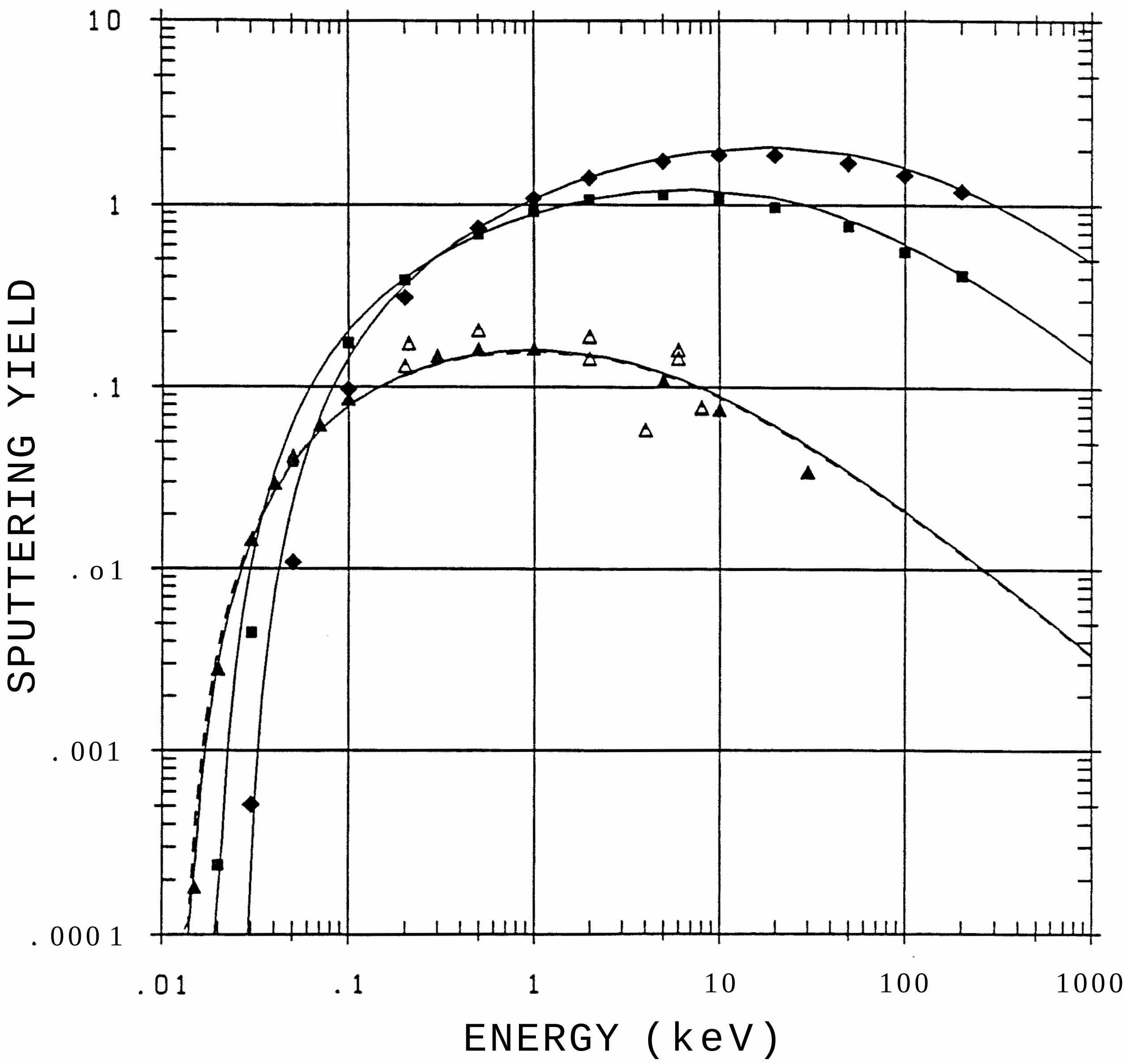


Fig. 9: Energy dependence of the sputtering yield of Al with ^4He , Ne and Ar. The threshold energy of the ^4He experimental data was taken from calculated data for fitting. The experimental data are published in [271.

Experimental Data

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
Al	He	0.200	0	0.13100	20	1	III	83	2.06.78
Al	He	0.210	0	0.17400	20	1	III	64	06.04.78
Al	He	0.500	0	0.20500	20	1	III	57	8.03.78
Al	He	2.000	0	0.14400	20	1	III	38	16.01.78
Al	He	2.000	0	0.19000	20	1	III	56	7.03.78
Al	He	4.000	0	0.05900	20	1	V	9	20.06.80
Al	He	6.000	0	0.16100	20	1	IX	71	2.07.87
Al ■	He	6.000	0	0.14500	20	1	IX	74	19.07.87
Al	He	8.000	0	0.07860	20	1	III	64	07.04.78
Al	He	8.000	0	0.07730	20	1	V	11	24.06.80

Calculated Data

Target	Proj.	Energy	Angle	Yield	Temp.	P	SBE
Al	He	0.015	0	0.000183	20	2.70	3.36
Al	He	0.020	0	0.002830	20	2.70	3.36
Al	He	0.030	0	0.014600	20	2.70	3.36
Al	He	0.040	0	0.029700	20	'2.70	3.36
Al	He	0.050	0	0.042000	20	2.70	3.36
Al	He	0.070	0	0.062400	20	2.70	3.36
Al	He	0.100	0	0.086400	20	2.70	3.36
Al	He	0.300	0	0.149000	20	2.70	3.36
Al	He	0.500	0	0.162000	20	2.70	3.36
Al	He	1.000	0	0.163000	20	2.70	3.36
Al	He	5.000	0	0.110000	20	2.70	3.36
Al	He	10.000	0	0.076200	20	2.70	3.36
Al	He	30.000	0	0.034700	20	2.70	3.36

Target	Proj.	Energy	Angle	Yield	Temp.	P	SBE
Al	Ne	0.020	0	0.000240	20	2.70	3.36
Al	Ne	0.030	0	0.004460	20	2.70	3.36
Al	Ne	0.050	0	0.039000	20	2.70	3.36
Al	Ne	0.100	0	0.174000	20	2.70	3.36
Al	Ne	0.200	0	0.385000	20	2.70	3.36
Al	Ne	0.500	0	0.692000	20	2.70	3.36
Al	Ne	1.000	0	0.917000	20	2.70	3.36
Al	Ne	2.000	0	1.060000	20	2.70	3.36
Al	Ne	5.000	0	1.130000	20	2.70	3.36
Al	Ne	10.000	0	1.090000	20	2.70	3.36
Al	Ne	20.000	0	0.971000	20	2.70	3.36
Al	Ne	50.000	0	0.764000	20	2.70	3.36
Al	Ne	100.000	0	0.553000	20	2.70	3.36
Al	Ne	200.000	0	0.412000	20	2.70	3.36

Target	Proj.	Energy	Angle	Yield	Temp.	P	SBE
Al	Ar	0.030	0	0.000510	20	2.70	3.36
Al	Ar	0.050	0	0.010900	20	2.70	3.36
Al	Ar	0.100	0	0.097200	20	2.70	3.36
Al	Ar	0.200	0	0.310000	20	2.70	3.36
Al	Ar	0.500	0	0.738000	20	2.70	3.36
Al	Ar	1.000	0	1.080000	20	2.70	3.36
Al	Ar	2.000	0	1.400000	20	2.70	3.36
Al	Ar	5.000	0	1.730000	20	2.70	3.36
Al	Ar	10.000	0	1.870000	20	2.70	3.36
Al	Ar	20.000	0	1.870000	20	2.70	3.36
Al	Ar	50.000	0	1.690000	20	2.70	3.36
Al	Ar	100.000	0	1.450000	20	2.70	3.36
Al	Ar	200.000	0	1.180000	20	2.70	3.36

Expei'unental Data

Target	Projectile	Angle	Symbol	$E_{th}(eV)$	Q(atoms/ion)
Au	H	0	□	200.	0.0440
Au	D	0	0	96.0	0.114
Au	^{3}He	0	V	52.0	0.348

Calculated Data

Target	Projectile	Angle	Symbol	$E_{th}('V)$	Q(atoms/ion)
Au	■ D	0	♦	96.0	0.102

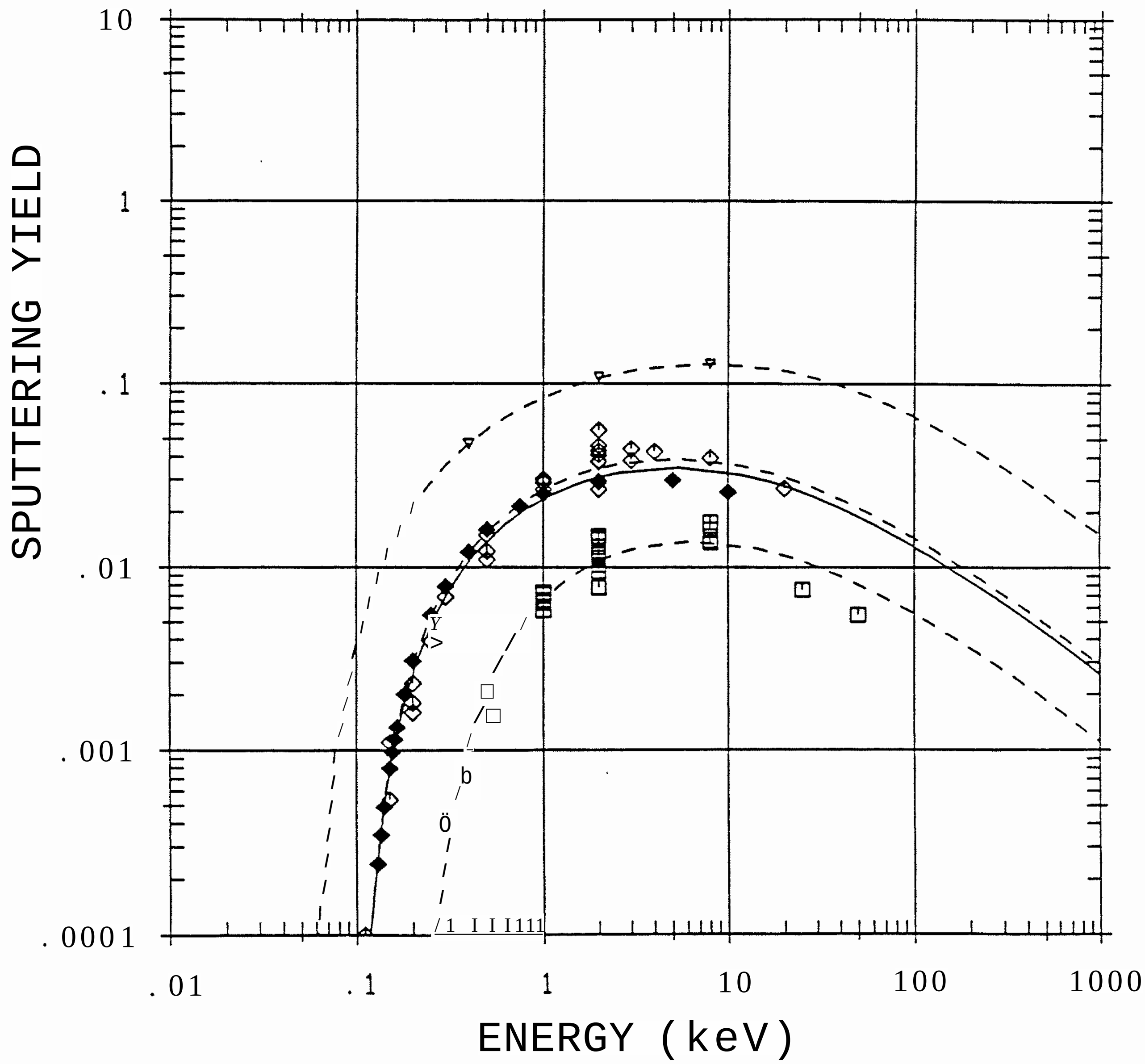


Fig. 10: Energy dependence of the sputtering yield of Au with H, D and ^{3}He. The experimental data are partly published in [28].

Experimental Data

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
Au	H	0.250	0	0.00008	20	3		0	1979
Au	H	0.300	0	0.00040	20	3		0	1979
Au	H	0.400	0	0.00073	20	3	II	76	15.10.76
Au	H	0.500	0	0.00157	20	3	II	72	01.10.76
Au	H	0.500	0	0.00210	20	3	V	56	25.11.80
Au	H	1.000	0	0.00730	20	3	II	56	12.08.76
Au	H	1.000	0	0.00580	20	3	II	.77	16.10.76
Au	H	1.000	0	0.00710	20	3	II	134	18.04.77
Au	H	1.000	0	0.00660	20	3	V	56	24.11.80
Au	H	1.000	0	0.00639	20	3	V	57	26.11.80
Au	H	2.000	0	0.00950	20	3	II	55	09.08.76
Au	H	2.000	0	0.01120	20	3	II	76	15.10.76
Au	H	2.000	0	0.01300	725	3	IV	119	5.11.79
Au	H	2.000	0	0.01440	620	3	IV	119	5.11.79
Au	H	2.000	0	0.01410	510	3	IV	120	5.11.79
Au	H	2.000	0	0.01170	100	3	IV	121	6.11.79
Au	H	2.000	0	0.01130	730	3	IV	121	6.11.79
Au	H	2.000	0	0.01480	300	3	IV	121	6.11.79
Au	H	2.000	0	0.01030	830	3	IV	123	7.11.79
Au	H	2.000	0	0.00775	210	3	IV	123	7.11.79
Au	H	2.000	0	0.01200	840	3	IV	123	7.11.79
Au	H	2.000	0	0.01290	20	3	V	56	20.11.80
Au	H	8.000	0	0.01600	20	2	II	55	09.08.76
Au	H	8.000	0	0.01760	20	1	II	76	12.10.76
Au	H	8.000	0	0.01410	20	1	II	90	14.12.76
Au	H	8.000	0	0.01370	20	1	II	90	14.12.76
Au	H	25.000	0	0.00754	20	1			PHARAO80
Au	H	50.000	0	0.00547	20	1			PHARAO80

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
Au	D	0.110	0	0.00010	20	3			1979
Au	D	0.150	0	0.00110	20	3	II	80	25.10.76
Au	D	0.150	0	0.00054	20	3	IX	31	24.11.86
Au	D	0.200	0	0.00230	20	3	II	75	07.10.76
Au	D	0.200	0	0.00180	20	3	IX	31	24.11.86
Au	D	0.200	0	0.00160	20	3	IX	115	19.10.87
Au	D	0.250	0	0.00390	20	3	II	78	19.10.76
Au	D	0.300	0	0.00686	20	3	VIII	181	20.08.86
Au	D	0.500	0	0.01500	20	3	II	75	11.10.76
Au	D	0.500	0	0.01100	20	3	IX	94	31.08.87
Au	D	0.500	0	0.01220	20	3	IX	96	02.09.87
Au	D	1.000	0	0.02660	20	3	II	77	16.10.76
Au	D	1.000	0	0.02900	20	3	VIII	181	21.08.86
Au	D	1.000	0	0.03020	20	3			1979
Au	D	2.000	0	0.03810	20	3	II	75	07.10.76
Au	D	2.000	0	0.04580	200	3	III	11	03.05.79
Au	D	2.000	0	0.03790	170	3	III	180	13.02.79
Au	D	2.000	0	0.04090	325	3	III	180	13.02.79
Au	D	2.000	0	0.03720	400	3	III	181	13.02.79
Au	D	2.000	0	0.05600	530	3	III	181	13.02.79
Au	D	2.000	0	0.04300	500	3	III	181	13.02.79
Au	D	2.000	0	0.04330	530	3	III	182	14.02.79
Au	D	2.000	0	0.02660	20	3	IX	94	31.08.87
Au	D	2.000	0	0.02960	20	3	IX	94	31.08.87
Au	D	2.000	0	0.02950	20	3	IX	96	03.09.87
Au	D	2.000	0	0.02960	20	3	IX	97	03.09.87
Au	D	3.000	0	0.04430	20	2	VIII	181	21.08.86
Au	D	3.000	0	0.03830	20	2	IX	30	20.11.86
Au	D	4.000	0	0.04280	20	2	II	74	07.10.76
Au	D	8.000	0	0.03950	20	1	II	73	05.10.76
Au	D	20.000	0	0.02700	20	3	II	105	04.02.77

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
Au	^{3}He	0.400	0	0.04710	20	1	II	78	18.10.76
Au	^{3}He	2.000	0	0.10800	20	1	II	77	18.10.76
Au	^{3}He	8.000	0	0.12800	20	1	II	77	18.10.76

Calculated Data

Target	Proj.	Energy	Angle	Yield	Temp.	P	SBE
Au	D	0.120	0	0.000084	20	19.30	3.80
Au	D	0.130	0	0.000244	20	19.30	3.80
Au	D	0.135	0	0.000349	20	19.30	3.80
Au	D	0.140	0	0.000492	20	19.30	3.80
Au	D	0.150	0	0.000796	20	19.30	3.80
Au	D	0.155	0	0.000970	20	19.30	3.80
Au	D	0.160	0	0.001140	20	.19.30	3.80
Au	D	0.165	0	0.001330	20	19.30	3.80
Au	D	0.180	0	0.002010	20	19.30	3.80
Au	D	0.200	0	0.003050	20	19.30	3.80
Au	D	0.250	0	0.005450	20	19.30	3.80
Au	D	0.300	0	0.007840	20	19.30	3.80
Au	D	0.400	0	0.012100	20	19.30	3.80
Au	D	0.500	0	0.016000	20	19.30	3.80
Au	D	0.750	0	0.021500	20	19.30	3.80
Au	D	1.000	0	0.025100	20	19.30	3.80
Au	D	2.000	0	0.029100	20	19.30	3.80
Au	D	5.000	0	0.029800	20	19.30	3.80
Au	D	10.000	0	0.025800	20	19.30	3.80

Target: Au

Experimented Data

Target	Projectile	Angle	Symbol	$E_{th}(eV)$	Q(atoms/ion)
Au	He	0	A	55.0	0.510

Calculated Data

Target	Projectile	Angle	Symbol	$E_{th}(eV)$	Q(atoms/ion)
Au	He	0	A	48.0	0.410
Au	Ar	0	♦	19.0	17.8
Au	Xe	0	A	29.0	58.6

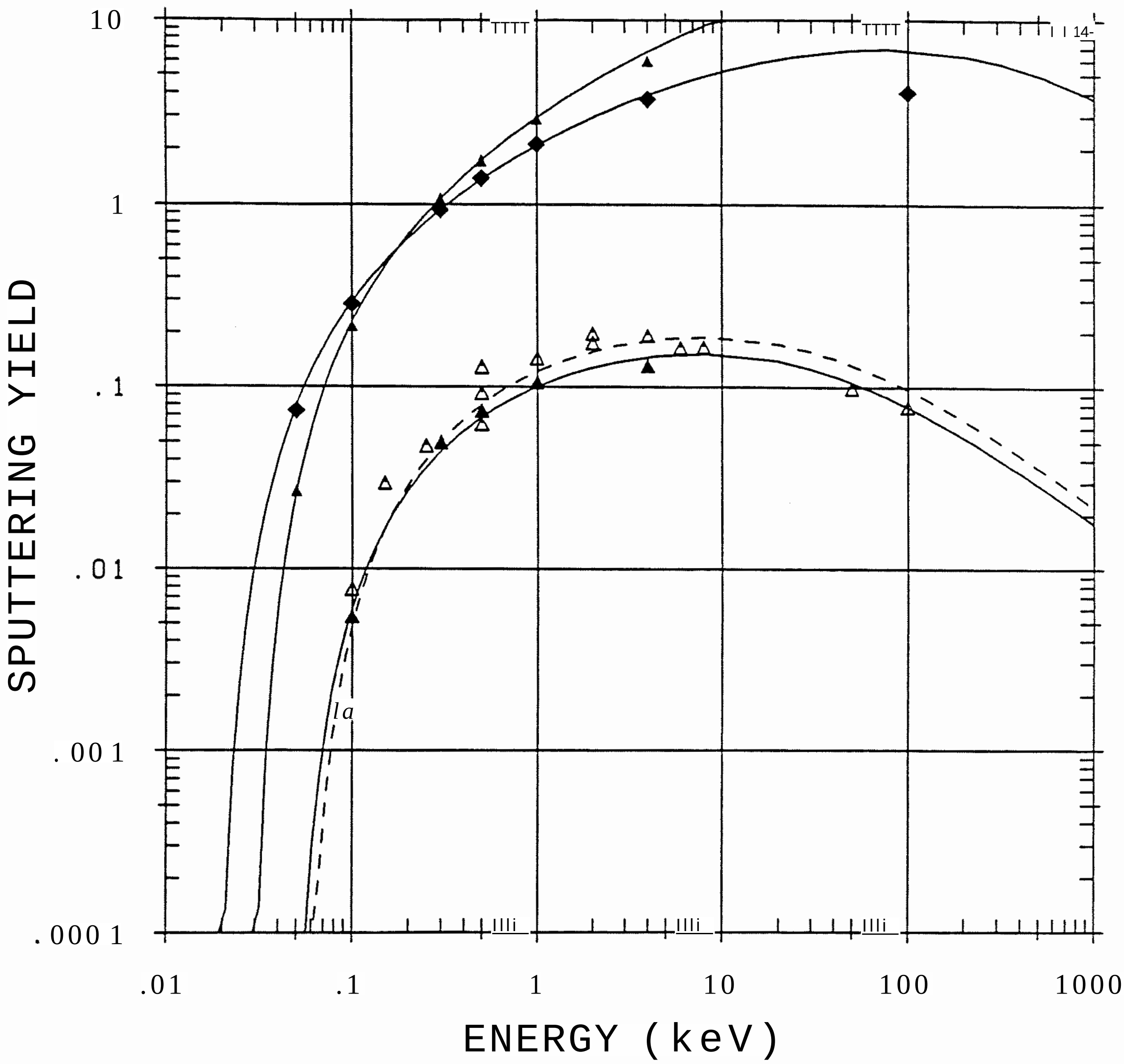


Fig. 11: Energy dependence of the sputtering yield of Au with ^{4}He, Ar and Xe. The experimental data are partly published in [281.

Experimental Data

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
Au	He	0.100	0	0.00777	20	1	IX	92	26.08.87
Au	He	0.100	0	0.00167	20	1	IX	92	26.08.87
Au	He	0.150	0	0.03000	20	1	II	80	25.10.76
Au	He	0.250	0	0.04800	20	1	II	72	30.09.76
Au	He	0.500	0	0.09280	20	1	II	71	27.09.76
Au	He	0.500	0	0.06270	20	1	IX	93	27.07.87
Au	He	0.500	0	0.12900	20	1	IX	93	28.08.87
Au	He	1.000	0	0.14400	20	1	II	71	27.09.76
Au	He	2.000	0	0.19800	20	1	II	56	12.08.76
Au	He	2.000	0	0.17600	20	1	II	57	12.08.76
Au	He	4.000	0	0.19200	20	1	II	55	09.08.76
Au	He	6.000	0	0.16500	20	1	IX	92	26.08.87
Au	He	8.000	0	0.16600	20	1	II	55	09.08.76
Au	He	50.000	0	0.09900	20	1			PHARAO80
Au	He	100.000	0	0.07900	20	1			PHARAO80

Calculated Data

Target	Proj.	Energy	Angle	Yield	Temp.	*P*	SBE
Au	He	0.100	0	0.005460	20	19.31	3.80
Au	He	0.300	0	0.049800	20	19.31	3.80
Au	He	0.500	0	0.074200	20	19.31	3.80
Au	He	1.000	0	0.106000	20	19.31	3.80
Au	He	4.000	0	0.131000	20	19.31	3.80

Target	Proj.	Energy	Angle	Yield	Temp.	*P*	SBE
Au	Ar	0.050	0	0.074300	20	19.31	3.80
Au	Ar	0.100	0	0.286000	20	19.31	3.80
Au	Ar	0.300	0	0.930000	20	19.31	3.80
Au	Ar	0.500	0	1.380000	20	19.31	3.80
Au	Ar	1.000	0	2.100000	20	19.31	3.80
Au	Ar	4.000	0	3.680000	20	19.31	3.80
Au	Ar	100.000	0	4.033000	20	19.31	3.80

Target	Proj.	Energy	Angle	Yield	Temp.	*P*	SBE
Au	Xe	0.050	0	0.027000	20	19.31	3.80
Au	Xe	0.100	0	0.216000	20	19.31	3.80
Au	Xe	0.300	0	1.070000	20	19.31	3.80
Au	Xe	0.500	0	1.710000	20	19.31	3.80
Au	Xe	1.000	0	2.870000	20	19.31	3.80
Au	Xe	4.000	0	5.950000	20	19.31	3.80

Experimental Data

Target	Projectile	Angle	Symbol	$E_{th}(eV)$	Q(atoms/ion)
B	D	0	◊	13.0	0.136
B	He	0	△	20.0	0.310
B	B	0	▹	65.0	2.00

Calculated Data

Target	Projectile	Angle	Symbol	$E_{th}(eV)$	Q(atoms/ion)
B	D	0	◆	17.8	0.0770
B	B	0	▶	38.5	0.670
B	O	0	▼	69.7	1.14

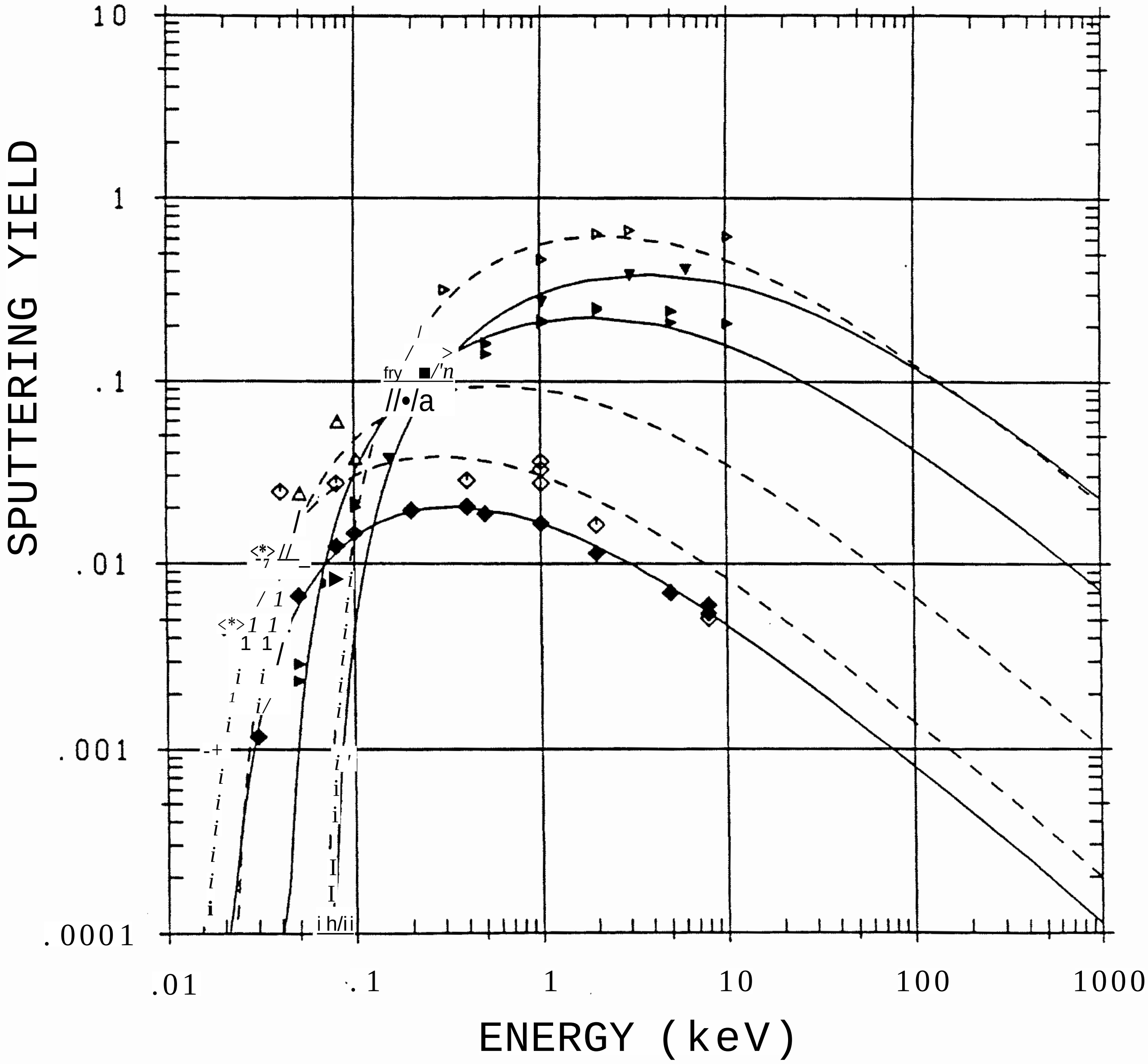


Fig. 12: Energy dependence of the sputtering yield of B with D, ^{4}He , B and O. The threshold energy of the D and ^{4}He experimental data was estimated for fitting. The data are partly published in [29, 30].

Experimental Data

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
B	D	0.020	0	0.00460	20	3	XI	110	24.02.1992
B	D	0.030	0	0.01140	20	3	X	166	22.03.1990
B	D	0.040	0	0.02460	20	3	IX	120	04.11.1987
B	D	0.080	0	0.02730	20	3	IX	119	03.11.1987
B	D	0.400	0	0.02840	20	3	V	132	17.03.1982
B	D	1.000	0	0.03600	700	3	X	166	22.03.1990
B	D	1.000	0	0.02750	20	3	X	191	09.05.1990
B	D	1.000	0	0.03250	500	3	X	192	10.05.1990
B	D	2.000	0	0.01630	20	3	V	83	02.07.1981
B	D	8.000	0	0.00510	20	1	V	132	16.03.1982

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
B	He	0.050	0	0.02420	20	1	X	161	15.03.1990
B	He	0.080	0	0.06030	20	1	X	161	19.03.1990
B	He	0.100	0	0.03780	20	1	X	160	13.03.1990
B	He	0.300	0	0.07520	20	1	X	161	14.03.1990

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
B	B	0.150	0	0.11000	20	1			HECHTL1991
B	B	0.300	0	0.32000	20	1			HECHTL1991
B	B	1.000	0	0.47000	20	1			HECHTL1991
B	B	2.000	0	0.65000	20	1			HECHTL1991
B	B	3.000	0	0.68000	20	1			HECHTL1991
B	B	10.000	0	0.63000	20	1			HECHTL1991

Calculated Data

Target	Proj.	Energy	Angle	Yield	Temp.	P	SBE
B	D	0.030	0	0.001170	20	2.35	5.73
B	D	0.050	0	0.006660	20	2.35	5.73
B	D	0.080	0	0.012400	20	2.35	5.73
B	D	0.100	0	0.014600	20	2.35	5.73
B	D	0.100	0	0.014600	20	2.35	5.73
B	D	0.200	0	0.019500	20	2.35	5.73
B	D	0.400	0	0.020300	20	2.35	5.73
B	D	0.400	0	0.020500	20	2.35	5.73
B	D	0.500	0	0.018700	20	2.35	5.73
B	D	1.000	0	0.016600	20	2.35	5.73
B	D	2.000	0	0.011400	20	2.35	5.73
B	D	5.000	0	0.006970	20	2.35	5.73
B	D	8.000	0	0.005990	20	2.35	5.73
B	D	8.000	0	0.005430	20	2.35	5.73

Target	Proj.	Energy	Angle	Yield	Temp.	p	SBE
B	B	0.050	0	0.002850	20	2.35	5.73
B	B	0.050	0	0.002310	20	2.35	5.73
B	B	0.070	0	0.007840	20	2.35	5.73
B	B	0.100	0	0.021700	20	2.35	5.73
B	B	0.100	0	0.020300	20	2.35	5.73
B	B	0.200	0	0.074400	20	2.35	5.73
B	B	0.500	0	0.160000	20	2.35	5.73
B	B	0.500	0	0.163000	20	2.35	5.73
B	B	0.500	0	0.142000	20	2.35	5.73
B	B	1.000	0	0.218000	20	2.35	5.73
B	B	1.000	0	0.210000	20	2.35	5.73
B	B	1.000	0	0.216000	20	2.35	5.73
B	B	2.000	0	0.256000	20	2.35	5.73
B	B	2.000	0	0.249000	20	2.35	5.73
B	B	5.000	0	0.245000	20	2.35	5.73
B	B	5.000	0	0.213000	20	2.35	5.73
B	B	10.000	0	0.210000	20	2.35	5.73

Target	Proj.	Energy	Angle	Yield	Temp.	p	SBE
B	O	0.150	0	0.037500	20	2.35	5.90
B	O	0.300	0	0.114000	20	2.35	5.90
B	O	1.000	0	0.277000	20	2.35	5.90
B	O	3.000	0	0.387000	20	2.35	5.90
B	O	6.000	0	0.416000	20	2.35	5.90

Target: Be

Experimental Data

Target	Projectile	Angle	Symbol	$E_{th}(eV)$	Q(atoms/ion)
Be/JET	H	0	□	12.2	0.128
Be/JET	D	0	0	10.0	0.220

Calculated Data

Target	Projectile	Angle	Symbol	$E_{th}('V)$	Q(atoms/ion)
Be	H	0	■	12.1	0.0730
Be	D	0	♦	9.80	0.122
Be	T	0	•	10.3	0.145

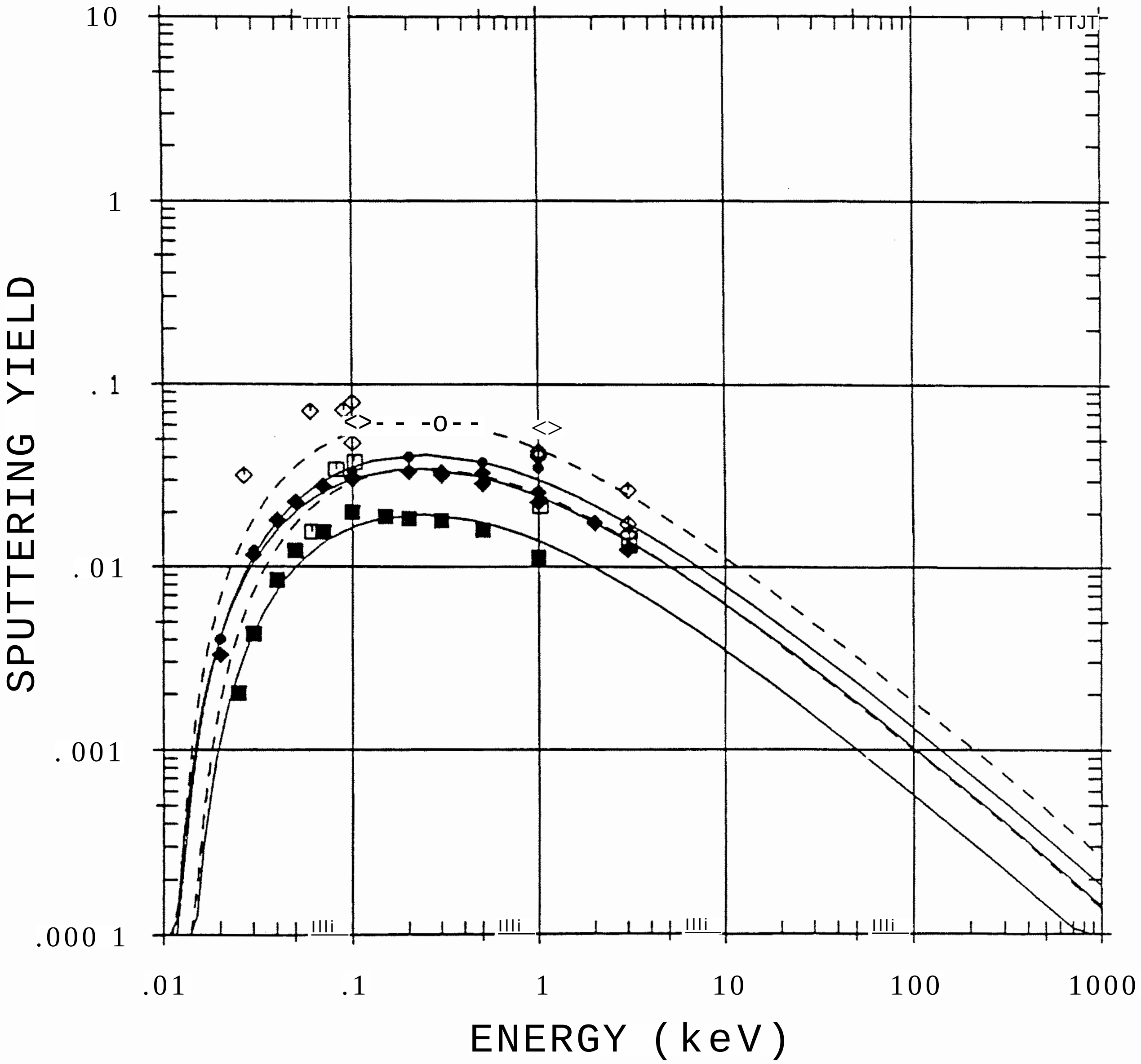


Fig. 13: Energy dependence of the sputtering yield of Be with H, D and T. The experimental data were measured at 650°C to avoid surface oxidation. The threshold energy of the experimental data for D and H was taken from calculated data for fitting. The data are published in [31,32,33].

Experimental Data

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
Be/JET	H	0.060	0	0.01520	650	3	VII	62	27.02.84
Be/JET	H	0.080	0	0.03350	650	3	VII	65	6.03.84
Be/JET	H	0.100	0	0.03670	650	3	VII	65	5.03.84
Be/JET	H	1.000	0	0.02120	650	3	VII	62	27.02.84
Be/JET	H	3.000	0	0.01410	650	2	VII	66	7.03.84
Be/JET	H	3.000	0	0.01290	650	2	VII	66	8.03.84

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
Be/JET	D	0.027	0	0.03200	580	3	VIII	148	19.03.86
Be/JET	D	0.060	0	0.07110	650	3	VII	58	16.02.84
Be/JET	D	0.090	0	0.07200	650	3	VII	55	09.02.84
Be/JET	D	0.100	0	0.07960	650	3	VII	54	08.02.84
Be/JET	D	0.100	0	0.06030	650	3	VII	82	12.04.84
Be/JET	D	0.100	0	0.07900	650	3	VII	148	26.11.84
Be/JET	D	0.100	0	0.04790	650	3	VII	156	10.12.84
Be/JET	D	0.300	0	0.05900	650	3	VII	54	07.02.84
Be/JET	D	0.300	0	0.03210	650	2	VII	64	5.03.84
Be/JET	D	0.300	0	0.05850	650	3	VII	82	12.04.84
Be/JET	D	1.000	0	0.04170	650	3	VII	54	08.02.84
Be/JET	D	1.000	0	0.04340	650	3	VII	79	10.04.84
Be/JET	D	1.000	0	0.05520	650	3	VII	145	20.11.84
Be/JET	D	1.000	0	0.04030	650	3	VII	149	28.11.84
Be/JET	D	3.000	0	0.01530	650	2	VII	55	09.02.84
Be/JET	D	3.000	0	0.01740	650	2	VII	64	2.03.84
Be/JET	D	3.000	0	0.02660	650	2	VII	79	10.04.84

Calculated Data

Target	Proj.	Energy	Angle	Yield	Temp.	P	SBE
Be	H	0.025	0	0.002020	20	1.80	3.38
Be	H	0.030	0	0.004300	20	1.80	3.38
Be	H	0.040	0	0.008500	20	1.80	3.38
Be	H	0.050	0	0.012300	20	1.80	3.38
Be	H	0.070	0	0.015600	20	1.80	3.38
Be	H	0.100	0	0.020000	20	1.80	3.38
Be	H	0.150	0	0.019000	20	1.80	3.38
Be	H	0.200	0	0.018500	20	1.80	3.38
Be	H	0.300	0	0.018000	20	1.80	3.38
Be	H	0.500	0	0.016000	20	1.80	3.38
Be	H	1.000	0	0.011300	20	1.80	3.38

Target	Proj.	Energy	Angle	Yield	Temp.	p	SEE
Be	D	0.020	0	0.003300	20	1.80	~T38
Be	D	0.030	0	0.011700	20	1.80	3.38
Be	D	0.040	0	0.018100	20	1.80	3.38
Be	D	0.050	0	0.022900	20	1.80	3.38
Be	D	0.070	0	0.028000	20	1.80	3.38
Be	D	0.100	0	0.030470	20	1.80	3.38
Be	D	0.100	0	0.031300	20	1.80	3.38
Be	D	0.200	0	0.033600	20	1.80	3.38
Be	D	0.300	0	0.033400	20	1.80	3.38
Be	D	0.300	0	0.033410	20	1.80	3.38
Be	D	0.500	0	0.028900	20	1.80	3.38
Be	D	0.500	0	0.033090	20	1.80	3.38
Be	D	1.000	0	0.025830	20	1.80	3.38
Be	D	1.000	0	0.022800	20	1.80	3.38
Be	D	2.000	0	0.017610	20	1.80	3.38
Be	D	3.000	0	0.012470	20	1.80	3.38

Target	Proj.	Energy	Angle	Yield	Temp.	p	SEE
Be	T	0.020	0	0.004020	20	1.80	3.38
Be	T	0.030	0	0.012300	20	1.80	3.38
Be	T	0.050	0	0.023100	20	1.80	3.38
Be	T	0.100	0	0.033500	20	1.80	3.38
Be	T	0.100	0	0.033500	20	1.80	3.38
Be	T	0.200	0	0.040400	20	1.80	3.38
Be	T	0.500	0	0.037600	20	1.80	3.38
Be	T	1.000	0	0.035400	20	1.80	3.38

Target: Be

Experimental Data

Target	Projectile	Angle	Symbol	$E_{th}(eV)$	Q(atoms/ion)
Be	H	0	□	35.1	0.0790
Be	D	0	0	26.2	0.181
Be	He	0	A	44.5	0.502

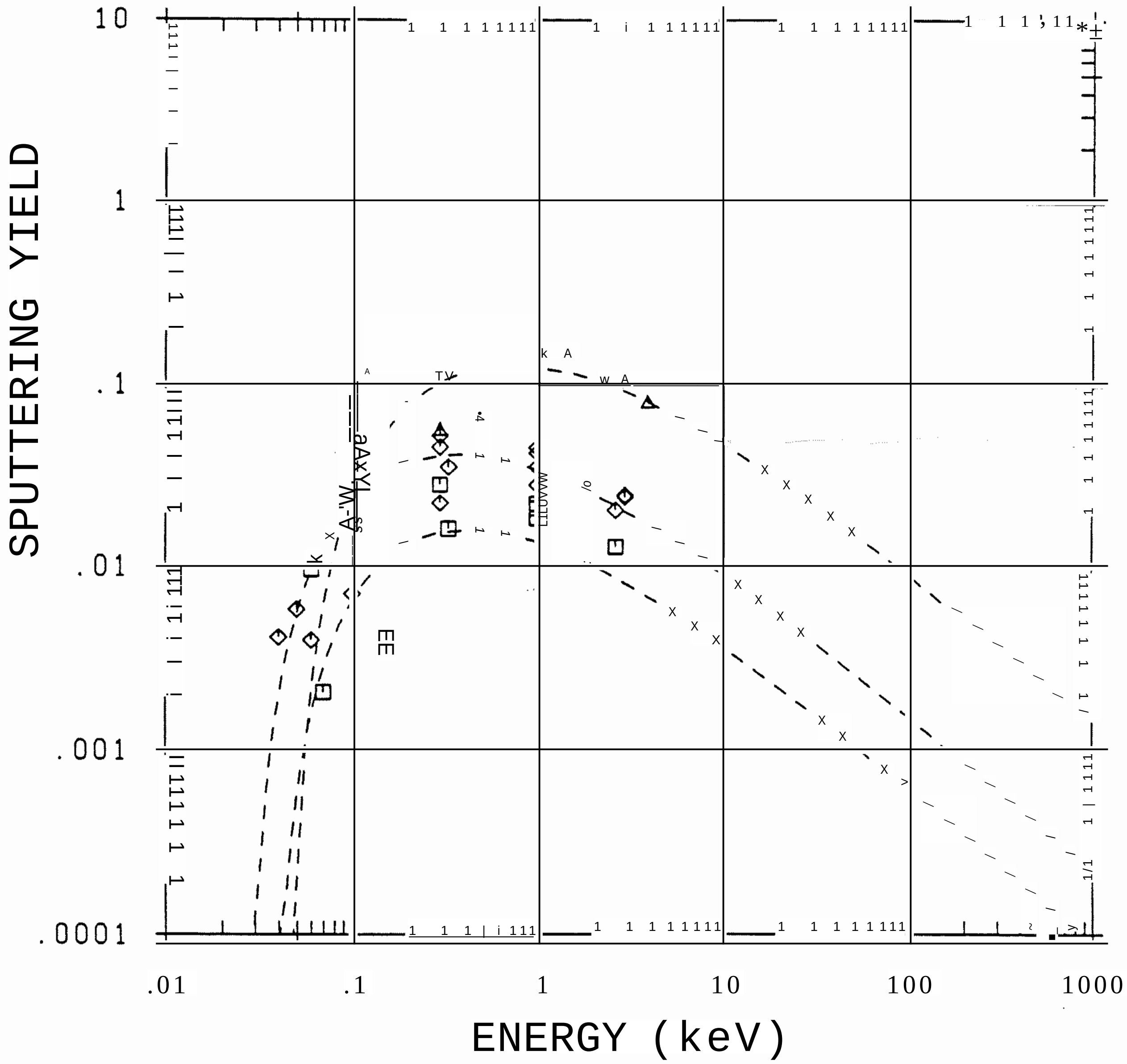


Fig. 14: Energy dependence of the sputtering yield of Be with H, D and ^{4}He measured at room temperature. The similarity with the results obtained for BeO (Fig. 52) as well as the large scatter of the data points indicates ion induced oxidation during sputtering. These results are published in [33,34].

Experimental Data

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
Be/JET	H	0.060	0	0.00959	20	3	VII	63	28.02.84
Be	H	0.070	0	0.00206	20	3	III	77	09.05.78
Be	H	0.150	0	0.00340	20	3	III	70	20.04.78
Be	H	0.150	0	0.00399	20	3	III	77	09.05.78
Be/JET	H	0.300	0	0.02800	20	3	VII	64	1.03.84
Be	H	0.333	0	0.01600	20	3	III	68	18.04.78
Be	H	1.000	0	0.01830	20	3	III	72	25.04.78
Be/JET	H	1.000	0	0.02200	20	3	VII	63	29.02.84
Be/JET	H	1.000	0	0.02080	20	3	VII	63	29.02.84
Be	H	2.667	0	0.01280	20	3	III	72	24.04.78

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
Be/JET	D	0.040	0	0.00408	20	3	VIII	147	18.03.86
Be	D	0.050	0	0.00580	20	3	III	69	20.04.78
Be	D	0.060	0	0.00395	20	3	VI	128	25.04.83
Be/JET	D	0.090	0	0.04180	20	3	VII	57	14.02.84
Be	D	0.100	0	0.00706	20	3	VI	126	21.04.83
Be/JET	D	0.100	0	0.04790	20	2	VII	56	13.02.84
Be/JET	D	0.100	0	0.02240	20	3	VII	81	11.04.84
Be/JET	D	0.100	0	0.02590	20	3	VII	82	13.04.84
Be/JET	D	0.100	0	0.02270	20	3	VII	145	22.11.84
Be/JET	D	0.100	0	0.04130	20	3	VII	149	27.11.84
Be/JET	D	0.100	0	0.01670	20	3	VII	155	6.12.84
Be	D	0.110	0	0.03900	20	3	III	67	14.04.78
Be	D	0.300	0	0.02220	20	3	VI	126	22.04.83
Be/JET	D	0.300	0	0.05210	20	3	VII	56	14.02.84
Be/JET	D	0.300	0	0.04520	20	3	VII	81	12.04.84
Be	D	0.333	0	0.03500	20	3	III	67	14.04.78
Be	D	1.000	0	0.02800	20	3	III	66	13.04.78
Be	D	1.000	0	0.03500	20	3	VI	126	22.04.83
Be/JET	D	1.000	0	0.04490	20	3	VII	55	10.02.84
Be/JET	D	1.000	0	0.04200	20	3	VII	77	9.04.84
Be	D	1.500	0	0.03330	20	3	VI	127	25.04.83
Be	D	2.667	0	0.02040	20	3	III	68	18.04.78
Be/JET	D	3.000	0	0.02470	20	2	VII	56	13.02.84
Be/JET	D	3.000	0	0.02400	20	2	VII	66	9.03.84

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
Be/JET	He	0.125	0	0.17200	20	1	VII	60	22.02.84
Be	He	0.130	0	0.02800	20	1	III	69	20.04.78
Be	He	0.300	0	0.05670	20	1	III	70	21.04.78
Be/JET	He	0.300	0	0.21500	20	1	VII	61	23.02.84
Be	He	0.500	0	0.06420	20	1	III	70	22.04.78
Be	He	0.750	0	0.20400	20	1	III	70	21.04.78
Be/JET	He	1.000	0	0.15000	20	1	VII	60	22.02.84
Be	He	1.500	0	0.15200	20	1	III	71	22.04.78
Be/JET	He	3.000	0	0.10500	20	1	VII	59	21.02.84
Be	He	4.000	0	0.08100	20	1	III	71	24.04.78

Target: Be

Experimental Data

Target	Projectile	Angle	Symbol	$E_{th}(eV)$	Q(atoms/ion)
Be/JET	He	0	A	13.9	0.707

Calculated Data

Target	Projectile	Angle	Symbol	Eth(eV)	Q(atoms/ion)
Be	He	0	A	13.9	0.330
Be	Ne	0	■	40.2	1.90
Be	Ar	0	♦	48.1	2.96

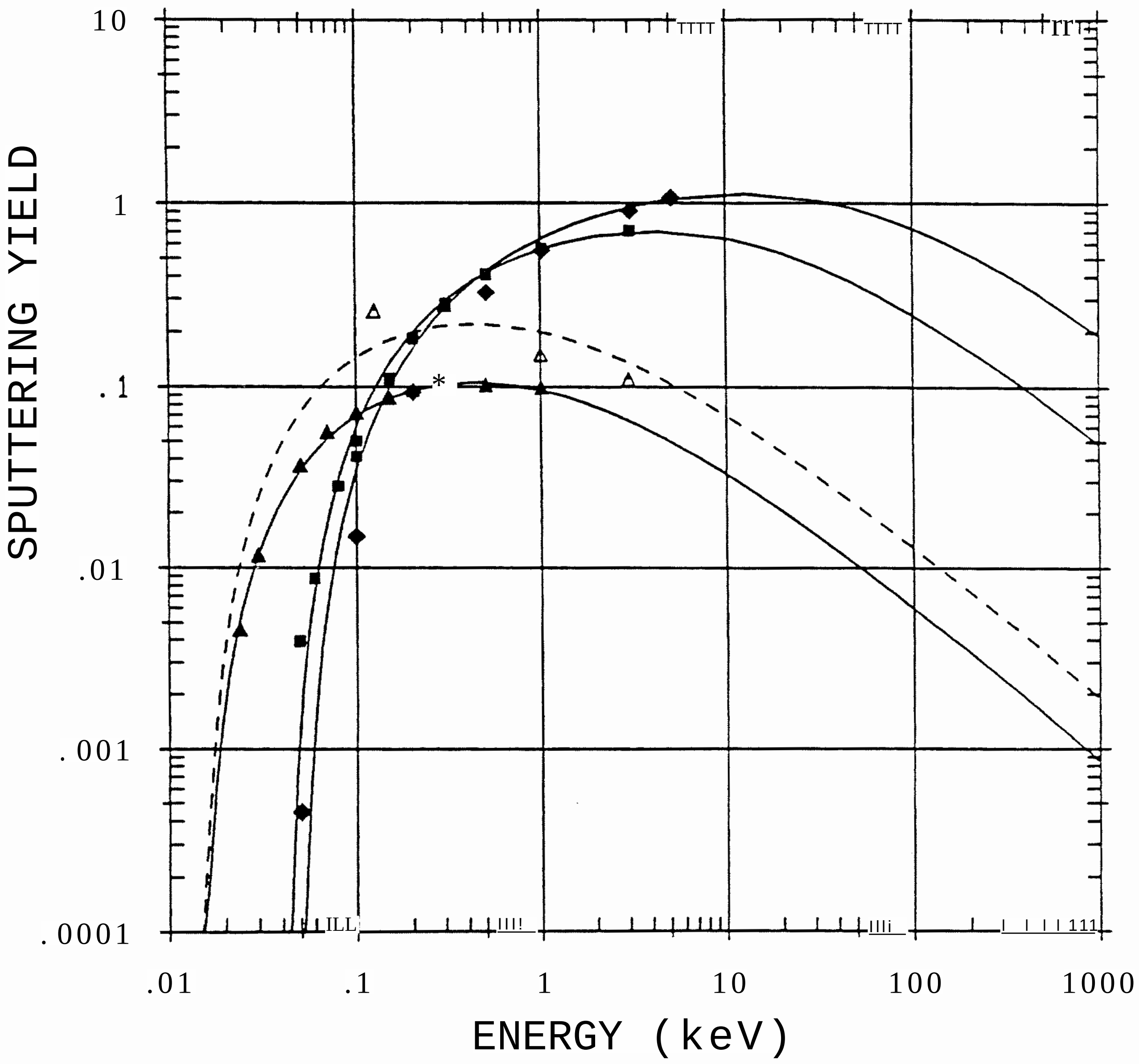


Fig. 15: Energy dependence of the sputtering yield of Be with ^{4}He , Ne and Ar. The experimental data for He were measured at 650°C to avoid surface oxidation. The threshold energy for these data was taken from calculated data for fitting. These results are published in [31,33].

Experimental Data

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
Be/JET	He	0.125	0	0.25900	650	1	VII	59	20.02.84
Be/JET	He	0.300	0	0.28000	650	1	VII	60	21.02.84
Be/JET	He	1.000	0	0.15000	650	1	VII	59	20.02.84
Be/JET	He	3.000	0	0.11000	650	1	VII	58	17.02.84

Calculated Data

Target	Proj.	Energy	Angle	Yield	Temp.	P	SBE
Be	He	0.024	0	0.004600	20	1.80	3.38
Be	He	0.030	0	0.011600	20	1.80	3.38
Be	He	0.050	0	0.036000	20	1.80	3.38
Be	He	0.070	0	0.055000	20	1.80	3.38
Be	He	0.100	0	0.070000	20	1.80	3.38
Be	He	0.150	0	0.085000	20	1.80	3.38
Be	He	0.200	0	0.094000	20	1.80	3.38
Be	He	0.300	0	0.097000	20	1.80	3.38
Be	He	0.500	0	0.100000	20	1.80	3.38
Be	He	1.000	0	0.097000	20	1.80	3.38

Target	Proj.	Energy	Angle	Yield	Temp.	P	SBE
Be	Ne	0.050	0	0.003950	20	1.80	3.38
Be	Ne	0.060	0	0.008700	20	1.80	3.38
Be	Ne	0.080	0	0.027500	20	1.80	3.38
Be	Ne	0.100	0	0.040400	20	1.80	3.38
Be	Ne	0.100	0	0.049000	20	1.80	3.38
Be	Ne	0.150	0	0.108000	20	1.80	3.38
Be	Ne	0.200	0	0.180000	20	1.80	3.38
Be	Ne	0.300	0	0.275000	20	1.80	3.38
Be	Ne	0.500	0	0.400000	20	1.80	3.38
Be	Ne	1.000	0	0.560000	20	1.80	3.38
Be	Ne	3.000	0	0.700000	20	1.80	3.38

Target	Proj.	Energy	Angle	Yield	Temp.	P	SBE
Be	Ar	0.050	0	0.000463	20	1.80	3.38
Be	Ar	0.100	0	0.014600	20	1.80	3.38
Be	Ar	0.200	0	0.091200	20	1.80	3.38
Be	Ar	0.500	0	0.319000	20	1.80	3.38
Be	Ar	1.000	0	0.544000	20	1.80	3.38
Be	Ar	3.000	0	0.900000	20	1.80	3.38
Be	Ar	5.000	0	1.060000	20	1.80	3.38

Calculated Data

Target	Projectile	Angle	Symbol	Eth(eV)	Q(atoms/ion)
~ Be	Ö	Ö	V	47T)	L71
Be	Be	0	▶	23.0	0.770

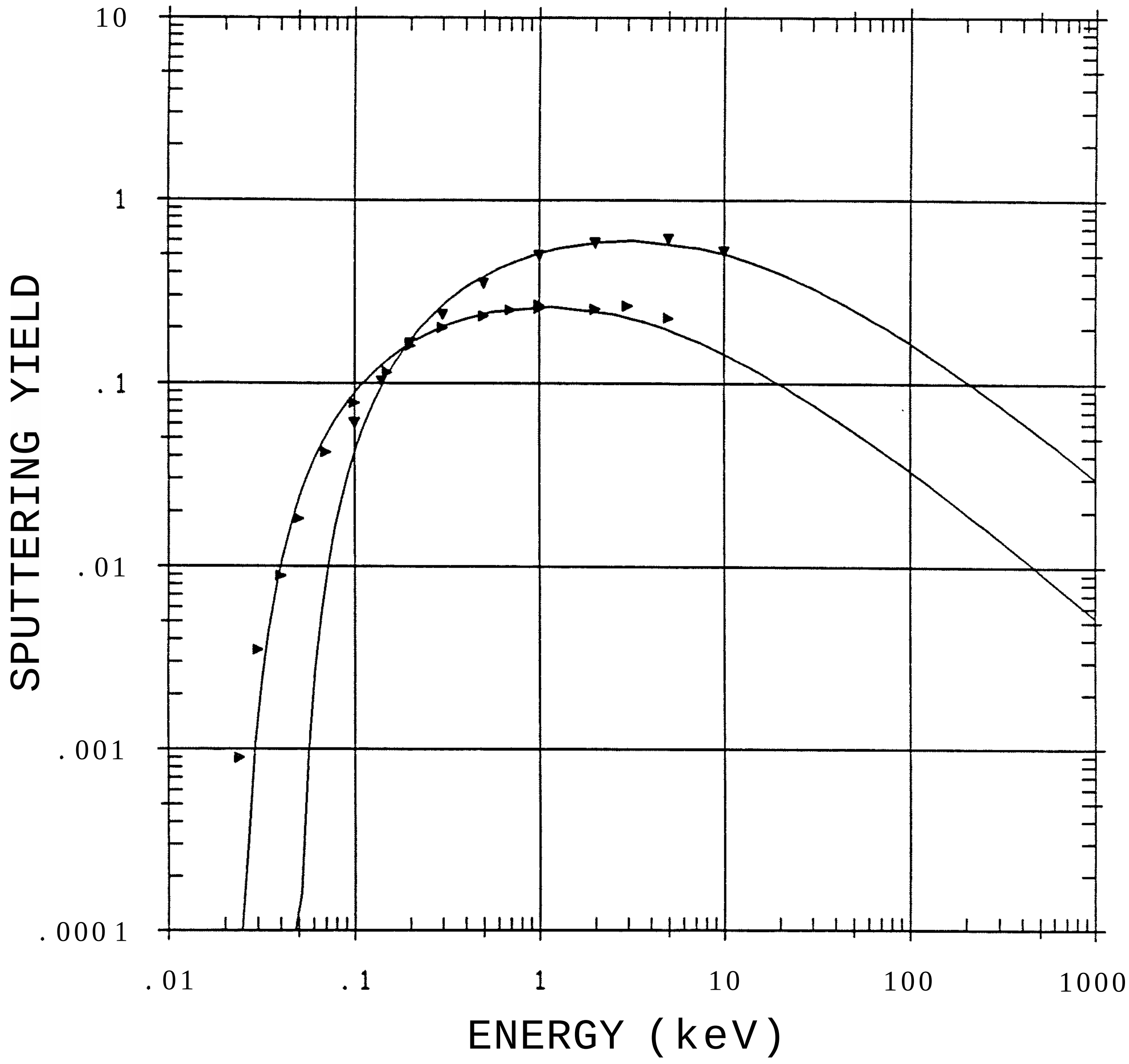


Fig. 16: Energy dependence of the sputtering yield of Be with 0 and Be. The data for 0 were calculated only for clean targets without formation of BeO (no dynamic calculation). The data are published in [33,35-38].

Calculated Data

Target	Proj.	Energy	Angle	Yield	Temp.	*P*	SBE
Be	0	0.100	0	0.060600	20	1.85	3.38
Be	0	0.140	0	0.102000	20	1.85	3.38
Be	0	0.200	0	0.165000	20	1.85	3.38
Be	0	0.300	0	0.235000	20	1.85	3.38
Be	0	0.500	0	0.350000	20	1.85	3.38
Be	0	1.000	0	0.497000	20	1.85	3.38
Be	0	2.000	0	0.581000	20	1.85	3.38
Be	0	5.000	0	0.610000	20	1.85	3.38
Be	0	10.000	0	0.524000	20	1.85	3.38

Target	Proj.	Energy	Angle	Yield	Temp.	*P*	SBE
Be	Be	0.024	0	0.000900	20	1.80	3.38
Be	Be	0.030	0	0.003500	20	1.80	3.38
Be	Be	0.040	0	0.008900	20	1.80	3.38
Be	Be	0.050	0	0.018200	20	1.80	3.38
Be	Be	0.070	0	0.042000	20	1.80	3.38
Be	Be	0.100	0	0.078000	20	1.80	3.38
Be	Be	0.150	0	0.115000	20	1.80	3.38
Be	Be	0.200	0	0.160000	20	1.80	3.38
Be	Be	0.300	0	0.200000	20	1.80	3.38
Be	Be	0.500	0	0.232000	20	1.80	3.38
Be	Be	0.700	0	0.250000	20	1.80	3.38
Be	Be	1.000	0	0.255000	20	1.80	3.38
Be	Be	1.000	0	0.266000	20	1.80	3.38
Be	Be	2.000	0	0.253000	20	1.80	3.38
Be	Be	3.000	0	0.263000	20	1.80	3.38
Be	Be	5.000	0	0.227000	20	1.80	3.38

Experimental Data

Target	Projectile	Angle	Symbol	$E_t h(eV)$	Q(atoms/ion)
C/*	H	0	□		
C/*	D	0	◇		

Calculated Data

Target	Projectile	Angle	Symbol	$E_t h(eV)$	Q(atoms/ion)
C	H	0	■	27.3	0.0271
C	D	0	♦	24.3	0.0601
C	T	0	•	22.4	0.0684

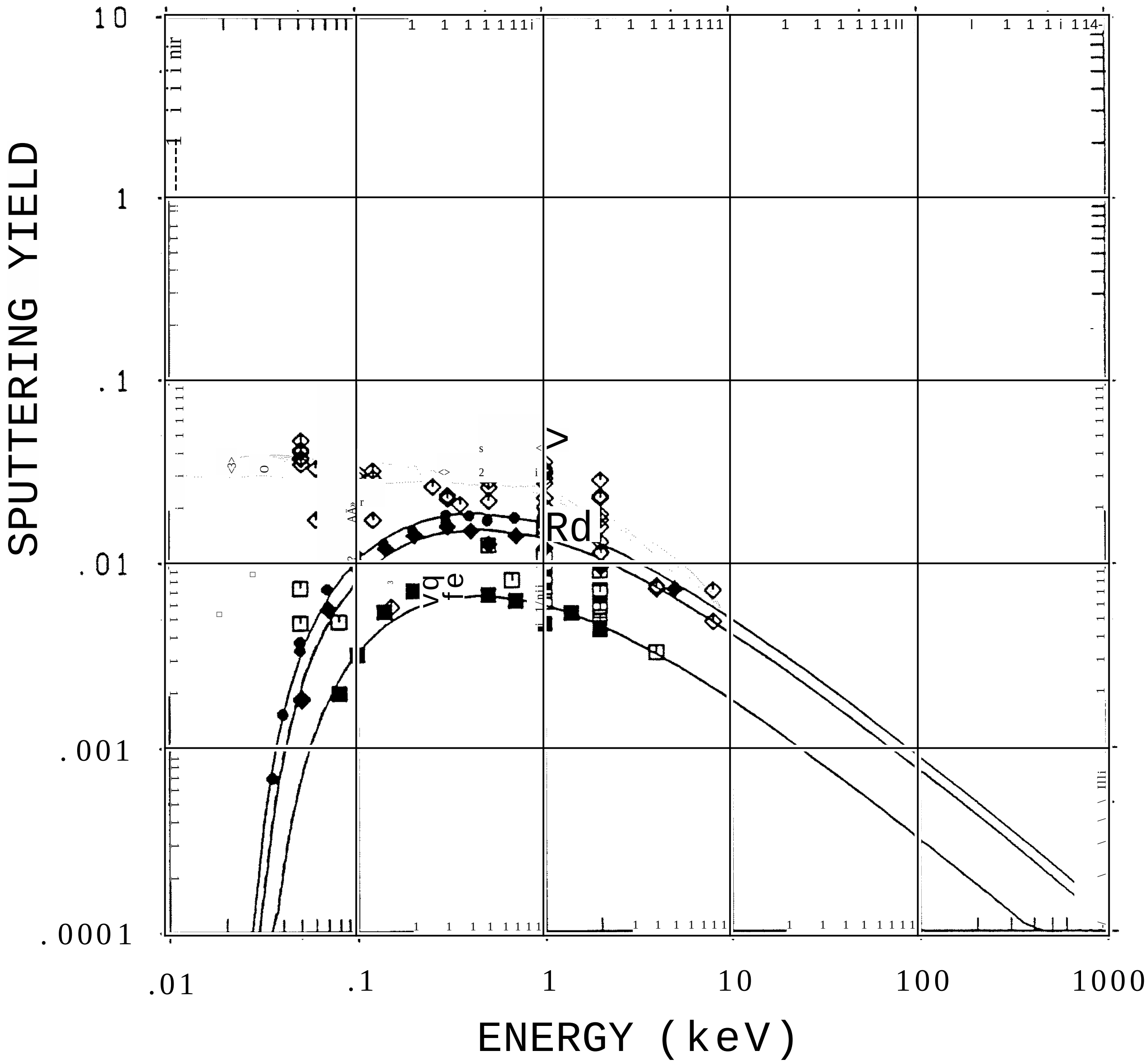


Fig. 17: Energy dependence of the sputtering yield of C with H, D and T. Throughout all calculations a surface binding energy of 7.40 eV was used though in some cases a surface energy of 4.4 results in a better agreement with experimental values [37]. Experimental data for different kinds of graphite are reported. Their sputtering yields vary widely depending on their structure, orientation and roughness degree. Only data measured at temperatures < 200°C are plotted. At temperatures in the range of 500°C increased sputtering yields due to chemical effects have been observed [39]. Above 900°C radiation enhanced sublimation (RES) leads also to an increase of the sputtering yields [40]. At ion energies below 100 eV chemical erosion is found even at room temperature. These results are published in [32,41-44].

Experimental Data

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
C/UC-	H	0.020	0	0.00498	20	3	VIII	96	5.12.1985
C/UC-	H	0.030	0	0.00810	20	3	X	118	25.10.1989
C/UC	H	0.050	0	0.00475	20	3	III	76	03.05.1978
C/UC-	H	0.050	0	0.00730	20	3	X	118	26.10.1989
C/LEC-	H	0.080	0	0.00481	20	3	VI	76	25.10.1982
C/UC	H	0.120	0	0.00860	20	3	II	185	08.09.1977
C/UC	H	0.250	0	0.00890	20	3	III	7	28.09.1977
C/UC	H	0.330	0	0.00940	20	3	II	40	31.05.1976
C/UC-	H	0.500	0	0.01250	120	3	XI	19	31.07.1990
C/UC	H	0.670	0	0.00810	20	3	II	38	26.05.1976
C/UC	H	1.000	0	0.00620	20	3	II	38	25.05.1976
C/JET	H	1.000	0	0.00932	20	3	IX	111	12.10.1987
C/JET	H	1.000	0	0.01100	20	3	IX	112	13.10.1987
C/UCHOP	H	1.000	0	0.00712	80	3	IX	167	20.06.1988
C/TI	H	1.000	0	0.00810	20	3	X	155	28.02.1990
C/UC-	H	1.000	0	0.01580	176	3	XI	21	01.08.1990
C/UC-	H	1.000	0	0.01510	120	3	XI	23	02.08.1990
C/UC-	H	1.000	0	0.00790	140	3	XI	26	09.08.1990
C/UC-	H	1.000	0	0.00840	130	3	XI	33	07.09.1990
C/UC	H	2.000	0	0.00490	20	3	I	95	05.06.1975
C/UC	H	2.000	0	0.00558	20	3	I	96	10.06.1975
C/POC	H	2.000	0	0.00912	150	3	VI	1	24.06.1982
C/UCI	H	2.000	0	0.00482	190	3	VI	7	1.07.1982
c/uc-	H	2.000	0	0.00693	200	3	VI	20	15.07.1982
C/LEC-	H	2.000	0	0.00716	160	3	VI	26	22.07.1982
C/UCHOP	H	2.000	0	0.00610	20	3	IX	184	16.08.1988
C/UC-	H	2.000	0	0.00440	160	3	XI	33	06.09.1990
c/uc	H	4.000	0	0.00330	20	2	III	5	22.09.1977

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
c/uc-	D	0.020	0	0.03560	20	3	VIII	95	3.12.1985
C/EK98	D	0.020	0	0.03880	20	3	VIII	99	8.01.1986
C/UC-	D	0.030	0	0.03620	20	3	VIII	94	28.11.1985
C/UC	D	0.050	0	0.03770	20	3	III	77	08.05.1978
C/UC	D	0.050	0	0.03570	20	3	III	115	25.07.1978
C/UC-	D	0.050	0	0.04810	20	3	VI	114	19.02.1983
C/UC-	D	0.050	0	0.03820	20	3	VIII	95	2.12.1985
C/EK98	D	0.050	0	0.03880	20	3	VIII	99	7.01.1986
C/UC	D	0.050	0	0.04150	20	3	VIII	185	28.08.1986
C/EK76	D	0.050	0	0.03830	20	3	IX	4	10.09.1986
C/TI	D	0.050	0	0.04290	20	3	X	156	01.03.1990
C/UC	D	0.060	0	0.03370	20	3	III	119	27.07.1978
C/UC-	D	0.060	0	0.01760	20	3	VI	113	15.02.1983
C/UC-	D	0.070	0	0.01380	20	3	VI	114	21.02.1983
C/LEC-	D	0.080	0	0.03170	20	3	VI	71	15.10.1982
C/LECI	D	0.080	0	0.03800	23	3	VI	81	4.11.1982
C/UC-	D	0.080	0	0.02070	20	3	VI	114	18.02.1983
C/UC	D	0.100	0	0.02390	20	3	III	117	26.07.1978
C/UC-	D	0.100	0	0.02320	20	3	VIII	94	2.12.1985
C/EK98	D	0.100	0	0.03170	20	3	VIII	100	9.01.1986
C/UC-	D	0.100	0	0.02720	20	3	VIII	167	14.07.1986

c/uc-	D	0.100	0	0.02960	200	3	VIII	168	15.07.1986
C/PIC	D	0.100	0	0.02720	20	3	VIII	175	5.08.1986
C/EK76	D	0.100	0	0.02950	20	3	IX	5	11.09.1986
C/UC	D	0.120	0	0.01760	20	3	II	185	09.09.1977
C/LEC-	D	0.120	0	0.02980	20	3	VI	76	27.10.1982
C/LECI	D	0.120	0	0.03270	23	3	VI	80	3.11.1982
C/LEC-	D	0.150	0	0.00596	20	3	VI	48	16.09.1982
C/UC	D	0.250	0	0.02670	20	3	II	180	22.08.1977
c/uc-	D	0.300	0	0.02390	200	3	IX	140	10.02.1988
c/uc-	D	0.300	0	0.02280	20	3	IX	158	27.04.1988
C/UCI	D	0.300	0	0.03320	20	3	XI	9	20.06.1990
C/UC	D	0.350	0	0.02120	20	3	V	96	12.10.1981
C/UC	D	0.500	0	0.02220	20	3	11	179	19.08.1977
c/uc-	D	0.500	0	0.02860	20	3	VIII	95	3.12.1985
C/EK98	D	0.500	0	0.03630	20	3	VIII	100	9.01.1986
C/TFTR	D	0.500	0	0.02630	20	3	VIII	144	13.03.1986
C/TFTR	D	0.500	0	0.04980	20	3	VIII	146	17.03.1986
C/TFTR	D	0.500	0	0.05900	20	3	VIII	147	17.03.1986
C/UC	D	1.000	0	0.01800	20	3	II	179	18.08.1977
C/UC	D	1.000	0	0.01670	20	3	V	97	16.10.1981
C/PAP	D	1.000	0	0.02030	20	3	V	107	25.11.1981
C/PAP	D	1.000	0	0.02050	20	3	V	114	18.12.1981
C/PAP	D	1.000	0	0.02310	20	3	V	115	13.01.1982
C/PAP	D	1.000	0	0.02070	20	3	V	120	28.01.1982
C/GLASS	D	1.000	0	0.01710	20	3	VII	126	27.09.1984
C/GLASS	D	1.000	0	0.01780	180	3	VII	140	26.10.1984
C/EK98	D	1.000	0	0.03250	20	3	VIII	69	23.09.1985
C/EK98	D	1.000	0	0.03210	20	3	VIII	70	24.09.1985
C/UCATJ	D	1.000	0	0.02290	20	3	VIII	74	1.10.1985
C/UC-	D	1.000	0	0.02050	20	3	IX	12	2.10.1986
C/JET	D	1.000	0	0.01550	20	3	IX	110	6.10.1987
C/JET	D	1.000	0	0.01830	20	3	IX	112	13.10.1987
C/TI	D	1.000	0	0.03620	20	3	X	157	05.03.1990
C/GB	D	1.000	0	0.03140	20	3	XI	51	28.01.1991
C/CXY	D	1.000	0	0.02960	20	3	XI	52	29.01.1991
C/CXX	D	1.000	0	0.03210	20	3	XI	53	31.01.1991
C/CXZ	D	1.000	0	0.02780	20	3	XI	54	01.02.1991
C/SEP	D	1.000	0	0.04500	20	3	XI	61	02.04.1991
C/SEP	D	1.000	0	0.03360	20	3	XI	99	29.10.1991
C/DIAM	D	1.333	0	0.01770	20	3	VII	138	18.10.1984
C/UC	D	2.000	0	0.01140	20	3	II	179	17.08.1977
C/LEC-	D	2.000	0	0.01320	96	3	V	87	17.07.1981
C/UC	D	2.000	0	0.01150	110	3	V	98	21.10.1981
C/UC	D	2.000	0	0.01170	20	3	V	102	6.11.1981
C/POCO	D	2.000	0	0.02880	180	3	V	187	23.06.1982
C/POCP	D	2.000	0	0.02300	160	3	VI	1	24.06.1982
c/uc-	D	2.000	0	0.01860	200	3	VI	17	14.07.1982
c/uc-	D	2.000	0	0.01740	200	3	VI	18	15.07.1982
C/LEC-	D	2.000	0	0.01600	160	3	VI	26	22.07.1982
C/UK76	D	2.000	0	0.02360	20	3	IX	4	11.09.1986
C/BE	D	2.000	0	0.02290	20	3	X	165	21.03.1990
C/UC	D	4.000	0	0.00770	20	2	II	178	16.08.1977
C/UC	D	4.000	0	0.00742	168	2	V	100	28.10.1981
C/UCI	D	8.000	0	0.00495	20	1	IX	37	5.03.1987
C/UC-	D	8.000	0	0.00727	20	1	IX	35	15.12.1986

Calculated Data

Target	Proj.	Energy	Angle	Yield	Temp.	*P*	SBE
C	H	0.080	0	0.001960	20	1.85	7.40
C	H	0.100	0	0.003180	20	1.85	7.40
C	H	0.100	0	0.003180	20	1.85	7.40
C	H	0.140	0	0.005460	20	1.85	7.40
C	H	0.200	0	0.007070	20	1.85	7.40
C	H	0.300	0	0.007010	20	1.85	7.40
C	H	0.500	0	0.006730	20	1.85	7.40
C	H	0.700	0	0.006270	20	1.85	7.40
C	H	1.000	0	0.004720	20	1.85	7.40
C	H	1.400	0	0.005370	20	1.85	7.40
C	H	2.000	0	0.004470	20	1.85	7.40

Target	Proj.	Energy	Angle	Yield	Temp.	*P*	SBE
C	D	0.050	0	0.001910	20	1.85	7.40
C	D	0.050	0	0.001860	20	1.85	7.40
C	D	0.070	0	0.005780	20	1.85	7.40
C	D	0.100	0	0.009570	20	1.85	7.40
C	D	0.100	0	0.009800	20	1.85	7.40
C	D	0.140	0	0.012200	20	1.85	7.40
C	D	0.200	0	0.014400	20	1.85	7.40
C	D	0.300	0	0.016100	20	1.85	7.40
C	D	0.400	0	0.015300	20	1.85	7.40
C	D	0.500	0	0.012900	20	1.85	7.40
C	D	0.700	0	0.014300	20	1.85	7.40
C	D	1.000	0	0.012300	20	1.85	7.40
C	D	2.000	0	0.009650	20	1.85	7.40
C	D	5.000	0	0.007400	20	1.85	7.40

Target	Proj.	Energy	Angle	Yield	Temp.	*P*	SBE
C	T	0.035	0	0.000690	20	1.85	7.40
C	T	0.035	0	0.000686	20	1.85	7.40
C	T	0.040	0	0.001520	20	1.85	7.40
C	T	0.050	0	0.003380	20	1.85	7.40
C	T	0.050	0	0.003740	20	1.85	7.40
C	T	0.070	0	0.007170	20	1.85	7.40
C	T	0.100	0	0.011000	20	1.85	7.40
C	T	0.100	0	0.010300	20	1.85	7.40
C	T	0.140	0	0.012600	20	1.85	7.40
C	T	0.200	0	0.014900	20	1.85	7.40
C	T	0.300	0	0.018000	20	1.85	7.40
C	T	0.300	0	0.016700	20	1.85	7.40
C	T	0.400	0	0.017800	20	1.85	7.40
C	T	0.500	0	0.016800	20	1.85	7.40
C	T	0.700	0	0.017400	20	1.85	7.40
C	T	1.000	0	0.018400	20	1.85	7.40

Experimental Data

Target	Projectile	Angle	Symbol	E(h (eV)	Q(atoms/ion)
c/*	He	0	A	30.2	0.387
C/‘	O	0	V		
c/*	H_2O	0	>		
c/*	^{12}C	0	□	35.0	1.20

Calculated Data

Target	Projectile	Angle	Symbol	$E_{ih}(eV)$	Q(atoms/ion)
C	He	0	A	25.4	0.169
C	^{12}C	0	■	44.0	0.620
C	0	0	▼	100.	0.990

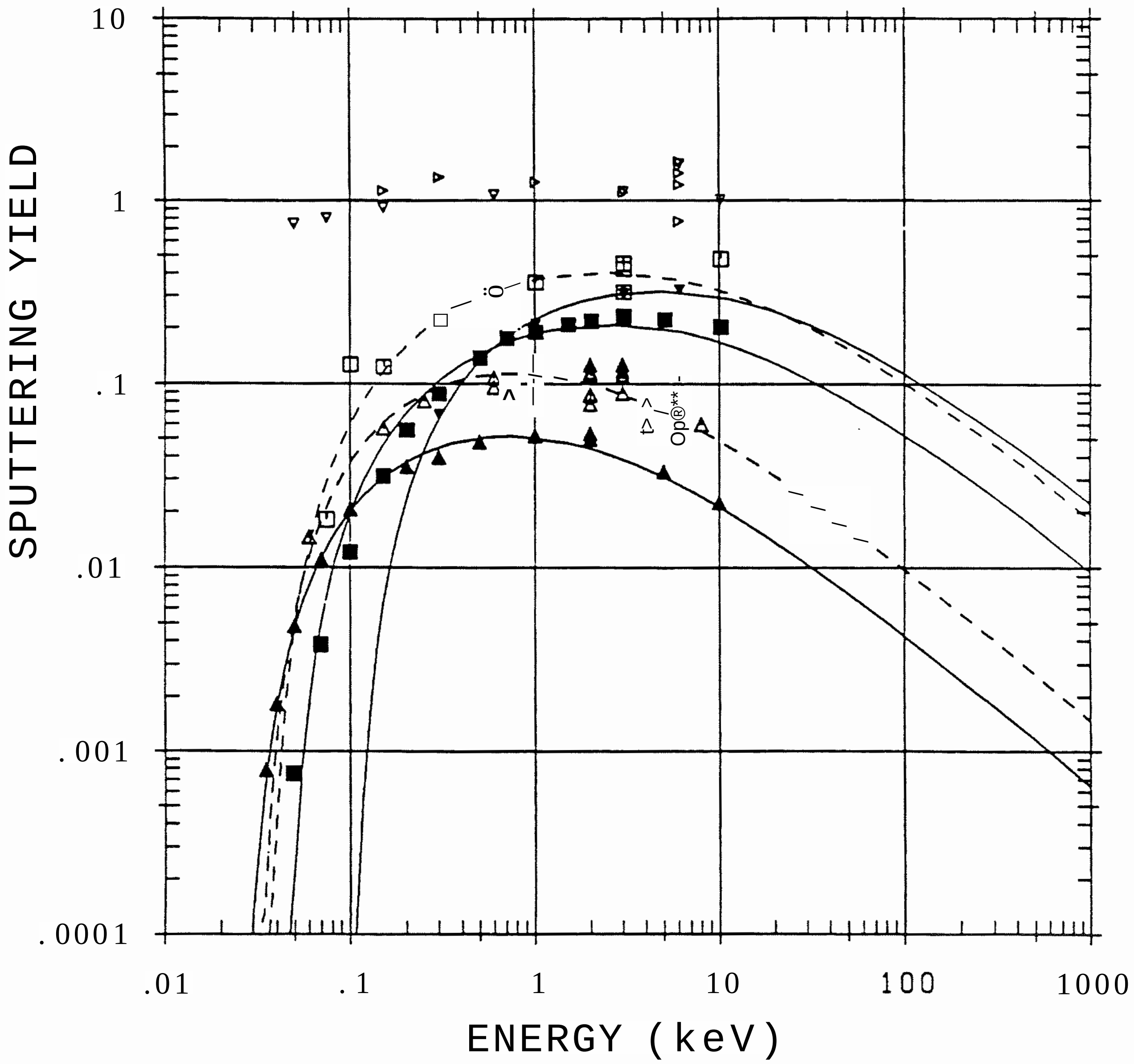


Fig. 18: Energy dependence of the sputtering yield of C with ^4He , C and 0. Only data measured at temperatures below 800°C are shown as at higher temperatures enhanced erosion yields due to RES occur. Experimental data for 0 show enhanced sputtering yields due to chemical effects. These effects are not taken into account for calculations. The data are published in [32,33,38,44,451.

Experimental Data

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
C/UCI	He	0.060	0	0.01460	20	1	VIII	96	9.12.1985
C/UC	He	0.150	0	0.05690	20	1	III	75	03.05.1978
C/UC	He	0.250	0	0.08080	20	1	III	2	12.09.1977
C/UCI	He	0.600	0	0.09590	20	1	VI	168	18.07.1983
C/UCI	He	0.600	0	0.10800	20	1	VI	169	19.07.1983
C/UC	He	0.750	0	0.08570	20	1	II	185	08.09.1977
C/UC	He	2.000	0	0.07730	20	1	II	184	07.09.1977
C/POC	He	2.000	0	0.12700	110	1	VI	2	25.06.1982
C/UCI	He	2.000	0	0.11200	no	1	VI	11	6.07.1982
C/UCI	He	2.000	0	0.05330	no	1	VI	14	12.07.1982
C/UCI	He	2.000	0	0.08800	130	1	VI	15	13.07.1982
C/UCI	He	2.000	0	0.08690	140	1	VI	15	13.07.1982
c/uo	He	2.000	0	0.11400	no	1	VI	21	19.07.1982
C/LECI	He	2.000	0	0.08670	no	1	VI	24	21.07.1982
C/LEC-	He	2.000	0	0.11700	no	1	VI	27	23.07.1982
C/UCI	He	3.000	0	0.08920	20	1	VI	168	18.07.1983
C/UCI	He	3.000	0	0.11300	20	1	VI	169	19.07.1983
C/GLASS	He	3.000	0	0.11100	20	1	VII	125	26.09.1984
C/GLASS	He	3.000	0	0.11800	20	1	VII	134	10.10.1984
C/GLASS	He	3.000	0	0.12700	220	3	VII	140	25.10.1984
C/5890	He	3.000	0	0.11000	20	1	VIII	71	25.09.1985
C/UC	He	4.000	0	0.08260	20	1	III	6	27.09.1977
C/PAP	He	4.000	0	0.05860	20	1	V	112	10.12.1981
C/UC	He	6.000	0	0.07760	20	1	III	1	12.09.1977
C/LEC-	He	6.000	0	0.08900	60	1	V	85	08.07.1981
C/UCI	He	6.000	0	0.06670	235	1	VI	15	13.07.1982
C/ATJ	He	6.000	0	0.06380	20	1	VII	128	2.10.1984
C/ATJ	He	6.000	0	0.05100	20	1	VII	130	4.10.1984
C/POC	He	6.000	0	0.08520	20	1	VII	132	8.10.1984
C/GLASS	He	6.000	0	0.07340	20	1	VII	133	9.10.1984
C/GLASS	He	6.000	0	0.10000	20	1	VII	133	10.10.1984
C/UC	He	8.000	0	0.06000	20	1	III	6	26.09.1977

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
C	0	0.050	0	0.73300	20	1			HECHTL81
C	0	0.075	0	0.78900	20	1			HECHTL81
C	0	0.150	0	0.90400	20	1			HECHTL81
C	0	0.600	0	1.06600	20	1			HECHTL81
C	0	3.000	0	1.12500	20	1			HECHTL81
C/UC-	0	6.000	0	1.62000	20	1	X	76	22.06.1989
C	0	10.000	0	1.03300	20	1			HECHTL81

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
C/UC-	h_2o	0.150	0	1.12000	20	1	X	144	31.01.1990
C/UC-	h_2o	0.300	0	1.33000	20	1	X	140	25.01.1990
C/UC-	h_2o	0.300	0	1.34000	20	1	X	145	31.01.1990
C/UC-	h_2o	1.000	0	1.26000	20	1	X	144	31.01.1990
C/UC-	h_2o	3.000	0	1.12000	20	1	X	144	31.01.1990
C/UC-	h_2o	6.000	0	1.24000	20	1	X	76	22.06.1989
C/UC-	h_2o	6.000	0	1.44000	70	1	X	77	26.06.1989
c/uc-	h_2o	6.000	0	1.67000	0	1	X	77	26.06.1989
c/uc-	h_2o	6.000	0	0.78200	20	1	X	143	31.01.1990

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
c	^{12}c	0.075	0	0.01800	20	1			HECHTL81
c/uc-	^{12}c	0.100	0	0.12800	20	1	X	5	7.10.1988
c	^{12}c	0.150	0	0.12500	20	1			HECHTL81
c/uc-	^{12}c	0.300	0	0.23300	20	1	X	7	13.10.1988
c	^{12}c	0.600	0	0.34100	20	1			HECHTL81
C/UC-	^{12}c	1.000	0	0.37000	20	1	X	2	3.10.1988
C/POC	^{12}c	3.000	0	0.44300	20	1	X	129	24.11.1989
C/UCIP	^{12}c	3.000	0	0.32900	20	1	X	129	27.11.1989
c	^{12}c	3.000	0	0.47400	20	1			HECHTL81
c	^{12}c	10.000	0	0.50700	20	1			HECHTL81

Calculated Data

Target	Proj.	Energy	Angle	Yield	Temp.	P	SBE
C	He	0.035	0	0.000790	20	1.85	7.40
C	He	0.040	0	0.001820	20	1.85	7.40
C	He	0.050	0	0.004800	20	1.85	7.40
C	He	0.070	0	0.011000	20	1.85	7.40
C	He	0.100	0	0.020600	20	1.85	7.40
C	He	0.200	0	0.035100	20	1.85	7.40
C	He	0.300	0	0.039500	20	1.85	7.40
C	He	0.500	0	0.047800	20	1.85	7.40
C	He	1.000	0	0.051700	20	1.85	7.40
C	He	2.000	0	0.049400	20	1.85	7.40
c	He	5.000	0	0.033000	20	1.85	7.40
c	He	10.000	0	0.022400	20	1.85	7.40

Target	Proj.	Energy	Angle	Yield	Temp.	*P*	SBE
C	^{12}C	0.050	0	0.000740	20	2.26	7.40
C	^{12}c	0.070	0	0.003700	20	2.26	7.40
C	^{12}c	0.100	0	0.012000	20	2.26	7.40
C	^{12}c	0.100	0	0.012000	20	2.26	7.40
C	^{12}c	0.150	0	0.031000	20	2.26	7.40
C	^{12}c	0.200	0	0.056000	20	2.26	7.40
C	^{12}c	0.300	0	0.089000	20	2.26	7.40
C	^{12}c	0.500	0	0.140000	20	2.26	7.40
C	^{12}c	0.700	0	0.180000	20	2.26	7.40
C	^{12}c	1.000	0	0.195000	20	2.26	7.40
C	^{12}c	1.000	0	0.195000	20	2.26	7.40
C	^{12}c	1.500	0	0.215000	20	2.26	7.40
C	^{12}c	2.000	0	0.225000	20	2.26	7.40
C	^{12}c	3.000	0	0.240000	20	2.26	7.40
C	^{12}c	5.000	0	0.230000	20	2.26	7.40
C	^{12}c	10.000	0	0.210000	20	2.26	7.40

Target	Proj.	Energy	Angle	Yield	Temp.	*P*	SBE
C	0	0.300	0	0.068500	20	2.00	7.40
C	0	1.000	0	0.215000	20	2.00	7.40
C	0	3.000	0	0.323000	20	2.00	7.40
C	0	6.000	0	0.340000	20	2.00	7.40

Target: C

Experimental Data

Target	Projectile	Angle	Symbol	$E_{th}(eV)$	Q(atoms/ion)
c/*	Ne	0	□	69.6	1.60
c/*	Ar	0	0	71.1	3.06
C/'	Kr	0	o	71.3	4.04
c/*	Xe	0	A	230.	5.90

Calculated Data

Target	Projectile	Angle	Symbol	Su(eV)	Q(atoms/ion)
C	Ar	0	♦	82.8	1.80
c	Xe	0	▲	160.	4.50

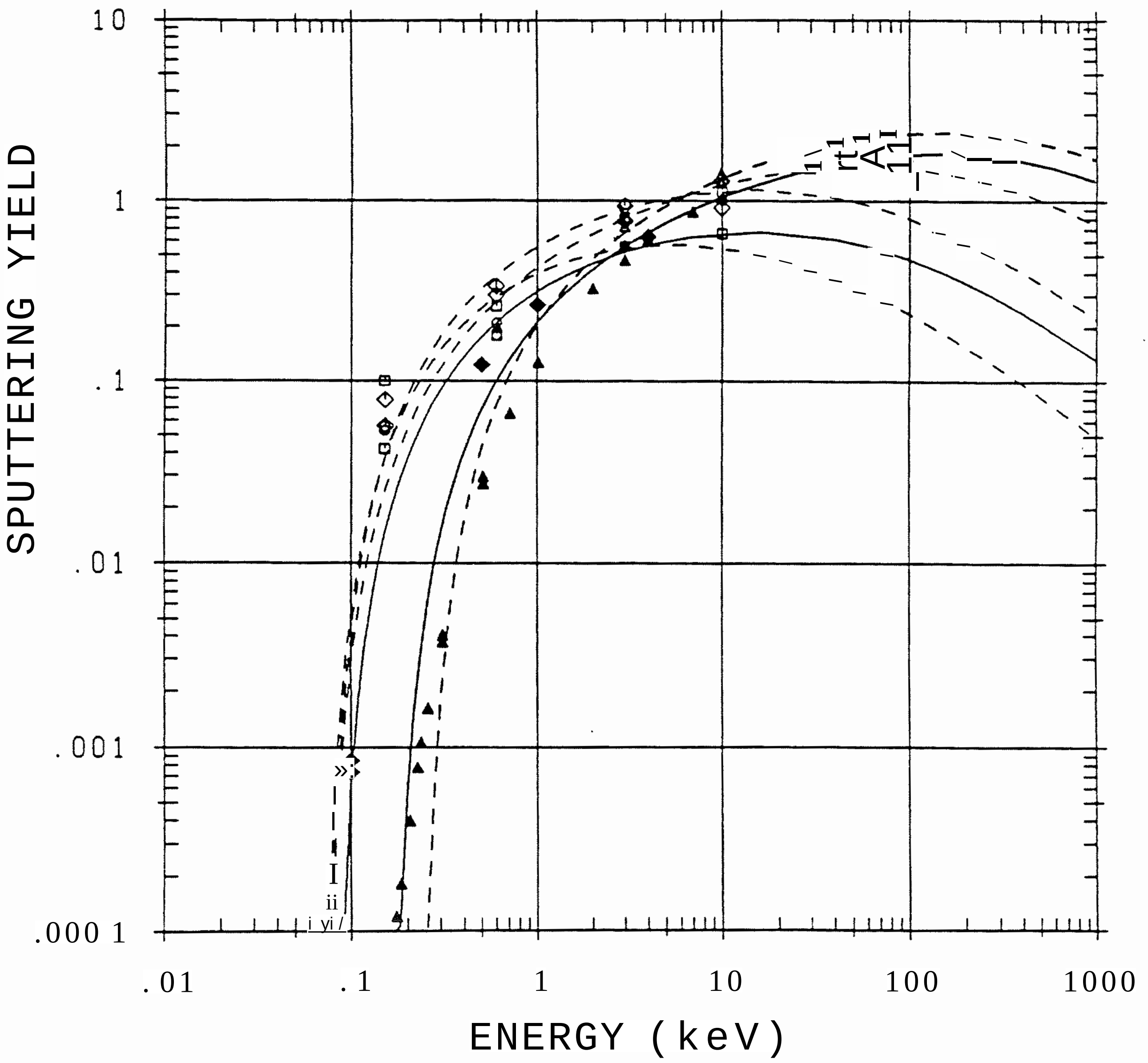


Fig. 19: Energy dependence of the sputtering yield of C with Ne,Ar,Kr and Xe. The experimental data are published in [461.

Experimental Data

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
C/UC-	Ne	0.150	0	0.10000	20	1			HECHTL1984
C/UCI	Ne	0.150	0	0.04200	20	1			HECHTL1984
C/UC-	Ne	0.600	0	0.26000	20	1			HECHTL1984
C/UCI	Ne	0.600	0	0.18000	20	1			HECHTL1984
C/UC-	Ne	3.000	0	0.81000	20	1			HECHTL1984
C/UCI	Ne	3.000	0	0.56000	20	1			HECHTL1984
C/UC-	Ne	10.000	0	1.11000	20	1			HECHTL1984
C/UCI	Ne	10.000	0	0.66000	20	1			HECHTL1984

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
C/UC-	Ar	0.150	0	0.08100	20	1			HECHTL1984
C/UCI	Ar	0.150	0	0.05800	20	1			HECHTL1984
C/UC-	Ar	0.600	0	0.34000	20	1			HECHTL1984
C/UCI	Ar	0.600	0	0.30500	20	1			HECHTL1984
C/UC-	Ar	3.000	0	0.94000	20	1			HECHTL1984
C/UCI	Ar	3.000	0	0.78000	20	1			HECHTL1984
C/UC-	Ar	10.000	0	1.29000	20	1			HECHTL1984
C/UCI	Ar	10.000	0	0.92000	20	1			HECHTL1984

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
C/UC-	Kr	0.150	0	0.05600	20	1			HECHTL1984
C/UCI	Kr	0.150	0	0.05300	20	1			HECHTL1984
C/UC-	Kr	0.600	0	0.21000	20	1			HECHTL1984
C/UCI	Kr	0.600	0	0.18000	20	1			HECHTL1984
C/UC-	Kr	3.000	0	0.96000	20	1			HECHTL1984
C/UCI	Kr	3.000	0	0.77000	20	1			HECHTL1984
C/UC-	Kr	10.000	0	1.26000	20	1			HECHTL1984
C/UCI	Kr	10.000	0	1.01000	20	1			HECHTL1984

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
C/UC-	Xe	0.600	0	0.20000	20	1			HECHTL1984
C/UC-	Xe	3.000	0	0.71000	20	1			HECHTL1984
C/UCI	Xe	3.000	0	0.56000	20	1			HECHTL1984
C/UC-	Xe	10.000	0	1.38000	20	1			HECHTL1984
C/UCI	Xe	10.000	0	1.24000	20	1			HECHTL1984

Calculated Data

Target	Proj.	Energy	Angle	Yield	Temp.	P	SEE
C	Xe	0.110	0	0.000002	20	2.26	7.42
C	Xe	0.120	0	0.000006	20	2.26	7.42
C	Xe	0.130	0	0.000012	20	2.26	7.42
C	Xe	0.140	0	0.000022	20	2.26	7.42
C	Xe	0.150	0	0.000045	20	2.26	7.42
C	Xe	0.170	0	0.000124	20	2.26	7.42
C	Xe	0.180	0	0.000189	20	2.26	7.42
C	Xe	0.200	0	0.000415	20	2.26	7.42
C	Xe	0.220	0	0.000808	20	2.26	7.42
C	Xe	0.230	0	0.001110	20	2.26	7.42
C	Xe	0.250	0	0.001700	20	2.26	7.42
C	Xe	0.300	0	0.003890	20	2.26	7.42
C	Xe	0.300	0	0.004240	20	2.26	7.42
C	Xe	0.500	0	0.030000	20	2.26	7.42
C	Xe	0.500	0	0.027600	20	2.26	7.42
C	Xe	0.700	0	0.067100	20	2.26	7.42
C	Xe	1.000	0	0.128000	20	2.26	7.42
C	Xe	1.000	0	0.127000	20	2.26	7.42
C	Xe	2.000	0	0.325000	20	2.26	7.42
C	Xe	3.000	0	0.466000	20	2.26	7.42
C	Xe	4.000	0	0.599000	20	2.26	7.42
C	Xe	7.000	0	0.850000	20	2.26	7.42
C	Xe	10.000	0	1.020000	20	2.26	7.42
C	Xe	30.000	0	1.460000	20	2.26	7.42
C	Xe	100.000	0	1.690000	20	2.26	7.42

Target	Proj.	Energy	Angle	Yield	Temp.	P	SBE
~C	Ar	0.100	0	0.000851	20	2.26	7.40
C	Ar	0.100	0	0.000735	20	2.26	7.40
C	Ar	0.500	0	0.123600	20	2.26	7.40
C	Ar	1.000	0	0.264000	20	2.26	7.40
C	Ar	4.000	0	0.632000	20	2.26	7.40

Experimental Data

Target	Projectile	Angle	Symbol	$E_{th}(eV)$	Q(atoms/ion)
Cu	H	0	□	51.0	0.0640
Cu	D	0	0	33.0	0.233

Calculated Data

Target	Projectile	Angle	Symbol	£.h(eV)	Q(atoms/ion)
Cu	H	0	■	54.0	0.0490
Cu	D	0	♦	32.0	0.154
Cu	Cu	0	▶	26.6	18.4

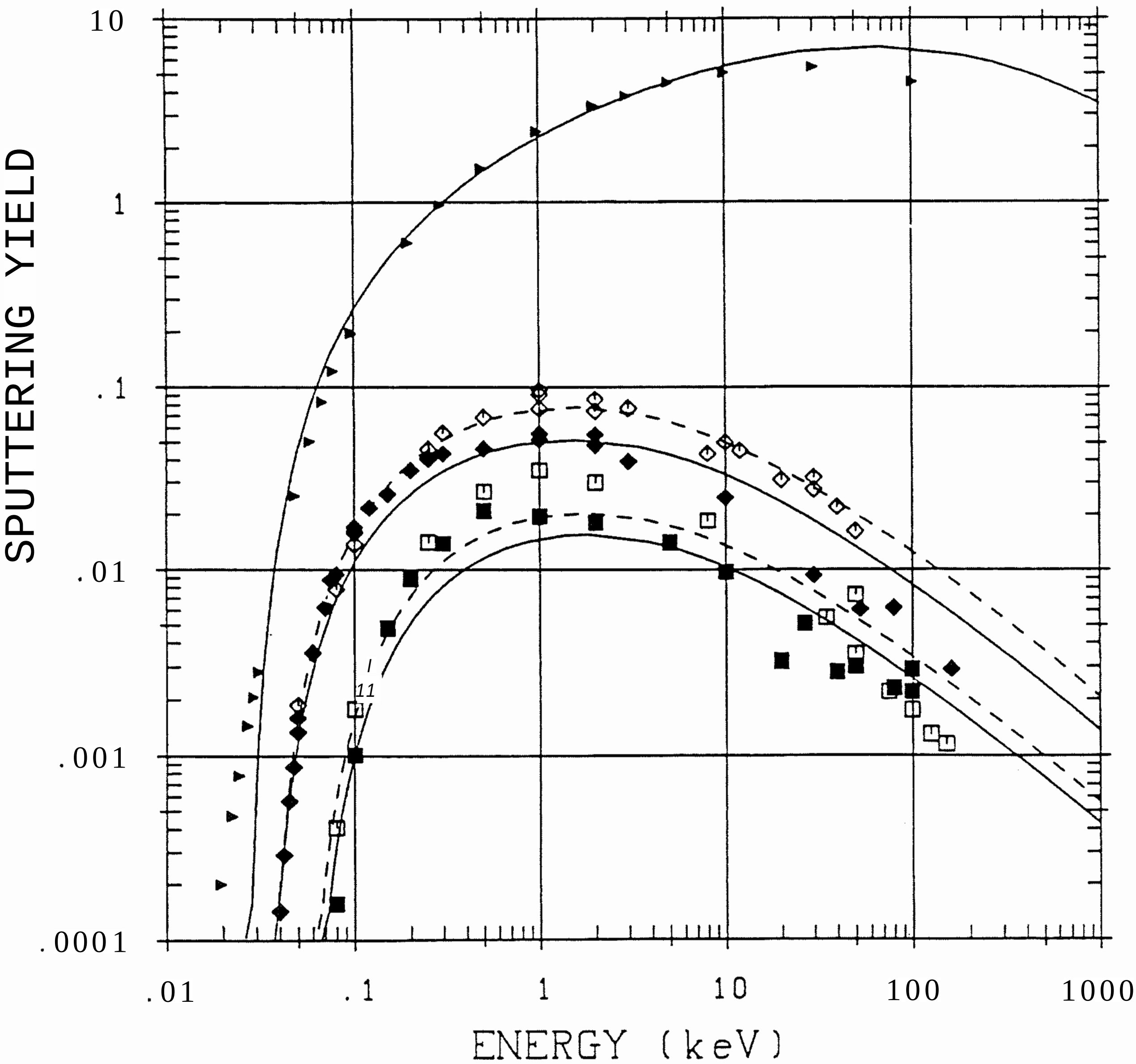


Fig. 20: Energy dependence of the sputtering yield of Cu with H, D and Cu. Only data measured at room temperature are plotted. The experimental data are published in [47,48,59,501.

Experimental Data

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
Cu	H	0.080	0	0.00041	100	3	IV	156	13.02.80
Cu	H	0.100	0	0.00178	20	3	IV	157	15.02.80
Cu	H	0.250	0	0.01410	20	3	IV	157	14.02.80
Cu	H	0.500	0	0.02670	100	3	IV	156	14.02.80
Cu	H	1.000	0	0.03510	100	3	IV	155	13.02.80
Cu	H	2.000	0	0.03000	100	3	IV	156	13.02.80
Cu	H	8.000	0	0.01840	20	1	IV	155	12.02.80
Cu	H	35.000	0	0.00550	20	1			PHARAO73
Cu	H	50.000	0	0.00350	20	1			PHARAO73
Cu	H	50.000	0	0.00730	20	1			PHARAO73
Cu	H	75.000	0	0.00220	20	1			PHARAO73
Cu	H	100.000	0	0.00175	20	1			PHARAO73
Cu	H	125.000	0	0.00130	20	1			PHARAO73
Cu	H	150.000	0	0.00115	20	1			PHARAO73

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
Cu	D	0.050	0	0.00187	20	3	IX	159	02.05.88
Cu	D	0.080	0	0.00784	20	3	IV	159	21.02.80
Cu	D	0.100	0	0.01610	20	3	VIII	127	17.02.86
Cu	D	0.100	0	0.01370	20	3	VIII	183	25.08.86
Cu	D	0.250	0	0.04590	20	3	IV	159	21.02.80
Cu	D	0.300	0	0.05640	20	3	IX	134	26.01.88
Cu	D	0.500	0	0.06880	20	3	IV	158	18.02.80
Cu	D	1.000	0	0.07640	100	3	IV	157	18.02.80
Cu	D	1.000	0	0.09660	20	3	VIII	127	17.02.86
Cu	D	1.000	0	0.09100	20	3	VIII	183	26.08.86
Cu	D	2.000	0	0.07410	20	3	IV	158	18.02.80
Cu	D	2.000	0	0.08580	210	3	VII	41	09.01.84
Cu	D	3.000	0	0.07680	20	2	VIII	183	26.08.80
Cu	D	8.000	0	0.04330	20	1	IV	158	18.02.80
Cu	D	10.000	0	0.05000	20	1			PHARAO73
Cu	D	12.000	0	0.04500	20	1			PHARAO73
Cu	D	20.000	0	0.03100	20	1			PHARAO73
Cu	D	30.000	0	0.03200	20	1			PHARAO73
Cu	D	30.000	0	0.02750	20	1			PHARAO73
Cu	D	40.000	0	0.02200	20	1			PHARAO73
Cu	D	50.000	0	0.01620	20	1			PHARAO73

Calculated Data

Target	Proj.	Energy	Angle	Yield	Temp.	*p*	SBE
Cu	H	0.080	0	0.000157	20	8.95	3.52
Cu	H	0.100	0	0.001010	20	8.95	3.52
Cu	H	0.150	0	0.004820	20	8.95	3.52
Cu	H	0.200	0	0.008890	20	8.95	3.52
Cu	H	0.300	0	0.013900	20	8.95	3.52
Cu	H	0.500	0	0.021000	20	8.95	3.52
Cu	H	1.000	0	0.019500	20	8.95	3.52
Cu	H	2.000	0	0.018000	20	8.95	3.52
Cu	H	5.000	0	0.014000	20	8.95	3.52
Cu	H	10.000	0	0.009680	20	8.95	3.52
Cu	H	20.000	0	0.003200	20	8.95	3.52
Cu	H	26.700	0	0.005100	20	8.95	3.52
Cu	H	40.000	0	0.002800	20	8.95	3.52
Cu	H	50.000	0	0.003010	20	8.95	3.52
Cu	H	80.000	0	0.002300	20	8.95	3.52
Cu	H	100.000	0	0.002200	20	8.95	3.52
Cu	H	100.000	0	0.002900	20	8.95	3.52

Target	Proj.	Energy	Angle	Yield	Temp.	*p*	SBE
Cu	D	0.037	0	0.000028	20	8.95	3.52
Cu	D	0.040	0	0.000143	20	8.95	3.52
Cu	D	0.040	0	0.000143	20	8.95	3.52
Cu	D	0.042	0	0.000289	20	8.95	3.52
Cu	D	0.042	0	0.000289	20	8.95	3.52
Cu	D	0.045	0	0.000569	20	8.95	3.52
Cu	D	0.047	0	0.000871	20	8.95	3.52
Cu	D	0.050	0	0.001600	20	8.95	3.52
Cu	D	0.050	0	0.001340	20	8.95	3.52
Cu	D	0.060	0	0.003560	20	8.95	3.52
Cu	D	0.070	0	0.006240	20	8.95	3.52
Cu	D	0.075	0	0.008800	20	8.95	3.52
Cu	D	0.080	0	0.009390	20	8.95	3.52
Cu	D	0.100	0	0.017000	20	8.95	3.52
Cu	D	0.100	0	0.015800	20	8.95	3.52
Cu	D	0.120	0	0.021700	20	8.95	3.52
Cu	D	0.150	0	0.025900	20	8.95	3.52
Cu	D	0.200	0	0.035000	20	8.95	3.52
Cu	D	0.250	0	0.041000	20	8.95	3.52
Cu	D	0.250	0	0.040200	20	8.95	3.52
Cu	D	0.300	0	0.043400	20	8.95	3.52
Cu	D	0.500	0	0.046200	20	8.95	3.52
Cu	D	1.000	0	0.056000	20	8.95	3.52
Cu	D	1.000	0	0.051800	20	8.95	3.52
Cu	D	2.000	0	0.055000	20	8.95	3.52
Cu	D	2.000	0	0.048300	20	8.95	3.52
Cu	D	3.000	0	0.039300	20	8.95	3.52
Cu	D	10.000	0	0.024700	20	8.95	3.52
Cu	D	30.000	0	0.009310	20	8.95	3.52
Cu	D	53.000	0	0.006100	20	8.95	3.52
Cu	D	80.000	0	0.006200	20	8.95	3.52
Cu	D	160.000	0	0.002900	20	8.95	3.52

Target	Proj.	Energy	Angle	Yield	Temp.	*P*	SBE
Cu	Cu	0.014	0	0.00001	20	8.95	3.52
Cu	Cu	0.016	0	0.00004	20	8.95	3.52
Cu	Cu	0.018	0	0.00010	20	8.95	3.52
Cu	Cu	0.020	0	0.00019	20	8.95	3.52
Cu	Cu	0.023	0	0.00046	20	8.95	3.52
Cu	Cu	0.025	0	0.00075	20	8.95	3.52
Cu	Cu	0.028	0	0.00139	20	8.95	3.52
Cu	Cu	0.030	0	0.00198	20	8.95	3.52
Cu	Cu	0.032	0	0.00270	20	8.95	3.52
Cu	Cu	0.050	0	0.02452	20	8.95	3.52
Cu	Cu	0.060	0	0.04840	20	8.95	3.52
Cu	Cu	0.070	0	0.07932	20	8.95	3.52
Cu	Cu	0.080	0	0.11600	20	8.95	3.52
Cu	Cu	0.100	0	0.18720	20	8.95	3.52
Cu	Cu	0.200	0	0.58500	20	8.95	3.52
Cu	Cu	0.300	0	0.94720	20	8.95	3.52
Cu	Cu	0.500	0	1.50000	20	8.95	3.52
Cu	Cu	1.000	0	2.40000	20	8.95	3.52
Cu	Cu	2.000	0	3.34700	20	8.95	3.52
Cu	Cu	3.000	0	3.80000	20	8.95	3.52
Cu	Cu	5.000	0	4.51800	20	8.95	3.52
Cu	Cu	5.000	0	4.51100	20	8.95	3.52
Cu	Cu	10.000	0	5.14000	20	8.95	3.52
Cu	Cu	30.000	0	5.57000	20	8.95	3.52
Cu	Cu	100.000	0	4.66000	20	8.95	3.52

Experimental Data

Target	Projectile	Angle	Symbol	$E_{th}(eV)$	Q(atoms/ion)
Cu	He	0	A	18.0	0.840
Cu	Ar	0	0		

Calculated Data

Target	Projectile	Angle	Symbol	$E_{th}(eV)$	Q(atoms/ion)
Cu	He	0	A	16.0	0.580
Cu	Ar	0	♦	27.0	14.0
Cu	Xe	0	A	39.0	31.0

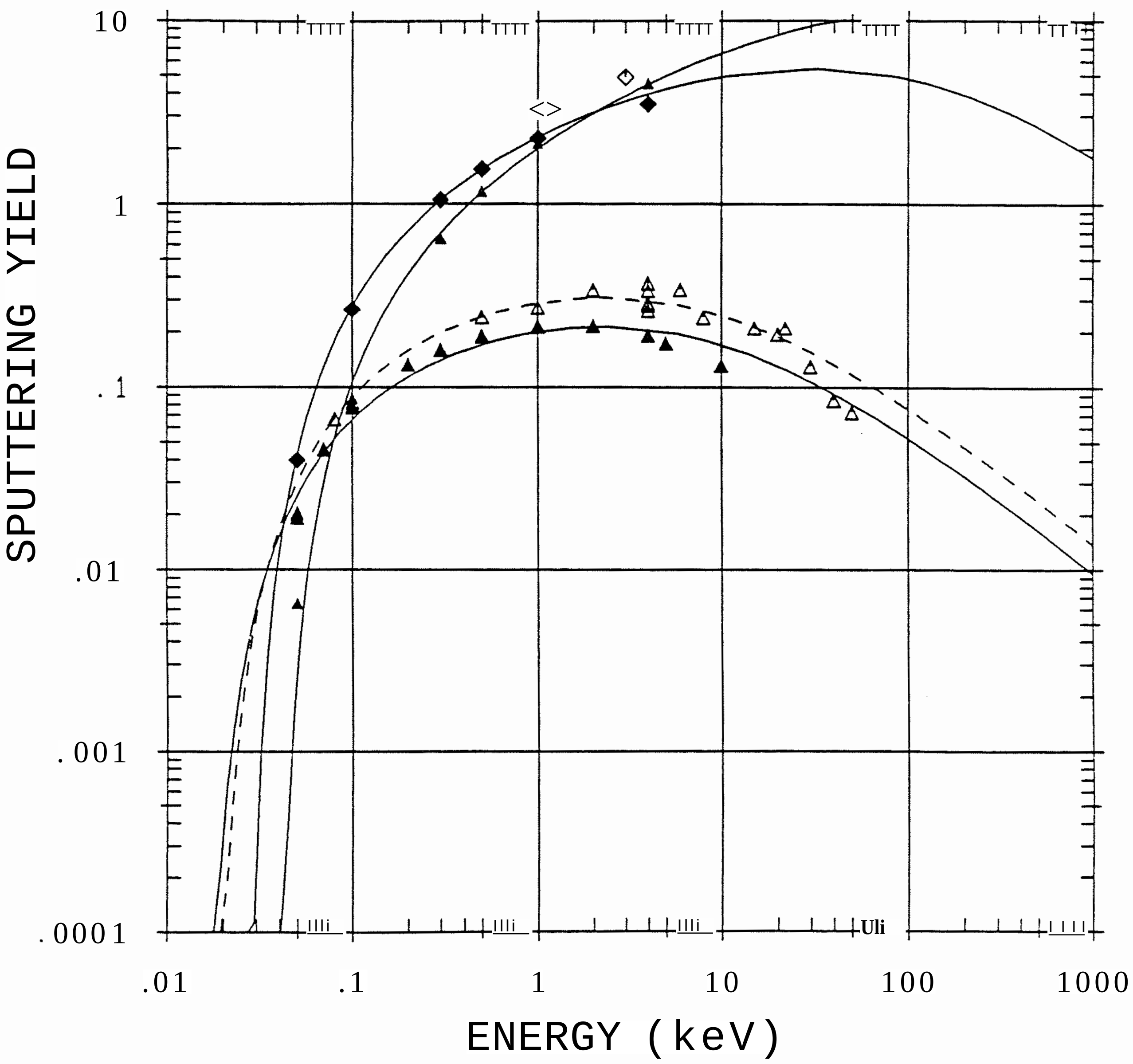


Fig. 21: Energy dependence of the sputtering yield of Cu with ^{4}He , Ar and Xe. Data measured at temperatures > 800°C show higher yields due to evaporation and are not included here. These results are published in [26,47,48,50].

Experimental Data

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
Cu	He	0.080	0	0.06700	20	1	IV	165	29.02.80
Cu	He	0.100	0	0.08260	20	1	IV	153	11.02.80
Cu	He	0.500	0	0.24200	20	1	IV	153	12.02.80
Cu	He	1.000	0	0.27200	20	1	IV	154	12.02.80
Cu	He	2.000	0	0.34000	20	1	IV	154	12.02.80
Cu	He	4.000	0	0.29000	20	1	IV	154	12.02.80
Cu	He	4.000	0	0.26200	710	1	IV	160	22.02.80
Cu	He	4.000	0	0.28100	670	1	IV	160	22.02.80
Cu	He	4.000	0	0.28900	785	1	IV	161	25.02.80
Cu	He	4.000	0	0.37000	800	1	IV	162	26.02.80
Cu	He	4.000	0	0.33600	800	1	IV	170	06.03.80
Cu	He	4.000	0	0.51800	815	1	IV	170	07.03.80
Cu	He	4.000	0	0.28000	533	1	V	38	07.08.80
Cu	He	6.000	0	0.34200	120	1	VII	43	11.01.84
Cu	He	8.000	0	0.24100	20	1	IV	155	12.02.80
Cu	He	15.000	0	0.21000	20	1			PHARAO73
Cu	He	20.000	0	0.19500	20	1			PHARAO73
Cu	He	22.000	0	0.21000	20	1			PHARAO73
Cu	He	30.000	0	0.13000	20	1			PHARAO73
Cu	He	40.000	0	0.08500	20	1			PHARAO73
Cu	He	50.000	0	0.07310	20	1			1982

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
Cu	Ar	1.000	0	3.20000	20	1			HECHTL87
Cu	Ar	3.000	0	4.90000	20	1			HECHTL87

Calculated Data

Target	Proj.	Energy	Angle	Yield	Temp.	P	SBE
Cu	He	0.050	0	0.019280	20	8.95	3.52
Cu	He	0.050	0	0.020400	20	8.95	3.52
Cu	He	0.070	0	0.045770	20	8.95	3.52
Cu	He	0.100	0	0.078570	20	8.95	3.52
Cu	He	0.100	0	0.077700	20	8.95	3.52
Cu	He	0.200	0	0.133000	20	8.95	3.52
Cu	He	0.300	0	0.160000	20	8.95	3.52
Cu	He	0.500	0	0.189600	20	8.95	3.52
Cu	He	0.500	0	0.191000	20	8.95	3.52
Cu	He	1.000	0	0.217000	20	8.95	3.52
Cu	He	1.000	0	0.213000	20	8.95	3.52
Cu	He	2.000	0	0.216300	20	8.95	3.52
Cu	He	4.000	0	0.192000	20	8.95	3.52
Cu	He	5.000	0	0.173700	20	8.95	3.52
Cu	He	10.000	0	0.131200	20	8.95	3.52

Target	Proj.	Energy	Angle	Yield	Temp.	P	SBE
Cu	Ar	0.050	0	0.039800	20	8.95	3.52
Cu	Ar	0.100	0	0.265000	20	8.95	3.52
Cu	Ar	0.300	0	1.050000	20	8.95	3.52
Cu	Ar	0.500	0	1.550000	20	8.95	3.52
Cu	Ar	1.000	0	2.270000	20	8.95	3.52
Cu	Ar	4.000	0	3.500000	20	8.95	3.52

Target	Proj.	Energy	Angle	Yield	Temp.	P	SBE
Cu	Xe	0.050	0	0.006480	20	8.95	3.52
Cu	Xe	0.100	0	0.086900	20	8.95	3.52
Cu	Xe	0.300	0	0.650000	20	8.95	3.52
Cu	Xe	0.500	0	1.170000	20	8.95	3.52
Cu	Xe	1.000	0	2.130000	20	8.95	3.52
Cu	Xe	4.000	0	4.510000	20	8.95	3.52

Experimental Data

Target	Projectile	Angle	Symbol	$E_{th}(eV)$	Q(atoms/ion)
Fe	H	0	□	67.0	0.0440
Fe	D	0	0	45.0	0.120
Fe	He	0	A	26.0	0.428

Calculated Data

Target	Projectile	Angle	Symbol	$Eth(eV)$	Q(atoms/ion)
Fe	He	0	A	20.0	0.440
Fe	Fe	0	▶	35.8	13.7

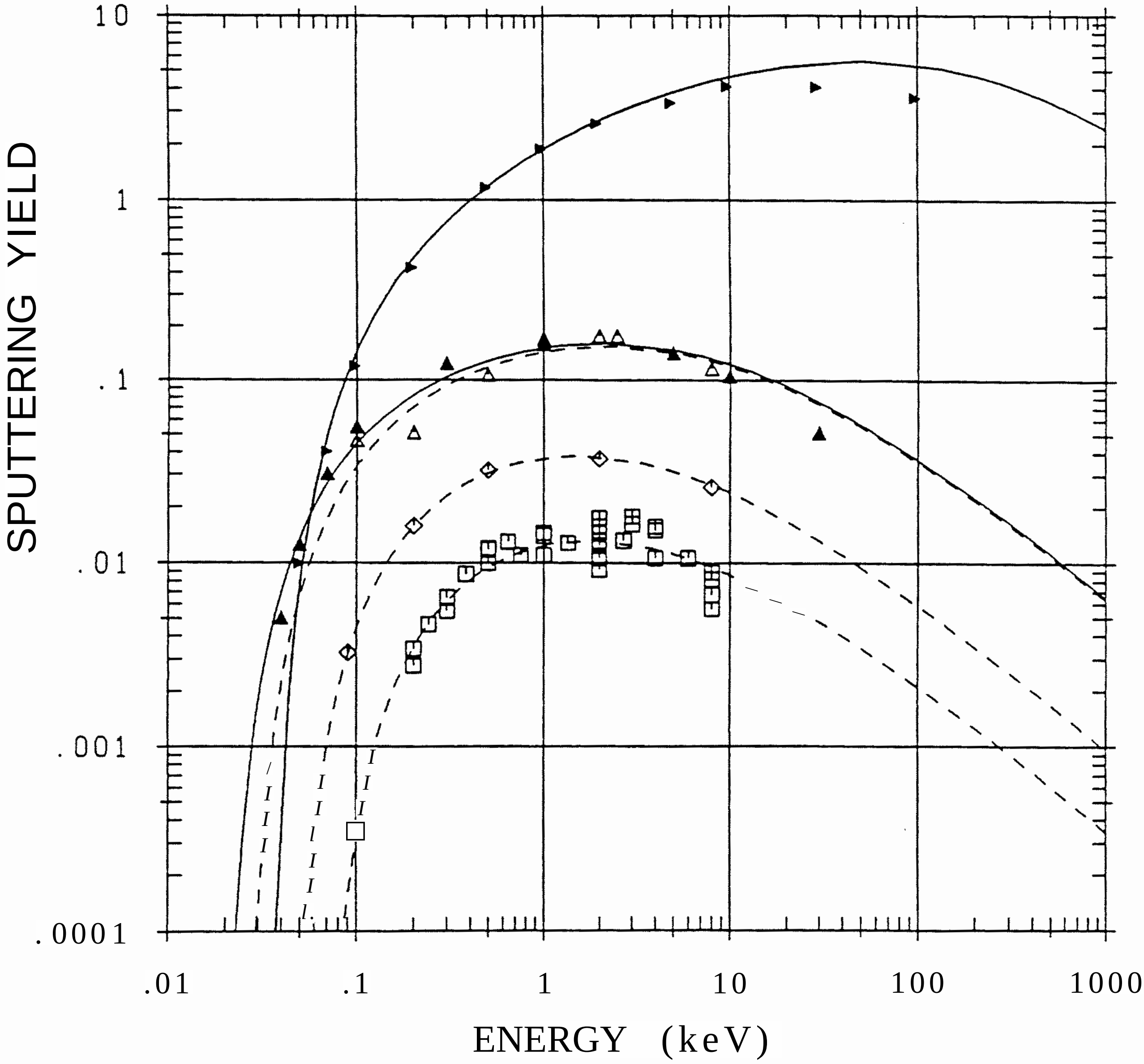


Fig. 22: Energy dependence of the sputtering yield of Fe with H, D, ^{4}He and Fe. Most of the data for II have been measured using the Laser Fluorescence signal of the sputtered particles and are calibrated by means of the weight loss method. This technique and the data are published in [51].

Experimental Data

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
Fe	H	0.100	0	0.00035	20	3	III	184	14.03.79
Fe	H	0.200	0	0.00276	20	3	III	185	19.03.79
Fe	H	0.200	0	0.00340	20	3			LIF1979
Fe	H	0.240	0	0.00460	20	3			LIF1979
Fe	H	0.300	0	0.00547	20	3	III	175	19.01.79
Fe	H	0.300	0	0.00650	20	3			LIF1979
Fe	H	0.380	0	0.00870	20	3			LIF1979
Fe	H	0.500	0	0.01200	20	3	III	185	19.03.79
Fe	H	0.500	0	0.01180	20	3			LIF1979
Fe	H	0.500	0	0.01000	20	3			LIF1979
Fe	H	0.640	0	0.01300	20	3			LIF1979
Fe	H	0.750	0	0.01100	20	3			LIF1979
Fe	H	1.000	0	0.01100	20	3			LIF1979
Fe	H	1.000	0	0.01400	20	3			LIF1979
Fe	H	1.000	0	0.01450	20	3			LIF1979
Fe	H	1.350	0	0.01280	20	3			LIF1979
Fe	H	2.000	0	0.01250	270	3	III	184	19.03.79
Fe	H	2.000	0	0.01230	20	3	IV	26	25.06.79
Fe	H	2.000	0	0.00920	20	3			LIF1979
Fe	H	2.000	0	0.01060	20	3			LIF1979
Fe	H	2.000	0	0.01440	20	3			LIF1979
Fe	H	2.000	0	0.01570	20	3			LIF1979
Fe	H	2.000	0	0.01750	20	3			LIF1979
Fe	H	2.000	0	0.01320	20	3			LIF1979
Fe	H	2.700	0	0.01320	20	3			LIF1979
Fe	H	3.000	0	0.01620	20	2			LIF1979
Fe	H	3.000	0	0.01780	20	2			LIF1979
Fe	H	4.000	0	0.01060	20	2			LIF1979
Fe	H	4.000	0	0.01500	20	2			LIF1979
Fe	H	4.000	0	0.01570	20	2			LIF1979
Fe	H	6.000	0	0.01060	20	1			LIF1979
Fe	H	8.000	0	0.00672	280	1	III	184	14.03.79
Fe	H	8.000	0	0.00560	20	1			LIF1979
Fe	H	8.000	0	0.00890	20	1			LIF1979
Fe	H	8.000	0	0.00815	20	1			LIF1979

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
Fe	D	0.090	0	0.00325	20	3	III	183	13.03.79
Fe	D	0.200	0	0.01580	20	3	III	183	14.03.79
Fe	D	0.500	0	0.03180	100	3	III	182	02.03.79
Fe	D	2.000	0	0.03690	210	3	III	182	02.03.79
Fe	D	8.000	0	0.02570	230	1	III	183	02.03.79

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
Fe	He	0.100	0	0.04640	20	1	XI	102	28.01.92
Fe	He	0.200	0	0.05140	20	1	III	187	03.04.79
Fe	He	0.500	0	0.10700	20	1	III	187	03.04.79
Fe	He	2.000	0	0.17600	20	1	III	187	03.04.79
Fe	He	2.500	0	0.17600	20	1			
Fe	He	8.000	0	0.11600	245	1	III	186	02.04.79

Calculated Data

Target	Proj.	Energy	Angle	Yield	Temp.	p	SBE
Fe	He	0.040	0	0.005020	0	7.87	4.34
Fe	He	0.050	0	0.012600	0	7.87	4.34
Fe	He	0.070	0	0.030400	0	7.87	4.34
Fe	He	0.100	0	0.055200	0	7.87	4.34
Fe	He	0.300	0	0.124000	0	7.87	4.34
Fe	He	1.000	0	0.167000	0	7.87	4.34
Fe	He	1.000	0	0.172000	0	7.87	4.34
Fe	He	1.000	0	0.158000	0	7.87	4.34
Fe	He	5.000	0	0.142000	0	7.87	4.34
Fe	He	10.000	0	0.106000	0	7.87	4.34
Fe	He	30.000	0	0.051500	0	7.87	4.34

Target	Proj.	Energy	Angle	Yield	Temp.	p	SBE
Fe	F	0.050	0	0.009840	0	7.87	4.34
Fe	F	0.070	0	0.040000	0	7.87	4.34
Fe	F	0.100	0	0.118000	0	7.87	4.34
Fe	F	0.200	0	0.410000	0	7.87	4.34
Fe	F	0.500	0	1.120000	0	7.87	4.34
Fe	F	1.000	0	1.800000	0	7.87	4.34
Fe	F	2.000	0	2.470000	0	7.87	4.34
Fe	F	5.000	0	3.190000	0	7.87	4.34
Fe	F	10.000	0	3.910000	0	7.87	4.34
Fe	F	30.000	0	3.880000	0	7.87	4.34
Fe	F	100.000	0	3.380000	0	7.87	4.34

Calculated Data

Target	Projectile	Angle	Symbol	$E_{th}(eV)$	Q(atoms/ion)
Ga	D	0	♦	24.1	0.134
Ga	T	0	•	16.8	0.193
Ga	Ga	0	▶	25.1	19.6
Ga	Hg	0	▶	41.6	42.9

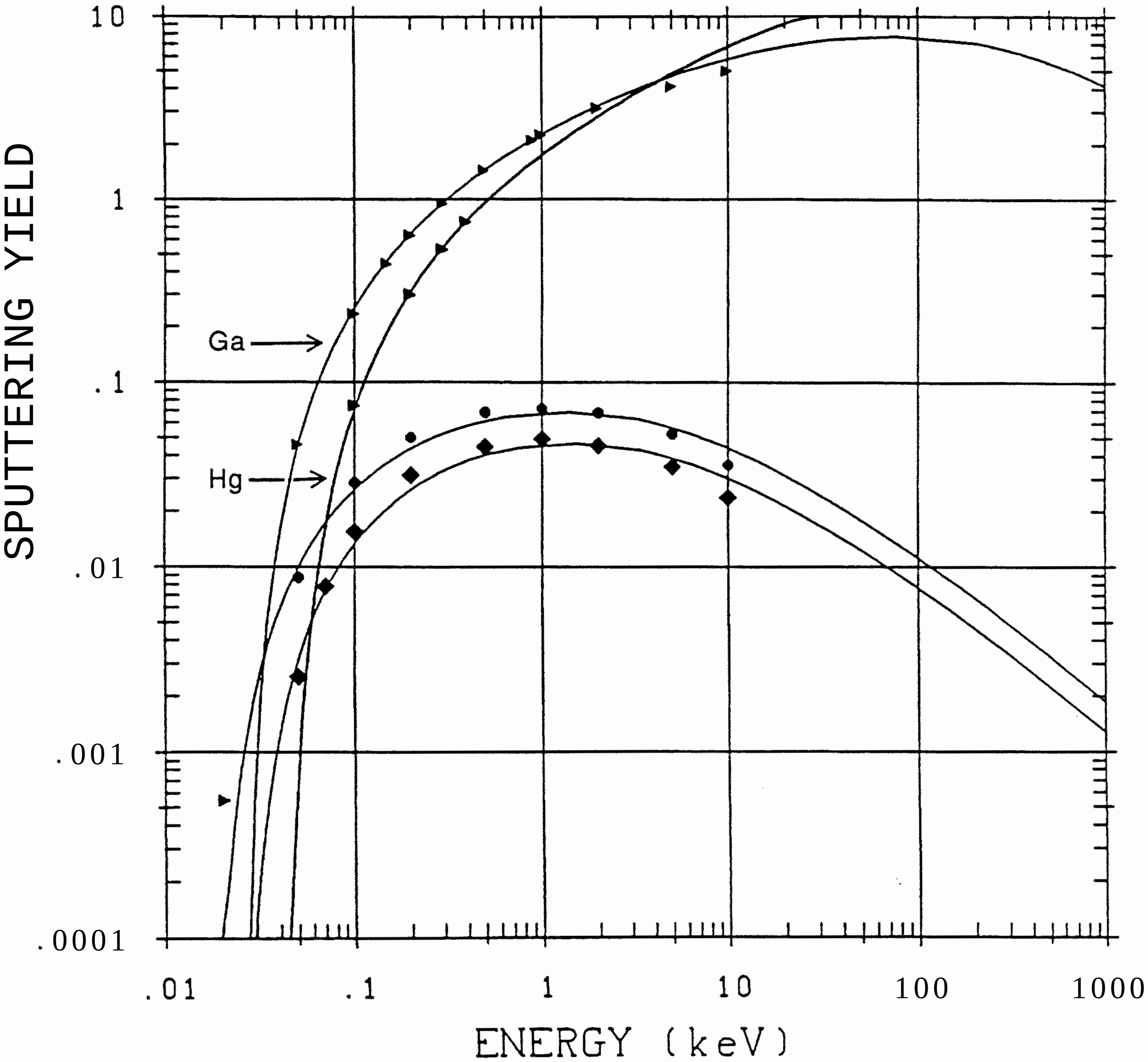


Fig. 23: Energy dependence of the sputtering yield of Ga with D, T, Ga and Hg. The data are partly published in [52].

Calculated Data

Target	Proj.	Energy	Angle	Yield	Temp.	*P*	SEE
Ga	D	0.050	0	0.002540	20	5.91	2.82
Ga	D	0.070	0	0.007800	20	5.91	2.82
Ga	D	0.100	0	0.015500	20	5.91	2.82
Ga	D	0.200	0	0.031300	20	5.91	2.82
Ga	D	0.500	0	0.044500	20	5.91	2.82
Ga	D	1.000	0	0.049200	20	5.91	2.82
Ga	D	2.000	0	0.045200	20	5.91	2.82
Ga	D	5.000	0	0.034800	20	5.91	2.82
Ga	D	10.000	0	0.023800	20	5.91	2.82

Target	Proj.	Energy	Angle	Yield	Temp.	*P*	SBE
Ga	T	0.050	0	0.008730	20	5.91	2.97
Ga	T	0.100	0	0.028500	20	5.91	2.97
Ga	T	0.200	0	0.050000	20	5.91	2.97
Ga	T	0.500	0	0.068400	20	5.91	2.97
Ga	T	1.000	0	0.071500	20	5.91	2.97
Ga	T	2.000	0	0.068100	20	5.91	2.97
Ga	T	5.000	0	0.052400	20	5.91	2.97
Ga	T	10.000	0	0.035600	20	5.91	2.97

Target	Proj.	Energy	Angle	Yield	Temp.	*P*	SBE
Ga	Ga	0.020	0	0.000556	20	5.91	2.97
Ga	Ga	0.050	0	0.046000	20	5.91	2.97
Ga	Ga	0.100	0	0.237000	20	5.91	2.97
Ga	Ga	0.150	0	0.443000	20	5.91	2.97
Ga	Ga	0.200	0	0.633000	20	5.91	2.97
Ga	Ga	0.300	0	0.946000	20	5.91	2.97
Ga	Ga	0.500	0	1.430000	20	5.91	2.97
Ga	Ga	0.900	0	2.080000	20	5.91	2.97
Ga	Ga	1.000	0	2.220000	20	5.91	2.97
Ga	Ga	2.000	0	3.100000	20	5.91	2.97
Ga	Ga	5.000	0	4.070000	20	5.91	2.97
Ga	Ga	10.000	0	4.960000	20	5.91	2.97

Target	Proj.	Energy	Angle	Yield	Temp.	*P*	SBE
Ga	Hg	0.100	0	0.079700	20	5.91	2.97
Ga	Hg	0.200	0	0.320000	20	5.91	2.97
Ga	Hg	0.300	0	0.562000	20	5.91	2.97
Ga	Hg	0.400	0	0.790000	20	5.91	2.97

Target: Ge

Calculated Data

Target	Projectile	Angle	Symbol	E_{th}(eV)	Q(atoms/ion)
Ge	Ar	0	♦	19.5	8.87

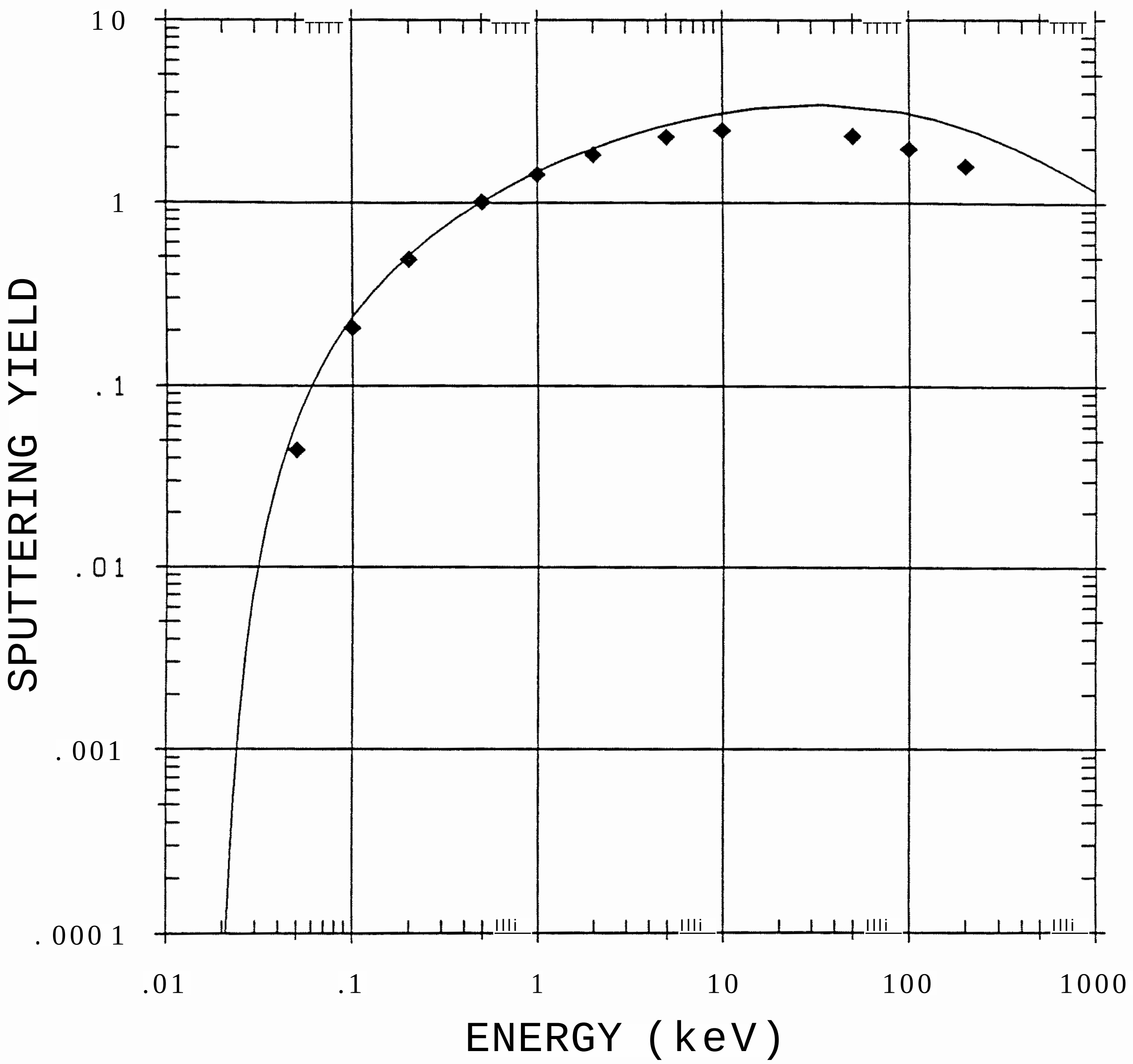


Fig. 24: Energy dependence of the sputtering yield of Ge with Ar. The data are unpublished.

Calculated Data

Target	Proj.	Energy	Angle	Yield	Temp.	P	SEE
Ge	Ar	0.050	0	0.044200	20	5.32	3.88
Ge	Ar	0.100	0	0.206000	20	5.32	3.88
Ge	Ar	0.200	0	0.488000	20	5.32	3.88
Ge	Ar	0.500	0	1.010000	20	5.32	3.88
Ge	Ar	1.000	0	1.430000	20	5.32	3.88
Ge	Ar	2.000	0	1.830000	20	5.32	3.88
Ge	Ar	5.000	0	2.290000	20	5.32	3.88
Ge	Ar	10.000	0	2.490000	20	5.32	3.88
Ge	Ar	50.000	0	2.320000	20	5.32	3.88
Ge	Ar	100.000	0	1.970000	20	5.32	3.88
Ge	Ar	200.000	0	1.590000	20	5.32	3.88

Calculated Data

Target	Projectile	Angle	Symbol	$E_{I/1}$(eV)	Q(atoms/ion)
~Hg	Kr	Ö	•	3L3	18?6

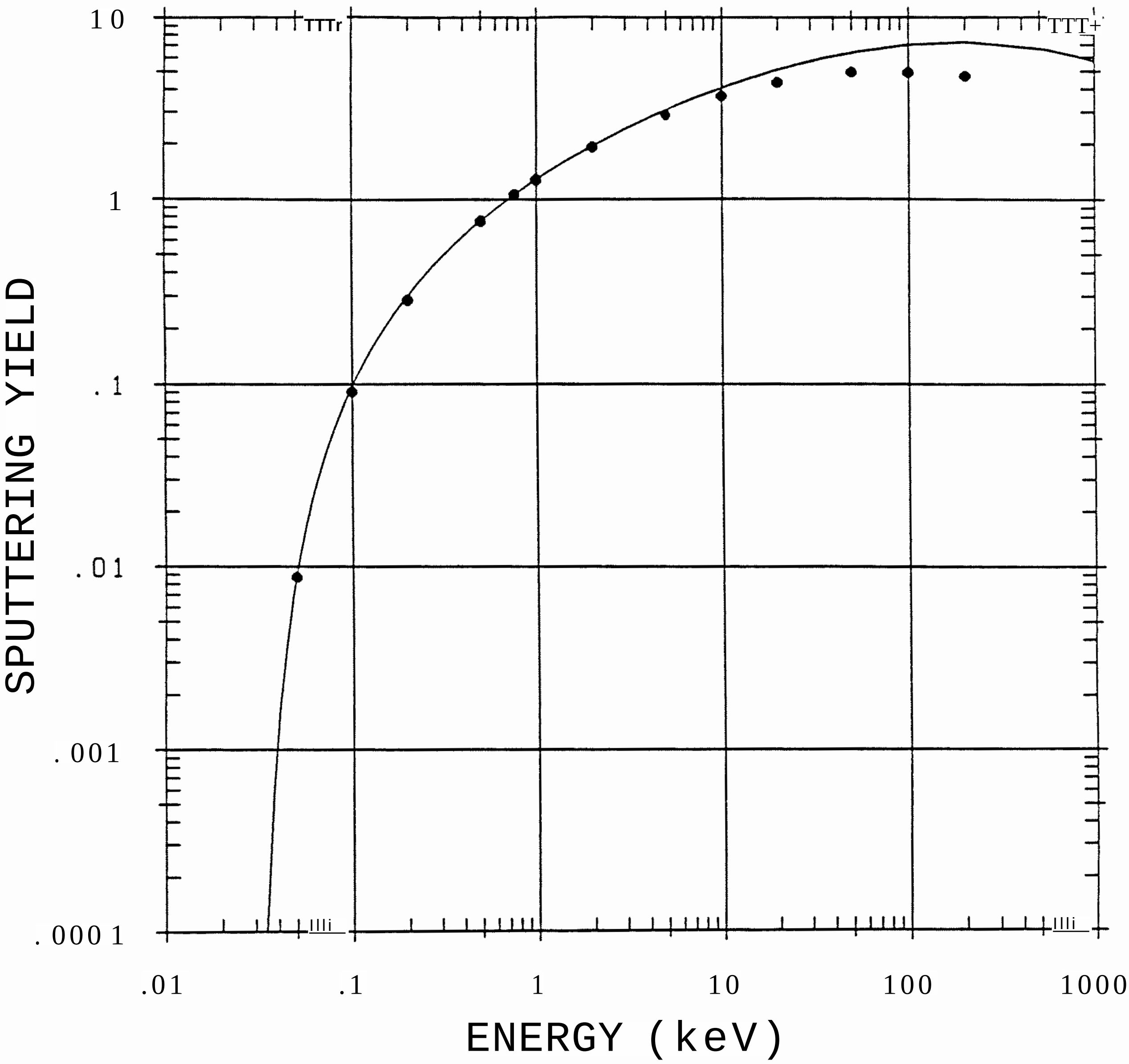


Fig. 25: Energy dependence of the sputtering yield of Hg with Kr. The data are unpublished.

Calculated Data

Target	Proj.	Energy	Angle	Yield	Temp.	p	SBE
H	[illegible]	0.050	0	0.008750	20	13.60	6.36
H	[illegible]	0.100	0	0.090700	20	13.60	6.36
H	[illegible]	0.200	0	0.285000	20	13.60	6.36
H	[illegible]	0.500	0	0.762000	20	13.60	6.36
H	[illegible]	0.762	0	1.060000	20	13.60	6.36
H	[illegible]	1.000	0	1.270000	20	13.60	6.36
H	[illegible]	2.000	0	1.920000	20	13.60	6.36
H	[illegible]	5.000	0	2.880000	20	13.60	6.36
H	[illegible]	10.000	0	3.650000	20	13.60	6.36
H	[illegible]	20.000	0	4.330000	20	13.60	6.36
H	[illegible]	50.000	0	4.950000	20	13.60	6.36
H	[illegible]	100.000	0	4.920000	20	13.60	6.36
H	Kr	200.000	0	4.690000	20	13.60	6.36

Target: In

Calculated Data

Target	Projectile	Angle	Symbol	Fu(eV)	Q(atoms/ion)
In	D	0	♦	28.5	0.118
In	T	0	•	23.9	0.199
In	In	0	▶	21.9	41.0

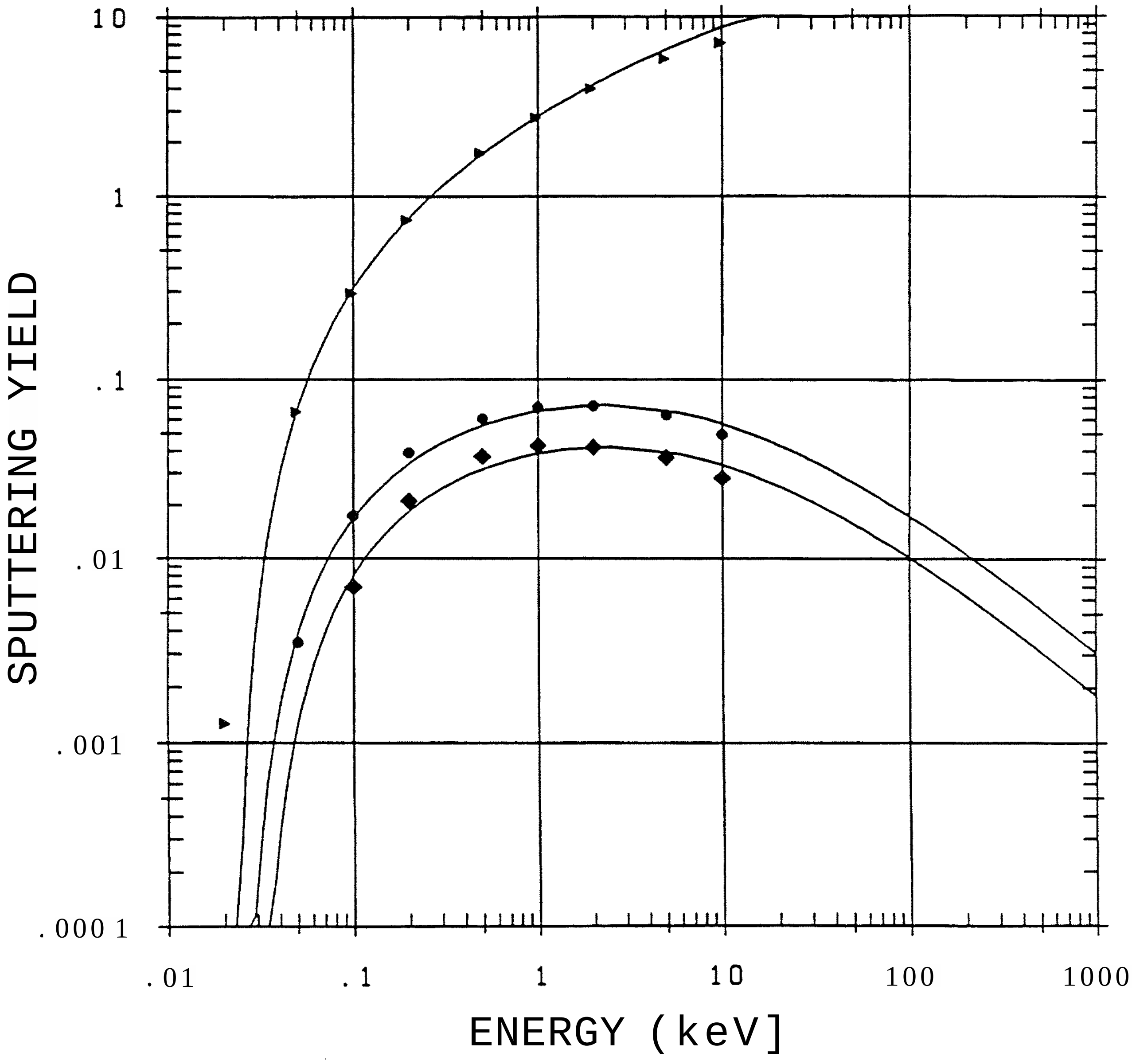


Fig. 26: Energy dependence of the sputtering yield of In with D, T and In. The data are published in [52],

Calculated Data

Target	Proj.	Energy	Angle	Yield	Temp.	*P*	SEE
In	D	0.100	0	0.006980	20	7.31	2.52
In	D	0.200	0	0.021000	20	7.31	2.52
In	D	0.500	0	0.037100	20	7.31	2.52
In	D	1.000	0	0.042900	20	7.31	2.52
In	D	2.000	0	0.042000	20	7.31	2.52
In	D	5.000	0	0.036700	20	7.31	2.52
In	D	10.000	0	0.028100	20	7.31	2.52

Target	Proj.	Energy	Angle	Yield	Temp.	*P*	SBE
In	T	0.050	0	0.003480	20	7.31	2.52
In	T	0.100	0	0.017400	20	7.31	2.52
In	T	0.200	0	0.039100	20	7.31	2.52
In	T	0.500	0	0.060300	20	7.31	2.52
In	T	1.000	0	0.069900	20	7.31	2.52
In	T	2.000	0	0.071200	20	7.31	2.52
In	T	5.000	0	0.063300	20	7.31	2.52
In	T	10.000	0	0.049500	20	7.31	2.52

Target	Proj.	Energy	Angle	Yield	Temp.	*P*	SBE
In	In	0.020	0	0.001310	20	7.31	2.52
In	In	0.050	0	0.066500	20	7.31	2.52
In	In	0.100	0	0.297000	20	7.31	2.52
In	In	0.200	0	0.749000	20	7.31	2.52
In	In	0.500	0	1.760000	20	7.31	2.52
In	In	1.000	0	2.760000	20	7.31	2.52
In	In	2.000	0	4.000000	20	7.31	2.52
In	In	5.000	0	5.890000	20	7.31	2.52
In	In	10.000	0	7.180000	20	7.31	2.52

Calculated Data

Target	Projectile	Angle	Symbol	$E_{th}(eV)$	Q(atoms/ion)
Li	D	0	♦	5.60	0.14"
Li	T	0	•	6.40	0.155
Li	Li	0	▶	13.7	0.612

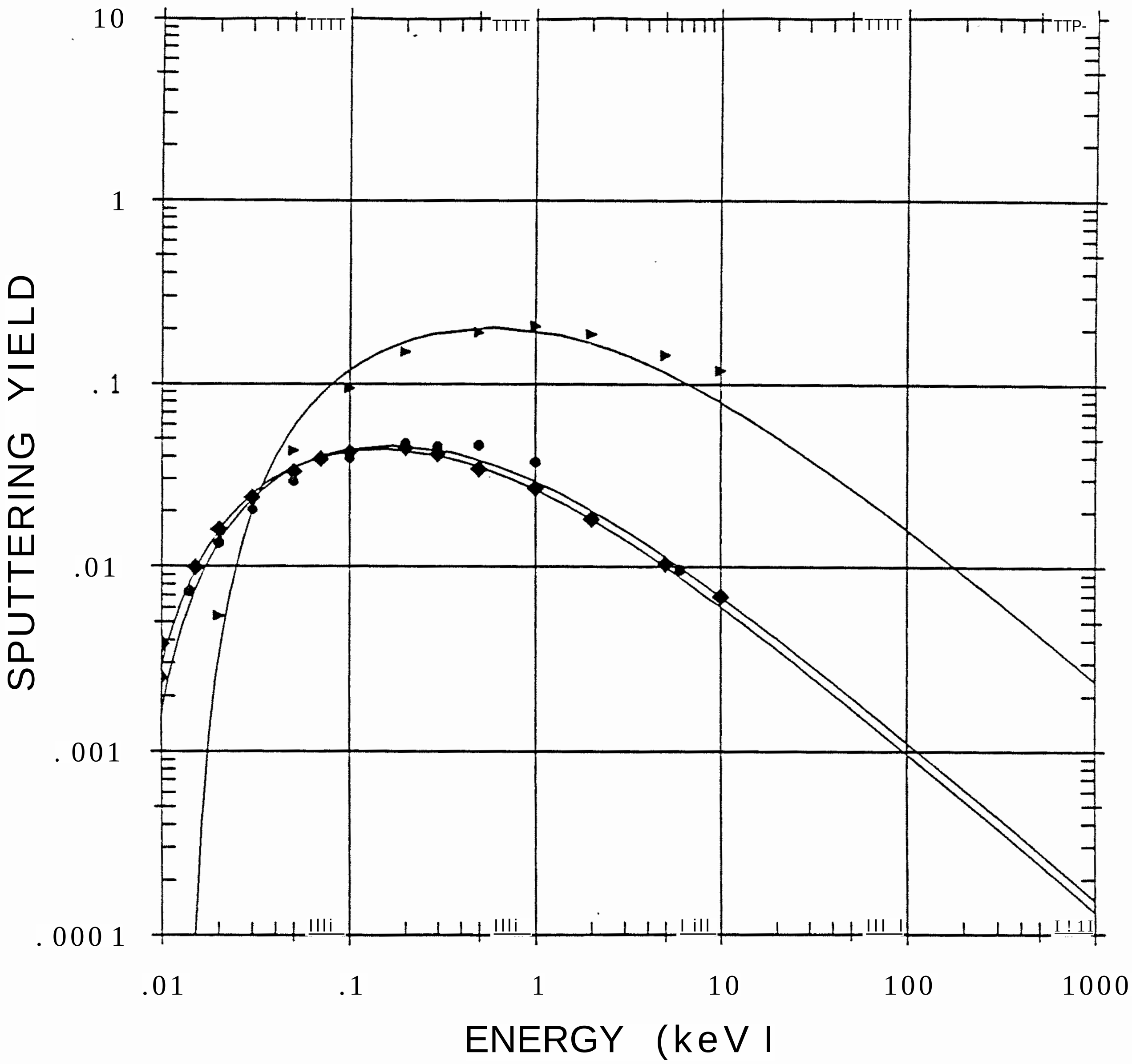


Fig. 27: Energy dependence of the sputtering yield of Li with D, T and Li. The data are published in [38,52],

Calculated Data

Target	Proj.	Energy	Angle	Yield	Temp.	P	SBE
Li	D	0.010	0	0.003810	20	0.53	1.67
Li	D	0.015	0	0.009880	20	0.53	1.67
Li	D	0.020	0	0.015800	20	0.53	1.67
Li	D	0.030	0	0.023800	20	0.53	1.67
Li	D	0.050	0	0.033000	20	0.53	1.67
Li	D	0.070	0	0.038700	20	0.53	1.67
Li	D	0.100	0	0.042200	20	0.53	1.67
Li	D	0.200	0	0.044500	20	0.53	1.67
Li	D	0.300	0	0.041000	20	0.53	1.67
Li	D	0.500	0	0.034100	20	0.53	1.67
Li	D	1.000	0	0.026700	20	0.53	1.67
Li	D	2.000	0	0.018100	20	0.53	1.67
Li	D	5.000	0	0.010400	20	0.53	1.67
Li	D	10.000	0	0.006930	20	0.53	1.67

Target	Proj.	Energy	Angle	Yield	Temp.	P	SBE
Li	T	0.010	0	0.002520	20	0.53	1.67
Li	T	0.014	0	0.007360	20	0.53	1.67
Li	T	0.020	0	0.013400	20	0.53	1.67
Li	T	0.030	0	0.020400	20	0.53	1.67
Li	T	0.050	0	0.029200	20	0.53	1.67
Li	T	0.100	0	0.039300	20	0.53	1.67
Li	T	0.100	0	0.039300	20	0.53	1.67
Li	T	0.200	0	0.047200	20	0.53	1.67
Li	T	0.300	0	0.045200	20	0.53	1.67
Li	T	0.500	0	0.046200	20	0.53	1.67
Li	T	1.000	0	0.037200	20	0.53	1.67
Li	T	6.000	0	0.009640	20	0.53	1.67

Target	Proj.	Energy	Angle	Yield	Temp.	P	SBE
Li	Li	0.020	0	0.005420	20	0.53	1.68
Li	Li	0.050	0	0.042900	20	0.53	1.68
Li	Li	0.100	0	0.094800	20	0.53	1.68
Li	Li	0.200	0	0.150000	20	0.53	1.68
Li	Li	0.500	0	0.191000	20	0.53	1.68
Li	Li	1.000	0	0.207000	20	0.53	1.68
Li	Li	2.000	0	0.187000	20	0.53	1.68
Li	Li	5.000	0	0.144000	20	0.53	1.68
Li	Li	10.000	0	0.119000	20	0.53	1.68

Experimental Data

Target	Projectile	Angle	Symbol	F, A(e/)	Q(atoms/ion)
Mo	H	0	□	199.	0.800 ▪IO"^{2}
Mo	D	0	0	90.0	0.0250

Calculated Data

Target	Projectile	Angle	Symbol	Frh(eV)	Q(atoms/ion)
Mo	D	0	♦	77.0	0.0470
Mo	T	0	•	60.0	0.0940
Mo	Mo	0	▶	55.1	16.0

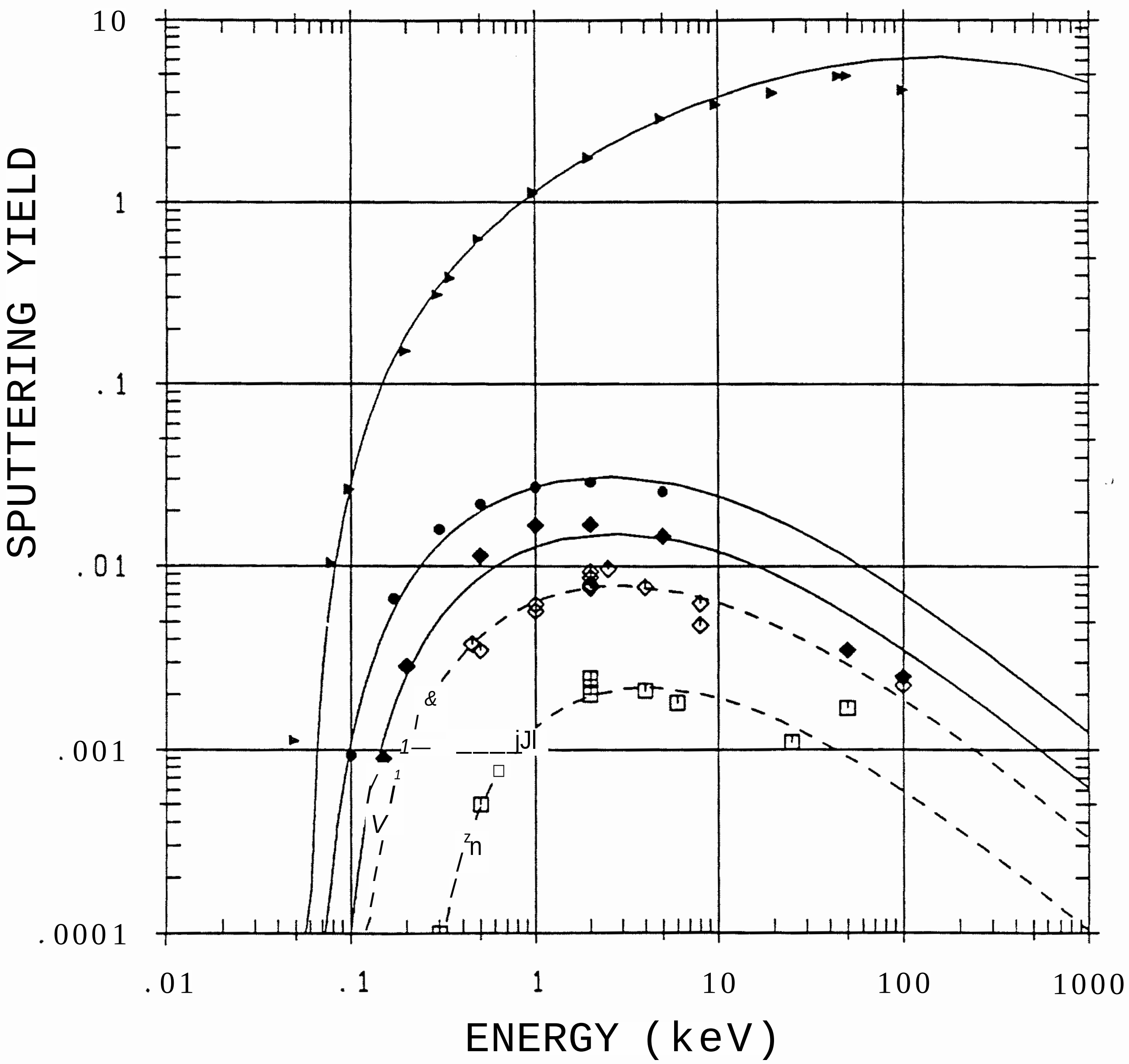


Fig. 28: Energy dependence of the sputtering yield of Mo with H, D, T and Mo. The data are published in [28,38,47],

Experimental Data

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
Mo	H	0.300	0	0.00010	20	3	II	70	23.09.76
Mo	H	0.500	0	0.00030	20	3	II	58	17.08.76
Mo	H	0.500	0	0.00050	20	3	II	68	17.09.76
Mo	H	0.670	0	0.00080	20	3	II	59	24.08.76
Mo	H	1.000	0	0.00110	20	3	II	41	23.06.76
Mo	H	2.000	0	0.00200	20	3	II	47	15.07.76
Mo	H	2.000	0	0.00220	20	3	II	165	07.07.77
Mo	H	2.000	0	0.00246	90	3	V	177	25.05.82
Mo	H	4.000	0	0.00210	20	2	II	40	31.05.76
Mo	H	6.000	0	0.00180	20	1	II	48	15.07.76
Mo	H	8.000	0	0.00170	20	1		0	GUESS
Mo	H	25.000	0	0.00110	20	1			PHARAO82
Mo	H	50.000	0	0.00168	20	1			PHARAO82

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
Mo	D	0.150	0	0.00040	20	3	II	69	22.09.76
Mo	D	0.300	0	0.00200	20	3	II	69	21.09.76
Mo	D	0.450	0	0.00380	20	3	V	78	07.04.81
Mo	D	0.500	0	0.00350	20	3	II	57	14.08.76
Mo	D	0.500	0	0.00350	20	3	II	69	21.09.76
Mo	D	1.000	0	0.00620	20	3	II	41	24.06.77
Mo	D	1.000	0	0.00570	20	3	II	48	16.07.76
Mo	D	2.000	0	0.00760	20	3	II	42	24.06.76
Mo	D	2.000	0	0.00770	20	3	II	43	30.06.76
Mo	D	2.000	0	0.00800	20	3	II	48	16.07.76
Mo	D	2.000	0	0.00930	20	3	II	166	08.07.77
Mo	D	2.000	0	0.00862	20	3	V	2	13.05.80
Mo	D	2.000	0	0.00868	72	3	V	75	19.03.81
Mo	D	2.500	0	0.00967	20	3	VIII	11	11.03.85
Mo	D	4.000	0	0.00770	20	2	II	42	24.06.76
Mo	D	8.000	0	0.00480	20	1	II	57	14.08.76
Mo	D	8.000	0	0.00627	90	1	V	80	04.05.81
Mo	D	100.000	0	0.00224	20	1			PHARAO82

Calculated Data

Target	Proj.	Energy	Angle	Yield	Temp.	P	SBE
Mo	D	0.150	0	0.000895	20	10.20	6.89
Mo	D	0.200	0	0.002860	20	10.20	6.89
Mo	D	0.500	0	0.011400	20	10.20	6.89
Mo	D	1.000	0	0.016700	20	10.20	6.89
Mo	D	2.000	0	0.016900	20	10.20	6.89
Mo	D	5.000	0	0.014600	20	10.20	6.89
Mo	D	50.000	0	0.003500	20	10.20	6.89
Mo	D	100.000	0	0.002500	20	10.20	6.89

Target	Proj.	Energy	Angle	Yield	Temp.	*P*	SBE
Mo	T	0.100	0	0.000932	20	10.20	6.89
Mo	T	0.170	0	0.006670	20	10.20	6.89
Mo	T	0.300	0	0.015900	20	10.20	6.89
Mo	T	0.500	0	0.022000	20	10.20	6.89
Mo	T	1.000	0	0.027300	20	10.20	6.89
Mo	T	2.000	0	0.029000	20	10.20	6.89
Mo	T	5.000	0	0.025800	20	10.20	6.89

Target	Proj.	Energy	Angle	Yield	Temp.	*P*	SBE
Mo	Mo	0.050	0	0.001140	20	10.20	6.89
Mo	Mo	0.080	0	0.010400	20	10.20	6.89
Mo	Mo	0.100	0	0.025900	20	10.20	6.89
Mo	Mo	0.200	0	0.151000	20	10.20	6.89
Mo	Mo	0.300	0	0.315000	20	10.20	6.89
Mo	Mo	0.350	0	0.390000	20	10.20	6.89
Mo	Mo	0.500	0	0.636000	20	10.20	6.89
Mo	Mo	1.000	0	1.140000	20	10.20	6.89
Mo	Mo	1.000	0	1.120000	20	10.20	6.89
Mo	Mo	2.000	0	1.770000	20	10.20	6.89
Mo	Mo	2.000	0	1.760000	20	10.20	6.89
Mo	Mo	5.000	0	2.880000	20	10.20	6.89
Mo	Mo	10.000	0	3.420000	20	10.20	6.89
Mo	Mo	20.000	0	3.960000	20	10.20	6.89
Mo	Mo	45.000	0	4.870000	20	10.20	6.89
Mo	Mo	50.000	0	4.880000	20	10.20	6.89
Mo	Mo	100.000	0	4.110000	20	10.20	6.89

Target: Mo

Experimental Data

Target	Projectile	Angle	Symbol	$E_{th}(eV)$	Q(atoms/ion)
Mo	^3He	0	V	44.8	0.0840
Mo	He	0	A	47.5	0.163
Mo	Ne	0	□	28.0	2.57

Calculated Data

Target	Projectile	Angle	Symbol	$E_{th}(eV)$	Q(atoms/ion)
Mo	He	0	▲		
Mo	Ar	0	♦	32.5	7.85
Mo	Kr	0	•	55.1	14.8

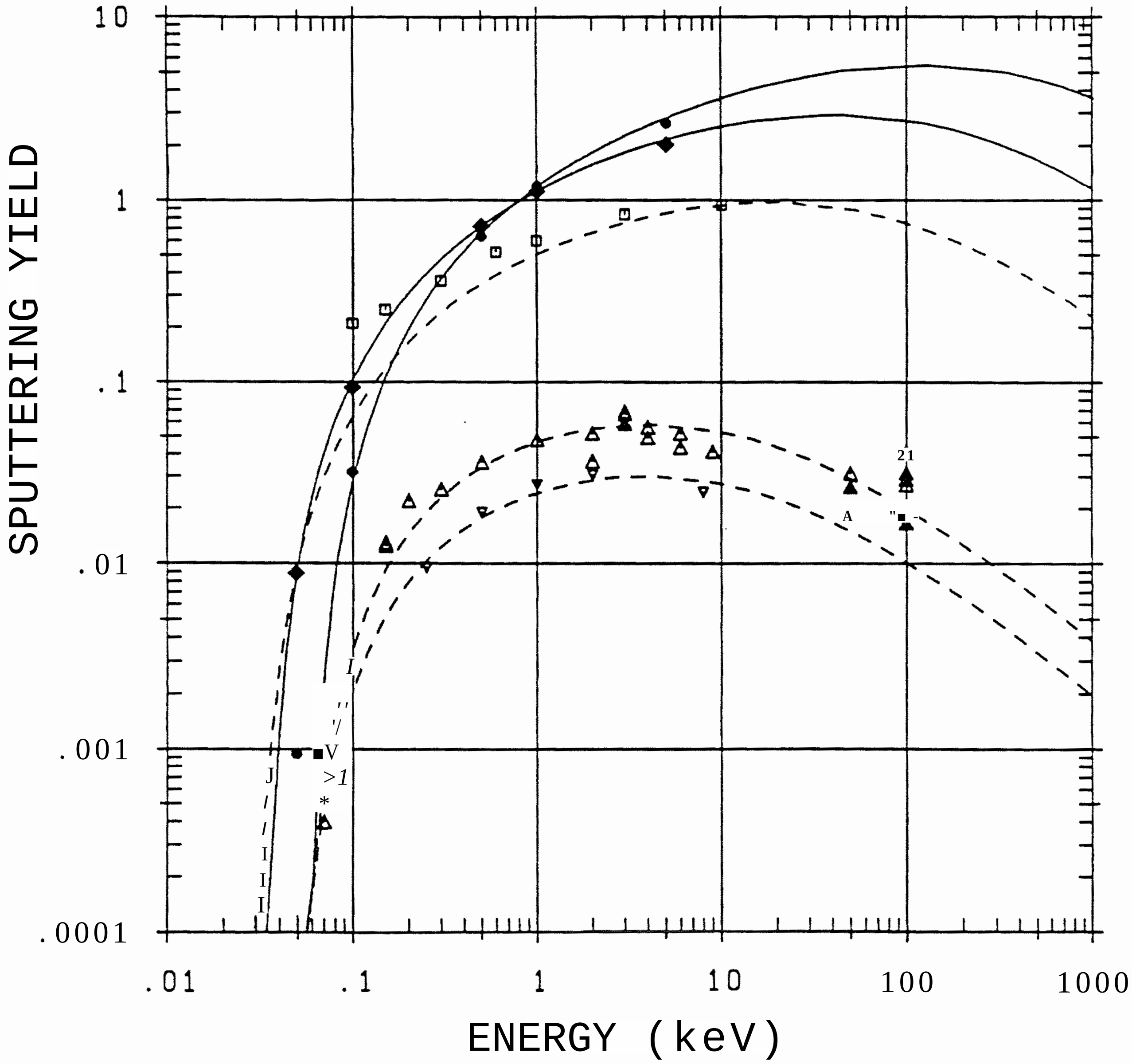


Fig. 29: Energy dependence of the sputtering yield of Mo with ^3He, ^4He, Ar, Ne and Kr. The threshold energy for Ne was estimated for fitting. The data are published in [28,46,53].

Experimental Data

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
Mo	^{3}He	0.250	0	0.00950	20	1	II	98	19.01.77
Mo	^{3}He	0.500	0	0.01900	20	1	II	78	20.10.76
Mo	^{3}He	1.000	0	0.02700	20	1	II	98	20.01.77
Mo	^{3}He	2.000	0	0.03050	20	1	II	99	20.01.77
Mo	^{3}He	8.000	0	0.02450	20	1	II	78	20.10.76

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
Mo	He	0,070	0	0.00040	20	1	II	67	13.09.76
Mo	He	0.150	0	0.01250	20	1	II	68	15.09.76
Mo	He	0.150	0	0.01300	20	1	II	70	27.09.76
Mo	He	0.200	0	0.02200	20	1	II	67	14.09.76
Mo	He	0.300	0	0.02550	20	1	II	66	09.09.76
Mo	He	0.500	0	0.03600	20	1	II	66	10.09.76
Mo	He	1.000	0	0.04800	20	1	II	67	10.09.76
Mo	He	2.000	0	0.03650	20	1	II	59	17.08.76
Mo	He	2.000	0	0.05200	20	1	II	67	13.09.76
Mo	He	3.000	0	0.05930	20	1	VIII	6	05.03.85
Mo	He	3.000	0	0.06870	500	1	VIII	11	12.03.85
Mo	He	3.000	0	0.05910	640	1	VIII	34	30.04.85
Mo	He	3.000	0	0.06670	640	1	VIII	85	22.10.85
Mo	He	4.000	0	0.04930	20	1	II	58	17.08.76
Mo	He	4.000	0	0.05650	20	1	II	166	08.07.77
Mo	He	6.000	0	0.05200	20	1	-II	44	01.07.76
Mo	He	6.000	0	0.04350	20	1	II	52	20.07.76
Mo	He	9.000	0	0.04120	20	1	II	58	17.08.76
Mo	He	50.000	0	0.01910	20	1			PHARAO82
Mo	He	50.000	0	0.03130	20	1			PHARAO82
Mo	He	100.000	0	0.03160	20	1			PHARAO82
Mo	He	100.000	0	0.02700	20	1			PHARAO82
Mo	He	100.000	0	0.02900	20	1			PHARAO82
Mo	He	100.000	0	0.04150	20	1			PHARAO82

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
Mo	Ne	0.100	0	0.21000	20				HECHTL84
Mo	Ne	0.150	0	0.25000	20				HECHTL84
Mo	Ne	0.300	0	0.36000	20				HECHTL84
Mo	Ne	0.600	0	0.52000	20				HECHTL84
Mo	Ne	1.000	0	0.60000	20				HECHTL84
Mo	Ne	3.000	0	0.84000	20				HECHTL84
Mo	Ne	10.000	0	0.95000	20				HECHTL84

Calculated Data

Target	Proj.	Energy	Angle	Yield	Temp.	P	SBE
Mo	He	50.000	0	0.026400	20	10.20	6.89
Mo	He	100.000	0	0.016700	20	10.20	6.89

Target	Proj.	Energy	Angle	Yield	Temp.	P	SBE
Mo	Ar	0.050	0	0.009060	20	10.20	6.89
Mo	Ar	0.100	0	0.093700	20	10.20	6.89
Mo	Ar	0.500	0	0.719000	20	10.20	6.89
Mo	Ar	1.000	0	1.120000	20	10.20	6.89
Mo	Ar	5.000	0	2.040000	20	10.20	6.89

Target	Proj.	Energy	Angle	Yield	Temp.	P	SBE
Mo	Kr	0.050	0	0.000915	20	10.20	6.89
Mo	Kr	0.100	0	0.032000	20	10.20	6.89
Mo	Kr	0.500	0	0.636000	20	10.20	6.89
Mo	Kr	1.000	0	1.190000	20	10.20	6.89
Mo	Kr	5.000	0	2.690000	20	10.20	6.89

Target: Mo

Experimental Data

Target	Projectile	Angle	Symbol	E_t/,(eV’)	Q(atoms/ion)
Mo	O	0	▽	52.0	2.30

Calculated Data

Target	Projectile	Angle	Symbol	E,h(eV)	Q(atoms/ion)
~MÖ	ö	Ö	▼	2LÖ	21Ö
Mo	Hg	0	▶	73.0	27.7

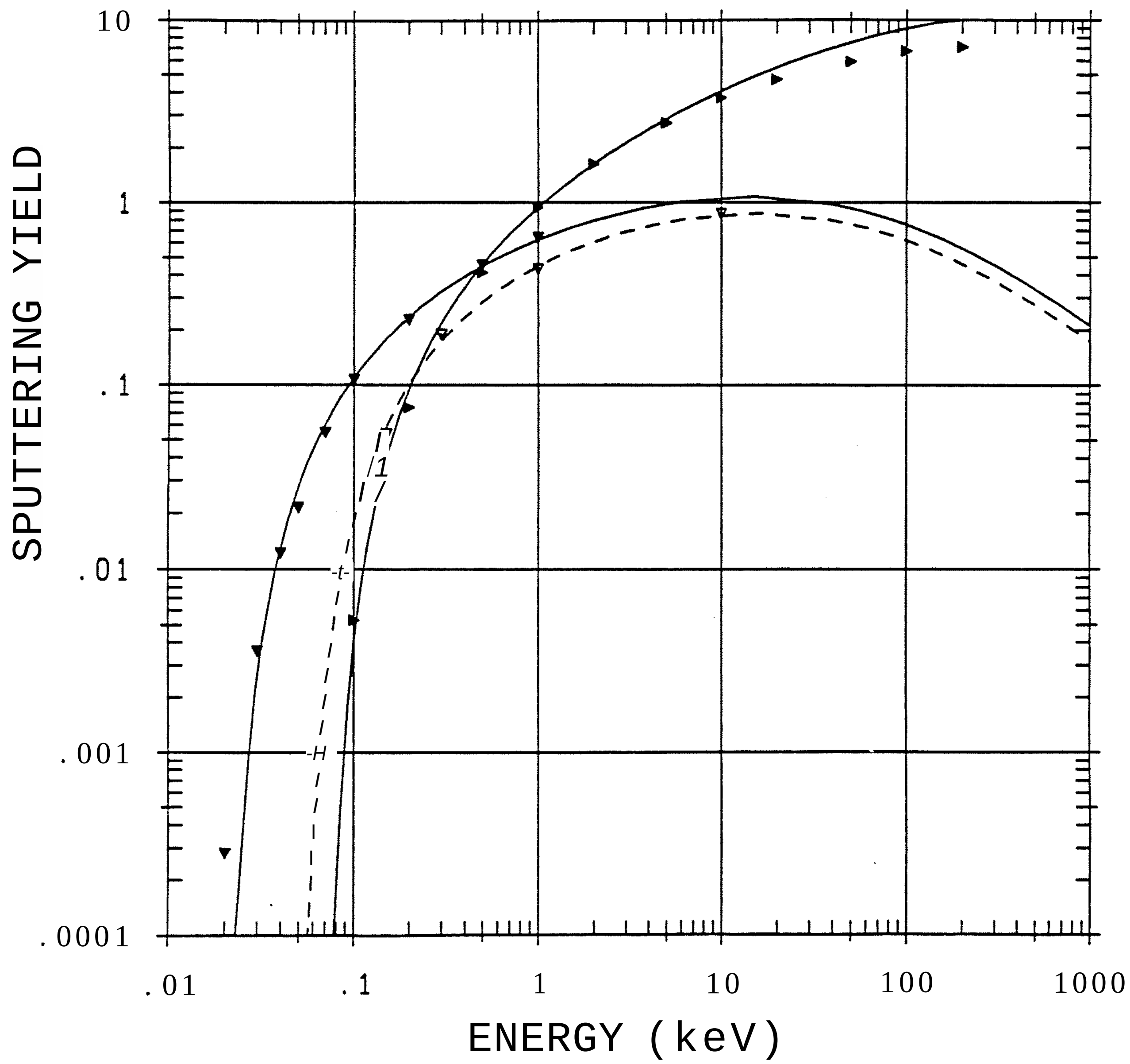


Fig. 30: Energy dependence of the sputtering yield of Mo with O and Hg. The data for 0 were measured at 750°C to reduce the oxygen built up in the surface layers during bombarding. The experimental data are published in [46]. The dependence of the sputtering yield by D, He and Ar bombardment on oxygen residual gas is reported in [54].

Experimental Data

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
Mo	0	0.150	0	0.05400	750				HECHTL84
Mo	0	0.300	0	0.19000	750				HECHTL84
Mo	0	1.000	0	0.43000	750				HECHTL84
Mo	0	10.000	0	0.87000	750				HECHTL84

Calculated Data

Target	Proj.	Energy	Angle	Yield	Temp.	P	SBE
Mo	O	0.020	0	0.000280	20	10.20	6.83
Mo	O	0.020	0	0.000280	20	10.20	6.83
Mo	O	0.030	0	0.003600	20	10.20	6.83
Mo	O	0.030	0	0.003600	20	10.20	6.83
Mo	O	0.040	0	0.012200	20	10.20	6.83
Mo	O	0.040	0	0.012200	20	10.20	6.83
Mo	O	0.050	0	0.021500	20	10.20	6.83
Mo	O	0.050	0	0.021500	20	10.20	6.83
Mo	O	0.070	0	0.054800	20	10.20	6.83
Mo	0	0.070	0	0.054800	20	10.20	6.83
Mo	0	0.100	0	0.107000	20	10.20	6.83
Mo	0	0.100	0	0.107000	20	10.20	6.83
Mo	0	0.200	0	0.228000	20	10.20	6.83
Mo	0	0.200	0	0.228000	20	10.20	6.83
Mo	0	0.500	0	0.451000	20	10.20	6.83
Mo	0	0.500	0	0.451000	20	10.20	6.83
Mo	0	1.000	0	0.642000	20	10.20	6.83
Mo	0	1.000	0	0.642000	20	10.20	6.83

Target	Proj.	Energy	Angle	Yield	Temp.	P	SBE
Mo	Hg	0.050	0	0.000037	20	10.20	6.83
Mo	Hg	0.100	0	0.005300	20	10.20	6.83
Mo	Hg	0.200	0	0.075200	20	10.20	6.83
Mo	Hg	0.500	0	0.413000	20	10.20	6.83
Mo	Hg	1.000	0	0.939000	20	10.20	6.83
Mo	Hg	2.000	0	1.620000	20	10.20	6.83
Mo	Hg	5.000	0	2.730000	20	10.20	6.83
Mo	Hg	10.000	0	3.740000	20	10.20	6.83
Mo	Hg	20.000	0	4.720000	20	10.20	6.83
Mo	Hg	50.000	0	5.890000	20	10.20	6.83
Mo	Hg	100.000	0	6.740000	20	10.20	6.83
Mo	Hg	200.000	0	7.090000	20	10.20	6.83

Target: Nb

Experimental Data

Target	Projectile	Angle	Symbol	Eth(eV')	Q(atoms/ion)
~Nb	D	Ö	ö	95Ü	0.0251

Calculated Data

Target	Projectile	Angle	Symbol	E_t/,(eV)	Q(atoms/ion)
~Nb	D	Ö	♦	95Ä	0.0489

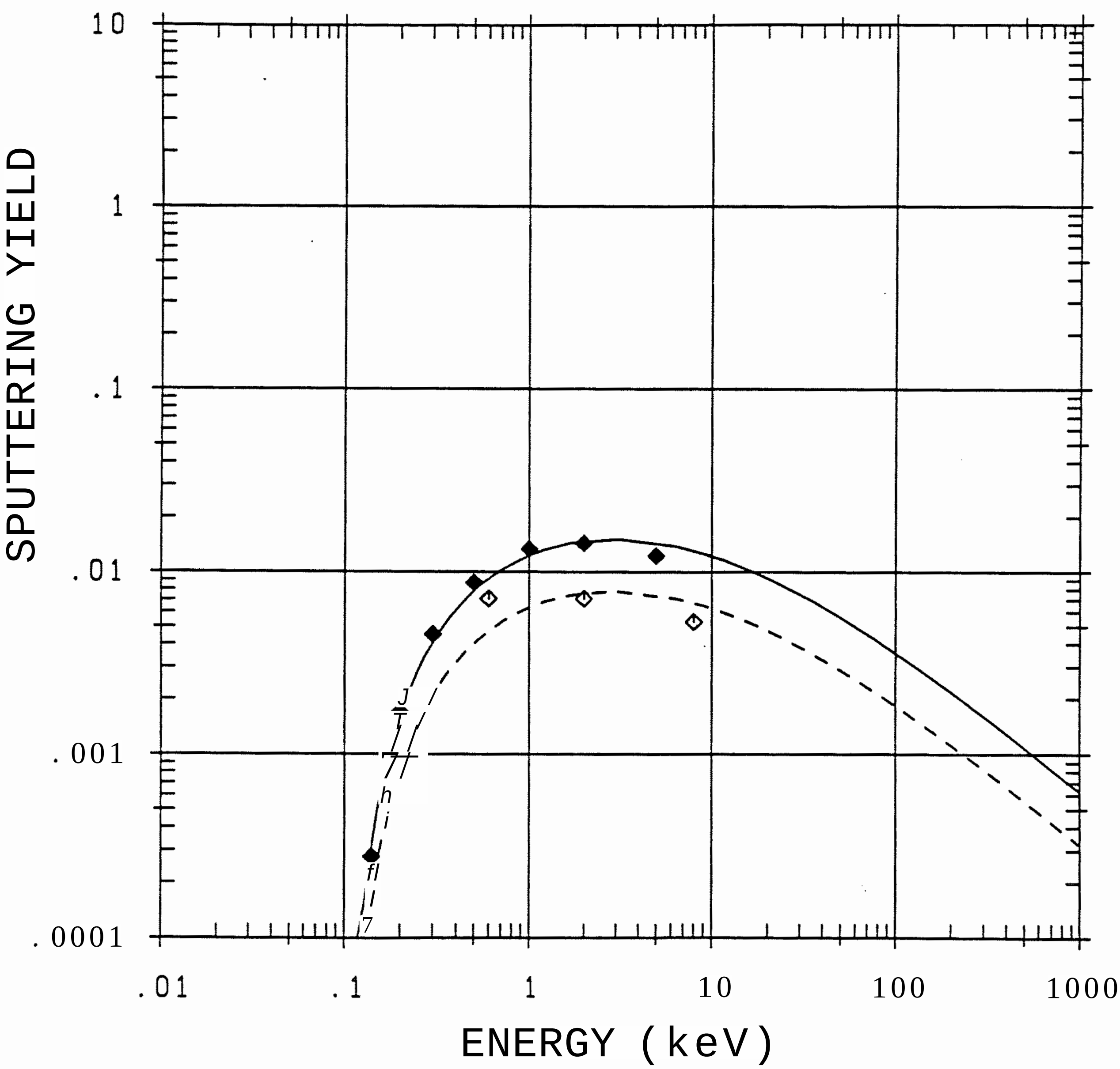


Fig. 31: Energy dependence of the sputtering yield of Nb with D. The threshold energy of the experimental data was taken from calculated data for fitting. The data are unpublished.

Experimental Data

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
Nb	D	0.600	0	0.00710	20	3	V	133	19.03.82
Nb	D	2.000	0	0.00710	no	3	V	133	19.03.82
Nb	D	8.000	0	0.00530	120	1	V	132	18.03.82

Calculated Data

Target	Proj.	Energy	Angle	Yield	Temp.	*p*	SBE
Nb	D	0.140	0	0.000277	20	8.60	7.59
Nb	D	0.200	0	0.001690	20	8.60	7.59
Nb	D	0.300	0	0.004530	20	8.60	7.59
Nb	D	0.500	0	0.008700	20	8.60	7.59
Nb	D	1.000	0	0.013400	20	8.60	7.59
Nb	D	2.000	0	0.014400	20	8.60	7.59
Nb	D	5.000	0	0.012300	20	8.60	7.59

Target: Ni

Experimental Data

Target	Projectile	Angle	Symbol	F.A(eV)	Q(atoms/ion)
Ni	H	0	□	51.4	0.0420
Ni	D	0	0	29.9	0.121
Ni	Ni	0	o	32.5	14.0

Calculated Data

Target	Projectile	Angle	Symbol	£<$_A$(eV)	Q(atoms/ion)
Ni	H	0	■	53.2	0.0420
Ni	D	0	♦	30.8	0.110
Ni	Ni	0	▶	33.9	16.7

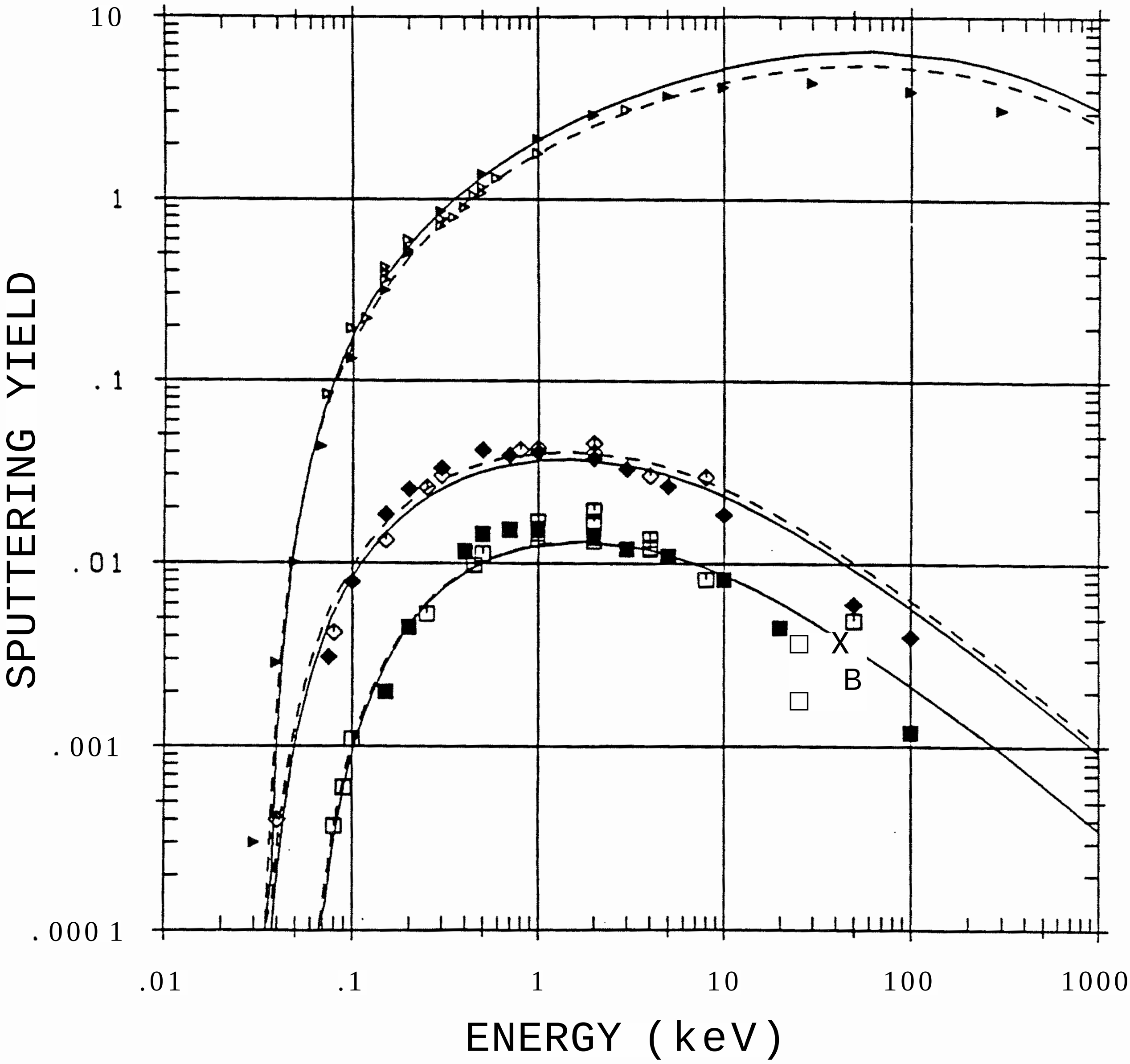


Fig. 32: Energy dependence of the sputtering yield of Ni with H, D and Ni. The data are published in [38,48,55-57],

Experimental Data

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
Ni	H	0.080	0	0.00037	20	3	III	176	22.01.78
Ni	H	0.090	0	0.00060	20	3	II	87	07.12.76
Ni	H	0.100	0	0.00110	20	3	II	85	03.12.76
Ni	H	0.250	0	0.00530	20	3	II	86	06.12.76
Ni	H	0.450	0	0.00982	20	3	V	69	18.05.81
Ni	H	0.500	0	0.01130	20	3	II	86	06.12.76
Ni	H	1.000	0	0.01360	20	3	II	85	03.12.76
Ni	H	1.000	0	0.01460	20	3	II	98	18.12.76
Ni	H	1.000	0	0.01550	20	3	II	135	20.04.77
Ni	H	1.000	0	0.01690	20	3	III	152	03.10.78
Ni	H	2.000	0	0.01380	20	3	II	84	01.12.76
Ni	H	2.000	0	0.01940	20	3	III	160	06.11.78
Ni	H	2.000	0	0.01320	20	3	III	160	06.11.78
Ni	H	2.000	0	0.01690	20	3	V	178	26.05.82
Ni	H	4.000	0	0.01200	20	2	II	84	01.12.76
Ni	H	4.000	0	0.01230	20	2	II	134	19.04.77
Ni	H	4.000	0	0.01360	20	2	III -	147	22.09.78
Ni	H	8.000	0	0.00820	20	1	II	85	02.12.76
Ni	H	25.000	0	0.00180	20	1			PHARAO82
Ni	H	25.000	0	0.00370	20	1			PHARAO82
Ni	H	50.000	0	0.00490	20	1			PHARAO82
Ni	H	50.000	0	0.00240	20	1			PHARAO82

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
Ni	D	0.040	0	0.00040	20	3	VIII	96	04.12.85
Ni	D	0.080	0	0.00420	20	3	II	89	13.12.76
Ni	D	0.150	0	0.01340	20	3	II	89	09.12.76
Ni	D	0.250	0	0.02580	20	3	II	89	09.12.76
Ni	D	0.300	0	0.02980	20	3	VIII	189	05.09.86
Ni	D	0.800	0	0.04160	20	3	II	90	14.12.76
Ni	D	1.000	0	0.04250	20	3	II	154	16.06.77
Ni	D	1.000	0	0.04260	20	3	VIII	185	28.08.86
Ni	D	2.000	0	0.04020	20	3	II	88	09.12.76
Ni	D	2.000	0	0.04500	20	3	V	2	13.05.80
Ni	D	4.000	0	0.03000	20	2	II	125	31.03.77
Ni	D	8.000	0	0.02960	20	1	II	89	13.12.76

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
Ni	Ni	0.075	0	0.08200	20	1			HECHTL81
Ni	Ni	0.100	0	0.18700	20	1			HECHTL81
Ni	Ni	0.120	0	0.21200	20	1			HECHTL81
Ni	Ni	0.150	0	0.34600	20	1			HECHTL79
Ni	Ni	0.150	0	0.38000	20	1			HECHTL81
Ni	Ni	0.150	0	0.40400	20	1			HECHTL81
Ni	Ni	0.200	0	0.57000	20	1			HECHTL81
Ni	Ni	0.200	0	0.50200	20	1			HECHTL81
Ni	Ni	0.300	0	0.68000	20	1			HECHTL81
Ni	Ni	0.300	0	0.74000	20	1			HECHTL81
Ni	Ni	0.350	0	0.75600	20	1			HECHTL81
Ni	Ni	0.400	0	0.86000	20	1			HECHTL81
Ni	Ni	0.450	0	1.00000	20	1			HECHTL81
Ni	Ni	0.500	0	1.04000	20	1			HECHTL81
Ni	Ni	0.500	0	1.11000	20	1			HECHTL81
Ni	Ni	0.600	0	1.25000	20	1			HECHTL79
Ni	Ni	1.000	0	1.72000	20	1			HECHTL81
Ni	Ni	3.000	0	3.02000	20	1			HECHTL79

Calculated Data

Target	Proj.	Energy	Angle	Yield	Temp.	P	SEE
Ni	H	0.150	0	0.002000	20	8.90	4.46
Ni	H	0.200	0	0.004500	20	8.90	4.46
Ni	H	0.400	0	0.011600	20	8.90	4.46
Ni	H	0.500	0	0.014400	20	8.90	4.46
Ni	H	0.700	0	0.015200	20	8.90	4.46
Ni	H	1.000	0	0.015200	20	8.90	4.46
Ni	H	2.000	O.	0.014200	20	8.90	4.46
Ni	H	3.000	0	0.012000	20	8.90	4.46
Ni	H	5.000	0	0.011000	20	8.90	4.46
Ni	H	10.000	0	0.008200	20	8.90	4.46
Ni	H	20.000	0	0.004500	20	8.90	4.46
Ni	H	50.000	0	0.002700	20	8.90	4.46
Ni	H	100.000	0	0.001200	20	8.90	4.46

Target	Proj.	Energy	Angle	Yield	Temp.	P	SBE
Ni	D	0.075	0	0.003100	20	8.90	4.46
Ni	D	0.100	0	0.007900	20	8.90	4.46
Ni	D	0.150	0	0.018400	20	8.90	4.46
Ni	D	0.200	0	0.025200	20	8.90	4.46
Ni	D	0.300	0	0.032700	20	8.90	4.46
Ni	D	0.500	0	0.041300	20	8.90	4.46
Ni	D	0.700	0	0.038600	20	8.90	4.46
Ni	D	1.000	0	0.040300	20	8.90	4.46
Ni	D	2.000	0	0.037200	20	8.90	4.46
Ni	D	3.000	0	0.032600	20	8.90	4.46
Ni	D	5.000	0	0.026400	20	8.90	4.46
Ni	D	10.000	0	0.018500	20	8.90	4.46
Ni	D	50.000	0	0.006000	20	8.90	4.46
Ni	D	100.000	0	0.004000	20	8.90	4.46

Target	Proj.	Energy	Angle	Yield	Temp.	P	SBE
Ni	Ni	0.030	0	0.000300	20	8.90	4.46
Ni	Ni	0.040	0	0.002800	20	8.90	4.46
Ni	Ni	0.050	0	0.009800	20	8.90	4.46
Ni	Ni	0.070	0	0.042500	20	8.90	4.46
Ni	Ni	0.100	0	0.128400	20	8.90	4.46
Ni	Ni	0.100	0	0.120000	20	8.90	4.46
Ni	Ni	0.150	0	0.302600	20	8.90	4.46
Ni	Ni	0.200	0	0.485100	20	8.90	4.46
Ni	Ni	0.300	0	0.815600	20	8.90	4.46
Ni	Ni	0.500	0	1.318000	20	8.90	4.46
Ni	Ni	1.000	0	2.066000	20	8.90	4.46
Ni	Ni	1.000	0	2.000000	20	8.90	4.46
Ni	Ni	2.000	0	2.810000	20	8.90	4.46
Ni	Ni	5.000	0	3.626000	20	8.90	4.46
Ni	Ni	10.000	0	4.047000	20	8.90	4.46
Ni	Ni	30.000	0	4.320000	20	8.90	4.46
Ni	Ni	30.000	0	4.309000	20	8.90	4.46
Ni	Ni	100.000	0	3.880000	20	8.90	4.46
Ni	Ni	300.000	0	3.050000	20	8.90	4.46

Target: Ni

Experimental Data

Target	Projectile	Angle	Symbol	$E_{th}(eV)$	Q(atoms/ion)
Ni	He	0	A	16.8	0.499
Ni	0	0	V	48.5	1.69
Ni	Ne	0	□	15.1	5.07

Calculated Data

Target	Projectile	Angie	Symbol	$E_{th}(eV)$	Q(atoms/ion)
Ni	^{3}He	0	v	28.4	0.372
Ni	He	0	A	24.3	0.432
Ni	Ne	0	■	22.7	4.73

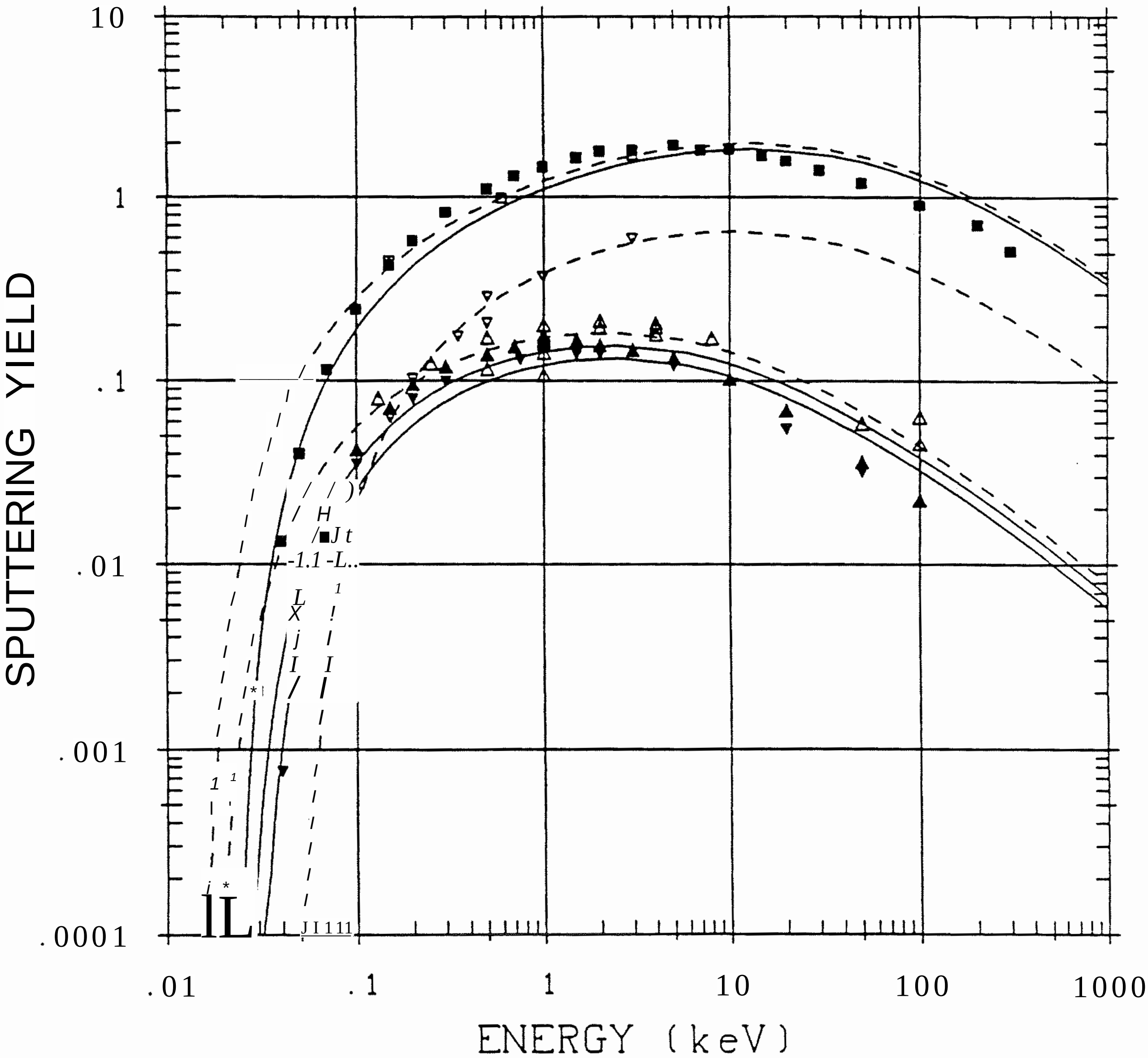


Fig. 33: Energy dependence of the sputtering yield of Ni with ^{3}He , ^{4}He , O and Ne. The data are published in [45,48,57-59].

Experimental Data

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
Ni	He	0.130	0	0.08090	20	1	II	98	18.12.76
Ni	He	0.250	0	0.12500	20	1	II	87	07.12.77
Ni	He	0.500	0	0.11600	20	1	II	87	07.12.76
Ni	He	0.500	0	0.17300	20	1	II	91	15.12.76
Ni	He	1.000	0	0.10800	20	1	II	87	18.12.76
Ni	He	1.000	0	0.14300	20	1	II	90	15.12.76
Ni	He	1.000	0	0.20300	20	1	II	119	16.03.77
Ni	He	1.000	0	0.17400	20	1	II	131	14.04.77
Ni	He	1.000	0	0.16900	20	1	II	131	14.04.77
Ni	He	1.000	0	0.18000	20	1	II	132	14.04.77
Ni	He	1.000	0	0.16600	20	1	II	132	14.04.77
Ni	He	2.000	0	0.19600	20	1	II	88	08.12.76
Ni	He	2.000	0	0.21300	20	1	II	118	16.03.77
Ni	He	4.000	0	0.20800	20	1	II	88	09.12.76
Ni	He	4.000	0	0.19700	20	1	II	155	21 06.77
Ni	He	4.000	0	0.18000	20	1	III	152	04.10.78
Ni	He	8.000	0	0.17200	20	1	II	91	15.12.76
Ni	He	50.000	0	0.05920	20	1			PHARAO82
Ni	He	100.000	0	0.04580	20	1.			PHARAO82
Ni	He	100.000	0	0.06410	20	1			PHARAO82

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
Ni	0	0.100	0	0.02400	20	1			HECHTL81
Ni	0	0.150	0	0.06200	20	1			HECHTL79
Ni	0	0.200	0	0.10000	20	1			HECHTL81
Ni	0	0.350	0	0.17000	20	1			HECHTL81
Ni	0	0.500	0	0.20000	20	1			HECHTL81
Ni	0	0.500	0	0.28000	20	1			HECHTL81
Ni	0	1.000	0	0.36000	20	1			HECHTL81
Ni	0	3.000	0	0.58000	20	1			HECHTL79

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
Ni	Ne	0.150	0	0.43800	20	1			HECHTL79
Ni	Ne	0.600	0	0.97000	20	1			HECHTL79
Ni	Ne	3.000	0	1.67000	20	1			HECHTL79

Calculated Data

Target	Proj.	Energy	Angle	Yield	Temp.	P	SBE
Ni	^{3}He	0.040	0	0.000760	20	8.90	4.46
Ni	^{3}He	0.050	0	0.003600	20	8.90	4.46
Ni	^{3}He	0.050	0	0.003810	20	8.90	4.46
Ni	^{3}He	0.070	0	0.013500	20	8.90	4.46
Ni	^{3}He	0.100	0	0.035000	20	8.90	4.46
Ni	^{3}He	0.200	0	0.080000	20	8.90	4.46
Ni	^{3}He	0.300	0	0.100000	20	8.90	4.46
Ni	^{3}He	0.750	0	0.130000	20	8.90	4.46
Ni	^{3}He	1.500	0	0.140000	20	8.90	4.46
Ni	^{3}He	2.000	0	0.140000	20	8.90	4.46
Ni	^{3}He	5.000	0	0.120000	20	8.90	4.46
Ni	^{3}He	20.000	0	0.055000	20	8.90	4.46
Ni	^{3}He	50.000	0	0.031800	20	8.90	4.46

Target	Proj.	Energy	Angle	Yield	Temp.	P	SBE
Ni	He	0.050	0	0.005500	20	8.90	4.46
Ni	He	0.050	0	0.006100	20	8.90	4.46
Ni	He	0.070	0	0.019100	20	8.90	4.46
Ni	He	0.100	0	0.042400	20	8.90	4.46
Ni	He	0.150	0	0.071400	20	8.90	4.46
Ni	He	0.200	0	0.096400	20	8.90	4.46
Ni	He	0.300	0	0.119700	20	8.90	4.46
Ni	He	0.500	0	0.140100	20	8.90	4.46
Ni	He	0.700	0	0.154200	20	8.90	4.46
Ni	He	1.000	0	0.164400	20	8.90	4.46
Ni	He	1.000	0	0.167900	20	8.90	4.46
Ni	He	1.000	0	0.158200	20	8.90	4.46
Ni	He	1.500	0	0.168300	20	8.90	4.46
Ni	He	2.000	0	0.157800	20	8.90	4.46
Ni	He	3.000	0	0.148100	20	8.90	4.46
Ni	He	5.000	0	0.135300	20	8.90	4.46
Ni	He	10.000	0	0.103200	20	8.90	4.46
Ni	He	20.000	0	0.069700	20	8.90	4.46
Ni	He	50.000	0	0.036400	20	8.90	4.46
Ni	He	100.000	0	0.022300	20	8.90	4.46

Target	Proj.	Energy	Angle	Yield	Temp.	P	SBE
Ni	Ne	0.030	0	0.002000	20	8.90	4.46
Ni	Ne	0.040	0	0.013000	20	8.90	4.46
Ni	Ne	0.050	0	0.039000	20	8.90	4.46
Ni	Ne	0.070	0	0.111000	20	8.90	4.46
Ni	Ne	0.100	0	0.238000	20	8.90	4.46
Ni	Ne	0.150	0	0.417000	20	8.90	4.46
Ni	Ne	0.200	0	0.566000	20	8.90	4.46
Ni	Ne	0.300	0	0.805000	20	8.90	4.46
Ni	Ne	0.500	0	1.090000	20	8.90	4.46
Ni	Ne	0.700	0	1.290000	20	8.90	4.46
Ni	Ne	1.000	0	1.440000	20	8.90	4.46
Ni	Ne	1.500	0	1.620000	20	8.90	4.46
Ni	Ne	2.000	0	1.750000	20	8.90	4.46
Ni	Ne	3.000	0	1.780000	20	8.90	4.46
Ni	Ne	5.000	0	1.900000	20	8.90	4.46
Ni	Ne	7.000	0	1.790000	20	8.90	4.46
Ni	Ne	10.000	0	1.810000	20	8.90	4.46
Ni	Ne	15.000	0	1.670000	20	8.90	4.46
Ni	Ne	20.000	0	1.560000	20	8.90	4.46
Ni	Ne	30.000	0	1.390000	20	8.90	4.46
Ni	Ne	50.000	0	1.180000	20	8.90	4.46
Ni	Ne	100.000	0	0.889000	20	8.90	4.46
Ni	Ne	200.000	0	0.694000	20	8.90	4.46
Ni	Ne	300.000	0	0.500000	20	8.90	4.46

Target: Ni

Experimental Data

Target	Projectile	Angle	Symbol	$E_{th}(eV)$	Q(atoms/ion)
Ni	Ar	0	*0*	20.4	10.4
Ni	Kr	0	*o*	42.5	18.5
Ni	Xe	0	*A*	49.7	22.1

Calculated Data

Target	Projectile	Angle	Symbol	$E_{th}(eV)$	Q(atoms/ion)
Ni	Ar	0	♦	32.0	11.7
Ni	Kr	0	•	41.7	19.0
Ni	Xe	0	A	47.4	27.9

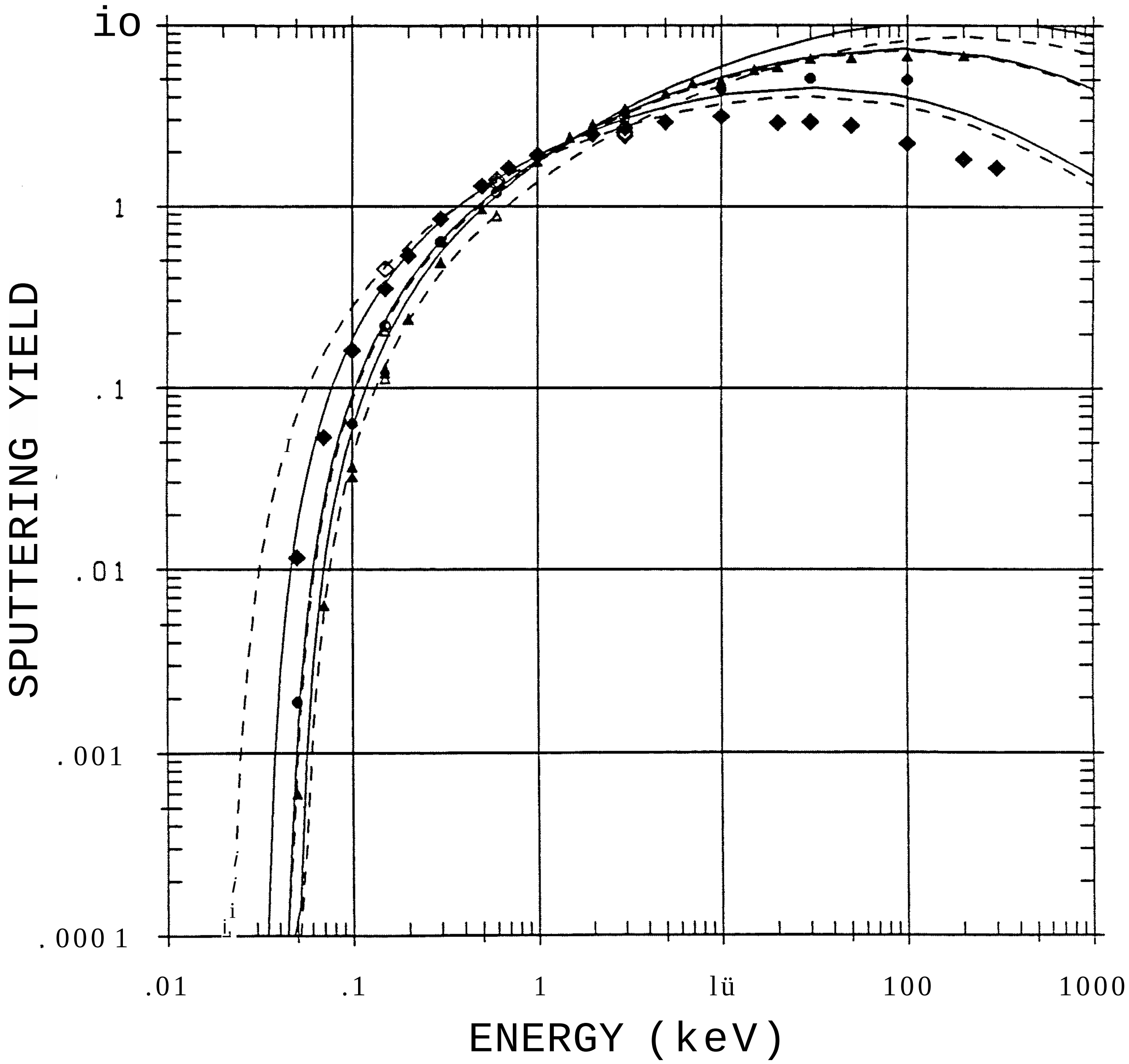


Fig. 34: Energy dependence of the sputtering yield of Ni with Ar, Kr and Xe. The data are published in [55,591.

Experimental Data

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
Ni	Ar	0.150	0	0.45000	20	1			HECHTL79
Ni	Ar	0.600	0	1.33000	20	1			HECHTL79
Ni	Ar	0.600	0	1.40000	20	1			HECHTL79
Ni	Ar	3.000	0	2.56000	20	1			HECHTL79
Ni	Ar	3.000	0	2.45000	20	1			HECHTL79

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
Ni	Kr	0.150	0	0.22000	20	1			HECHTL79
Ni	Kr	0.600	0	1.19000	20	1			HECHTL79
Ni	Kr	3.000	0	3.07000	20	1			HECHTL79

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
Ni	Xe	0.150	0	0.20700	20	1			HECHTL81
Ni	Xe	0.150	0	0.11300	20	1			HECHTL79
Ni	Xe	0.150	0	0.12800	20	1			HECHTL79
Ni	Xe	0.600	0	0.89000	20	1			HECHTL79
Ni	Xe	3.000	0	3.07000	20	1			HECHTL79

Calculated Data

Target	Proj.	Energy	Angle	Yield	Temp.	P	SBE
Ni	Ar	0.050	0	0.011600	20	8.90	4.46
Ni	Ar	0.070	0	0.053500	20	8.90	4.46
Ni	Ar	0.100	0	0.159900	20	8.90	4.46
Ni	Ar	0.100	0	0.161200	20	8.90	4.46
Ni	Ar	0.150	0	0.352100	20	8.90	4.46
Ni	Ar	0.200	0	0.532000	20	8.90	4.46
Ni	Ar	0.300	0	0.850500	20	8.90	4.46
Ni	Ar	0.500	0	1.286000	20	8.90	4.46
Ni	Ar	0.700	0	1.612000	20	8.90	4.46
Ni	Ar	1.000	0	1.894000	20	8.90	4.46
Ni	Ar	1.000	0	1.905000	20	8.90	4.46
Ni	Ar	2.000	0	2.487000	20	8.90	4.46
Ni	Ar	3.000	0	2.716000	20	8.90	4.46
Ni	Ar	3.000	0	2.689000	20	8.90	4.46
Ni	Ar	5.000	0	2.903000	20	8.90	4.46
Ni	Ar	10.000	0	3.132000	20	8.90	4.46
Ni	Ar	20.000	0	2.884000	20	8.90	4.46
Ni	Ar	30.000	0	2.911000	20	8.90	4.46
Ni	Ar	30.000	0	2.927000	20	8.90	4.46
Ni	Ar	50.000	0	2.805000	20	8.90	4.46
Ni	Ar	100.000	0	2.237000	20	8.90	4.46
Ni	Ar	200.000	0	1.820000	20	8.90	4.46
Ni	Ar	300.000	0	1.637000	20	8.90	4.46

Target	Proj.	Energy	Angle	Yield	Temp.	P	SBE
Ni	Kr	0.050	0	0.001900	20	8.90	4.46
Ni	Kr	0.100	0	0.063600	20	8.90	4.46
Ni	Kr	0.300	0	0.634000	20	8.90	4.46
Ni	Kr	1.000	0	1.932000	20	8.90	4.46
Ni	Kr	3.000	0	3.260000	20	8.90	4.46
Ni	Kr	10.000	0	4.427000	20	8.90	4.46
Ni	Kr	30.000	0	5.060000	20	8.90	4.46
Ni	Kr	100.000	0	4.990000	20	8.90	4.46

Target	Proj.	Energy	Angle	Yield	Temp.	P	SBE
Ni	Xe	0.050	0	0.000600	20	8.90	4.46
Ni	Xe	0.070	0	0.006400	20	8.90	4.46
Ni	Xe	0.100	0	0.032600	20	8.90	4.46
Ni	Xe	0.100	0	0.036900	20	8.90	4.46
Ni	Xe	0.150	0	0.121500	20	8.90	4.46
Ni	Xe	0.200	0	0.239300	20	8.90	4.46
Ni	Xe	0.300	0	0.488000	20	8.90	4.46
Ni	Xe	0.300	0	0.489000	20	8.90	4.46
Ni	Xe	0.500	0	0.967700	20	8.90	4.46
Ni	Xe	1.000	0	1.786000	20	8.90	4.46
Ni	Xe	1.000	0	1.765000	20	8.90	4.46
Ni	Xe	1.500	0	2.395000	20	8.90	4.46
Ni	Xe	2.000	0	2.821000	20	8.90	4.46
Ni	Xe	3.000	0	3.439000	20	8.90	4.46
Ni	Xe	5.000	0	4.184000	20	8.90	4.46
Ni	Xe	7.000	0	4.782000	20	8.90	4.46
Ni	Xe	10.000	0	4.953000	20	8.90	4.46
Ni	Xe	15.000	0	5.671000	20	8.90	4.46
Ni	Xe	20.000	0	5.897000	20	8.90	4.46
Ni	Xe	30.000	0	6.529000	20	8.90	4.46
Ni	Xe	50.000	0	6.627000	20	8.90	4.46
Ni	Xe	100.000	0	6.760000	20	8.90	4.46
Ni	Xe	200.000	0	6.786000	20	8.90	4.46

Experimental Data

Target	Projectile	Angle	Symbol	$E_{th}(eV)$	Q(atoms/ion)
Si	H	0	□	34.9	0.0270
Si	D	0	0	26.1	0.0720
Si	He	0	A	16.7	0.240

Calculated Data

Target	Projectile	Angle	Symbol	$E_th(eV)$	Q(atoms/ion)
Si	H	0	■	37.5	0.0350
Si	D	0	♦	20.9	0.0750
Si	He	0	A	16.6	0.300

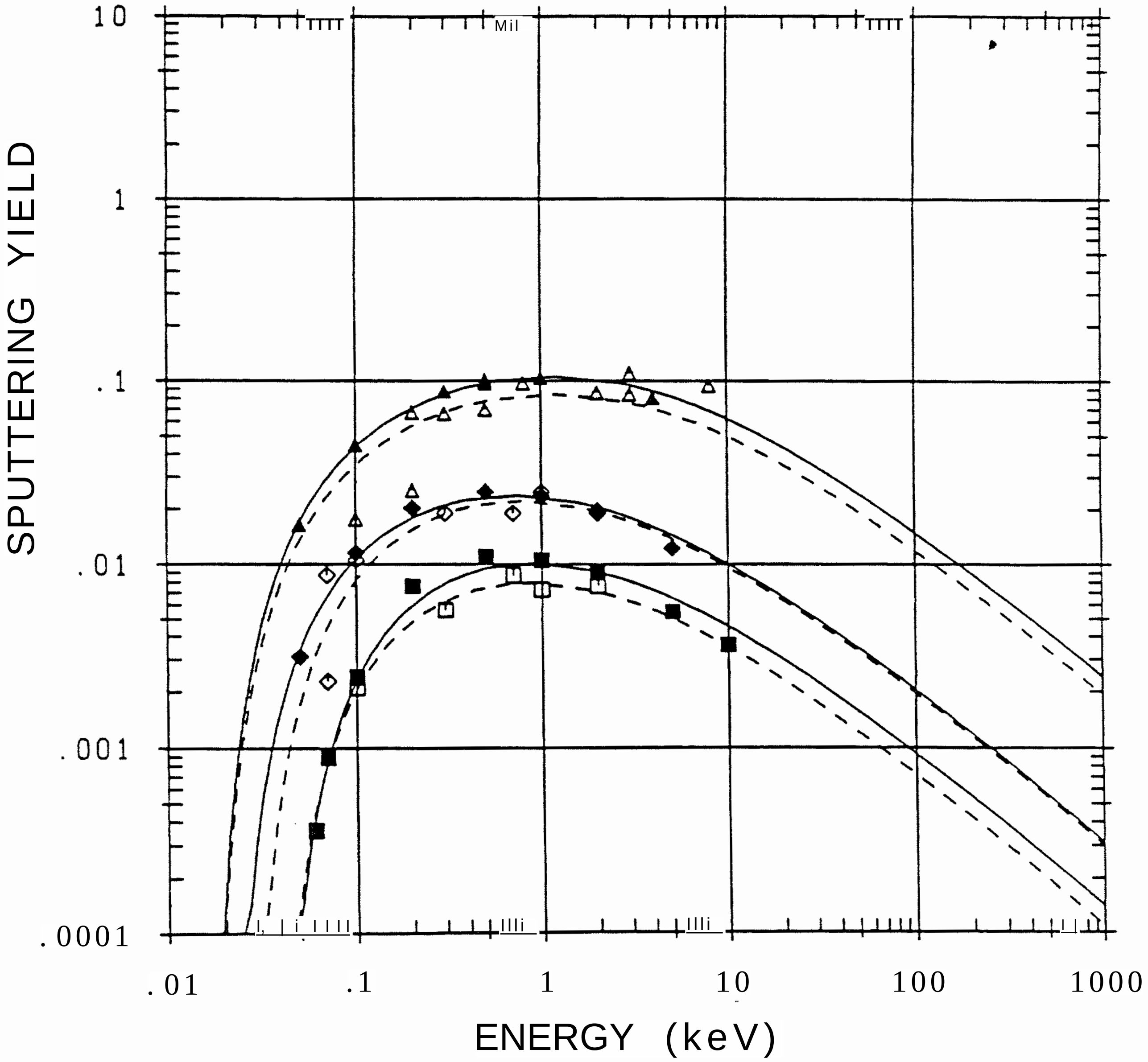


Fig. 35: Energy dependence of the sputtering yield of Si with H, D, ^{3}He, ^{4}He and Si. Due to possible oxide formation at low energies, which leads to lower sputtering yields in the threshold regime, the threshold energy of the ^{4}He experimental data was estimated for fitting. The data are published in [38,41,58].

Experimental Data

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
Si	H	0.100	0	0.00211	20	3	III	51	23.02.78
Si	H	0.300	0	0.00559	20	3	III	51	24.02.78
Si	H	0.700	0	0.00870	20	3	III	53	28.02.78
Si	H	1.000	0	0.00724	20	3	III	79	29.03.78
Si	H	2.000	0	0.00760	20	3	III	80	30.03.78

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
Si	D	0.070	0	0.00870	20	3	III	56	06.03.78
Si	D	0.070	0	0.00228	20	3	IX	165	09.06.88
Si	D	0.100	0	0.01050	20	3	III	53	01.03.78
Si	D	0.300	0	0.01900	20	3	III	53	01.03.78
Si	D	0.700	0	0.01900	20	3	III	54	02.03.78
Si	D	1.000	0	0.02480	850	3	V	122	08.02.82
Si	D	2.000	0	0.01900	20	3	III	54	02.03.78

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
tnc/rcnc/jcnc/icncncncnm	He	0.100	0	0.01750	20	1	IX	148	22.03.88
	He	0.200	0	0.06700	20	1	III	50	22.02.78
	He	0.200	0	0.02520	20	1	IX	149	29.03.88
	He	0.300	0	0.06600	20	1	IX	165	08.06.88
	He	0.500	0	0.09700	20	1	III	50	23.02.78
	He	0.500	0	0.06950	20	1	IX	163	07.06.88
	He	0.800	0	0.09730	20	1	III	50	23.02.78
	He	2.000	0	0.08600	20	1	III	52	28.02.78
	He	3.000	0	0.08470	20	1	IX	145	08.03.88
	He	3.000	0	0.11000	20	1	IX	146	11.03.88
	He	8.000	0	0.09460	20	1	III	49	22.02.78

Calculated Data

Target	Proj.	Energy	Angle	Yield	Temp.	P	SBE
Si	H	0.060	0	0.000360	20	2.33	4.70
Si	H	0.070	0	0.000890	20	2.33	4.70
Si	H	0.100	0	0.002400	20	2.33	4.70
Si	H	0.200	0	0.007600	20	2.33	4.70
Si	H	0.500	0	0.011000	20	2.33	4.70
Si	H	1.000	0	0.010500	20	2.33	4.70
Si	H	2.000	0	0.009000	20	2.33	4.70
Si	H	5.000	0	0.005500	20	2.33	4.70
Si	H	10.000	0	0.003600	20	2.33	4.70

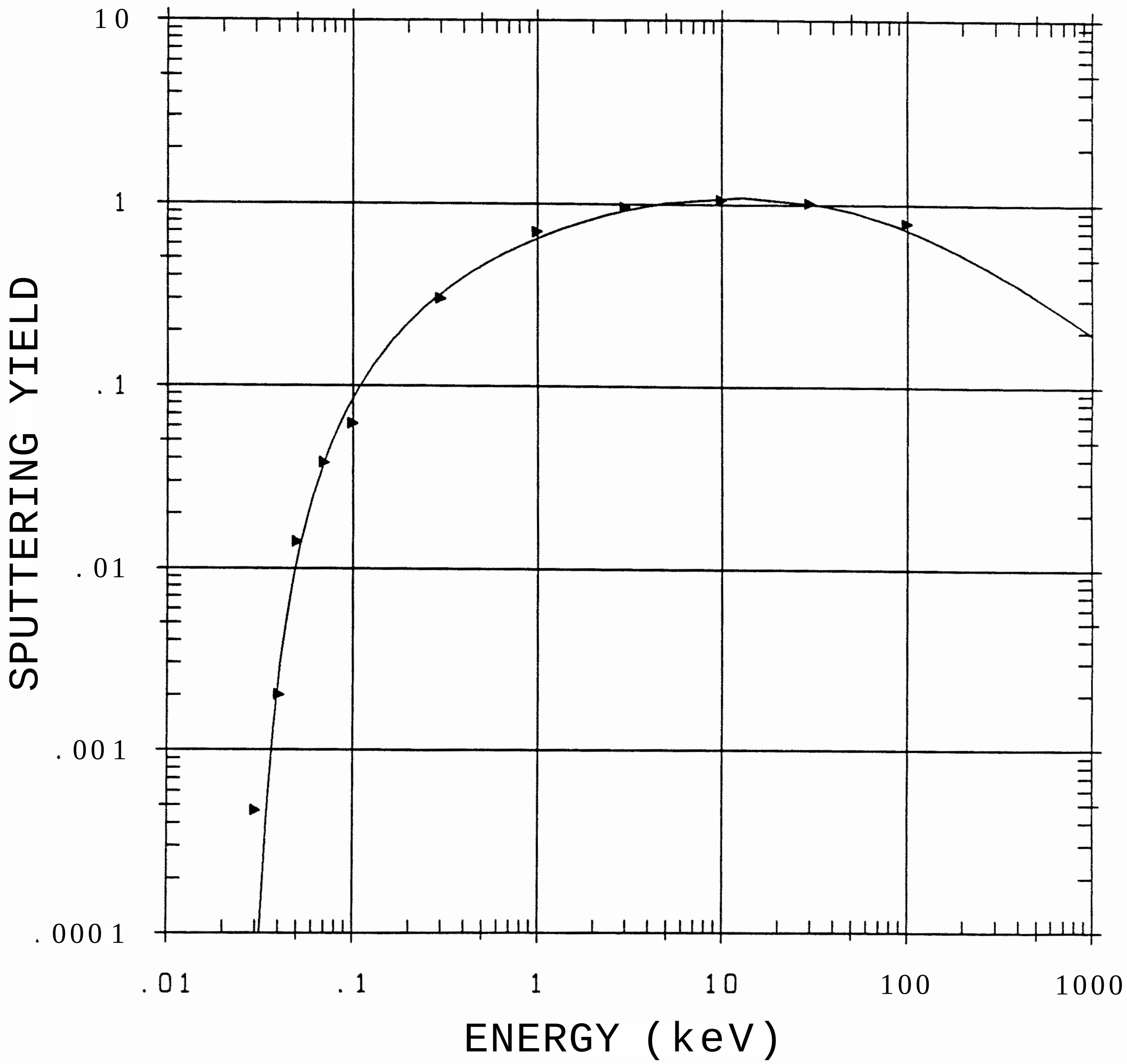
Target	Proj.	Energy	Angle	Yield	Temp.	P	SBE
Si	D	0.050	0	0.003090	20	2.33	4.70
Si	D	0.100	0	0.011500	20	2.33	4.70
Si	D	0.200	0	0.020300	20	2.33	4.70
Si	D	0.500	0	0.024800	20	2.33	4.70
Si	D	1.000	0	0.023600	20	2.33	4.70
Si	D	2.000	0	0.019600	20	2.33	4.70
Si	D	5.000	0	0.012200	20	2.33	4.70

Target	Proj.	Energy	Angle	Yield	Temp.	P	SBE
Si	He	0.050	0	0.016400	20	2.32	4.70
Si	He	0.100	0	0.044300	20	2.32	4.70
Si	He	0.300	0	0.087700	20	2.32	4.70
Si	He	0.500	0	0.101000	20	2.32	4.70
Si	He	1.000	0	0.104000	20	2.32	4.70
Si	He	4.000	0	0.080800	20	2.32	4.70

Target: Si

Calculated Data

Target	Projectile	Angle	Symbol	E_{th}(eV)	Q(atoms/ion)
Si	Si	0	▶	29.1	2.86



Calculated Data

Target	Proj.	Energy	Angle	Yield	Temp.	*p*	SBE
Si	Si	0.030	0	0.000470	20	2.32	4.70
Si	Si	0.040	0	0.002000	20	2.32	4.70
Si	Si	0.050	0	0.014000	20	2.32	4.70
Si	Si	0.070	0	0.038000	20	2.32	4.70
Si	Si	0.100	0	0.062000	20	2.32	4.70
Si	Si	0.300	0	0.300000	20	2.32	4.70
Si	Si	1.000	0	0.700000	20	2.32	4.70
Si	Si	3.000	0	0.960000	20	2.32	4.70
Si	Si	10.000	0	1.060000	20	2.32	4.70
Si	Si	30.000	0	1.020000	20	2.32	4.70
Si	Si	100.000	0	0.790000	20	2.32	4.70

Calculated Data

Target	Projectile	Angle	Symbol	Eth(eV)	Q(atoms/ion)
Si	Ne	0	■	27.9	2.15
Si	Ar	0	♦	44.5	4.01
Si	Kr	0	•	66.7	6.88
Si	Xe	0	A	73.3	9.59

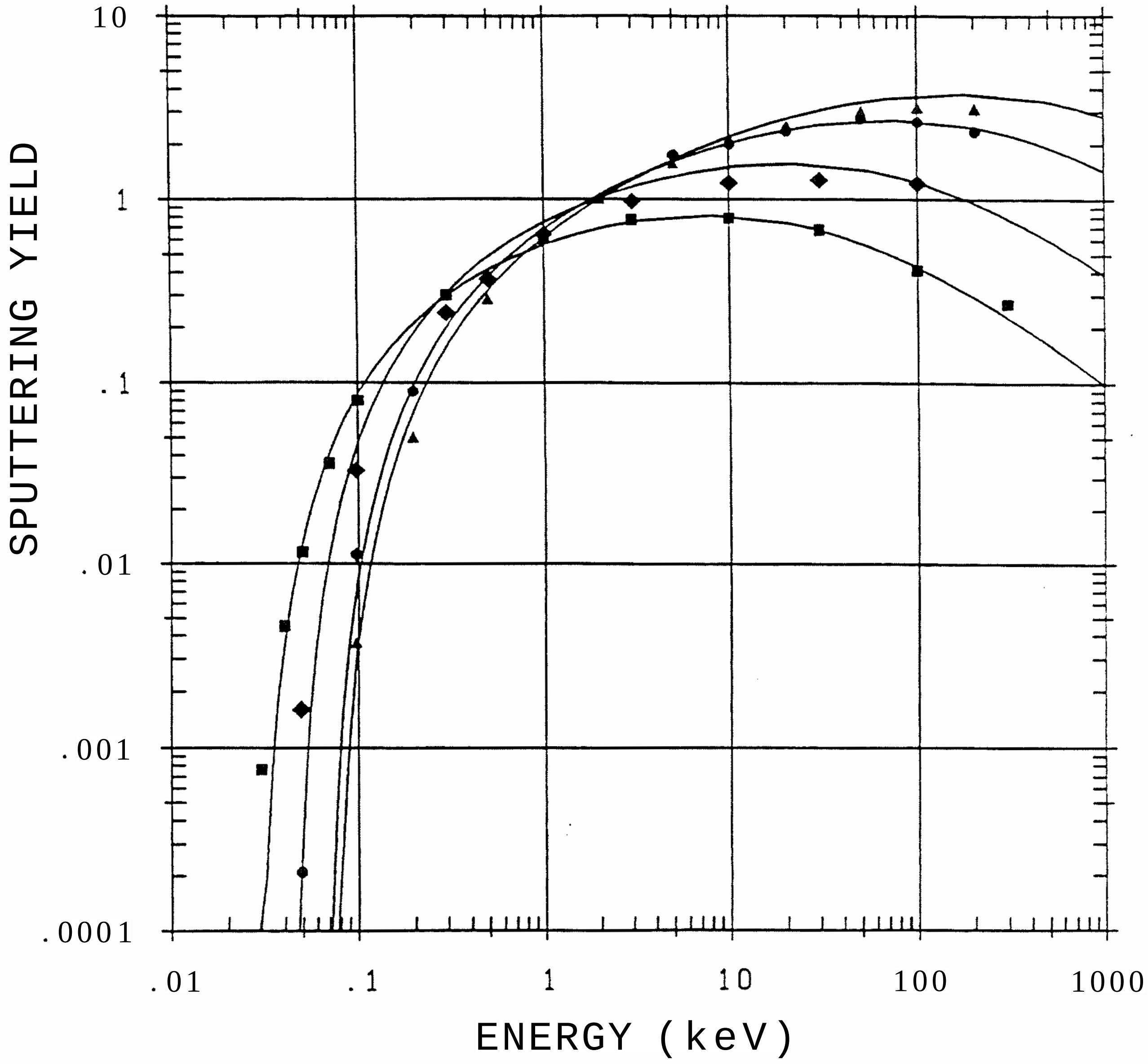


Fig. 36: Energy dependence of the sputtering yield of Si with Ne, Ar, Kr and Xe. The data are published in [58],

Calculated Data

Target	Proj.	Energy	Angle	Yield	Temp.	p	SEE
Si	Ne	0.030	0	0.000760	20	2.32	4.70
Si	Ne	0.040	0	0.004500	20	2.32	4.70
Si	Ne	0.050	0	0.011500	20	2.32	4.70
Si	Ne	0.070	0	0.036000	20	2.32	4.70
Si	Ne	0.100	0	0.080000	20	2.32	4.70
Si	Ne	0.300	0	0.300000	20	2.32	4.70
Si	Ne	1.000	0	0.620000	20	2.32	4.70
Si	Ne	3.000	0	0.770000	20	2.32	4.70
Si	Ne	10.000	0	0.790000	20	2.32	4.70
Si	Ne	30.000	0	0.680000	20	2.32	4.70
Si	Ne	100.000	0	0.410000	20	2.32	4.70
Si	Ne	300.000	0	0.270000	20	2.32	4.70

Target	Proj.	Energy	Angle	Yield	Temp.	p	SBE
Si	Ar	0.050	0	0.001600	20	2.33	4.70
Si	Ar	0.100	0	0.032000	20	2.33	4.70
Si	Ar	0.300	0	0.230000	20	2.33	4.70
Si	Ar	0.500	0	0.350000	20	2.33	4.70
Si	Ar	1.000	0	0.620000	20	2.33	4.70
Si	Ar	3.000	0	0.950000	20	2.33	4.70
Si	Ar	10.000	0	1.200000	20	2.33	4.70
Si	Ar	30.000	0	1.250000	20	2.33	4.70
Si	Ar	100.000	0	1.200000	20	2.33	4.70

Target	Proj.	Energy	Angle	Yield	Temp.	p	SBE
Si	Kr	0.050	0	0.000210	20	2.33	4.70
Si	Kr	0.100	0	0.011000	20	2.33	4.70
Si	Kr	0.200	0	0.086000	20	2.33	4.70
Si	Kr	0.500	0	0.350000	20	2.33	4.70
Si	Kr	1.000	0	0.630000	20	2.33	4.70
Si	Kr	5.000	0	1.700000	20	2.33	4.70
Si	Kr	10.000	0	1.950000	20	2.33	4.70
Si	Kr	20.000	0	2.300000	20	2.33	4.70
Si	Kr	50.000	0	2.700000	20	2.33	4.70
Si	Kr	100.000	0	2.600000	20	2.33	4.70
Si	Kr	200.000	0	2.300000	20	2.33	4.70

Target	Proj.	Energy	Angle	Yield	Temp.	p	SBE
Si	Xe	0.050	0	0.000040	20	2.33	4.70
Si	Xe	0.100	0	0.003650	20	2.33	4.70
Si	Xe	0.200	0	0.048300	20	2.33	4.70
Si	Xe	0.500	0	0.274000	20	2.33	4.70
Si	Xe	1.000	0	0.584000	20	2.33	4.70
Si	Xe	2.000	0	0.976000	20	2.33	4.70
Si	Xe	5.000	0	1.540000	20	2.33	4.70
Si	Xe	10.000	0	2.090000	20	2.33	4.70
Si	Xe	20.000	0	2.510000	20	2.33	4.70
Si	Xe	50.000	0	2.990000	20	2.33	4.70
Si	Xe	100.000	0	3.130000	20	2.33	4.70
Si	Xe	200.000	0	3.100000	20	2.33	4.70

Target: Sm

Calculated Data

Target	Projectile	Angle	Symbol	E_{th}(eV)	Q(atoms/ion)
					369

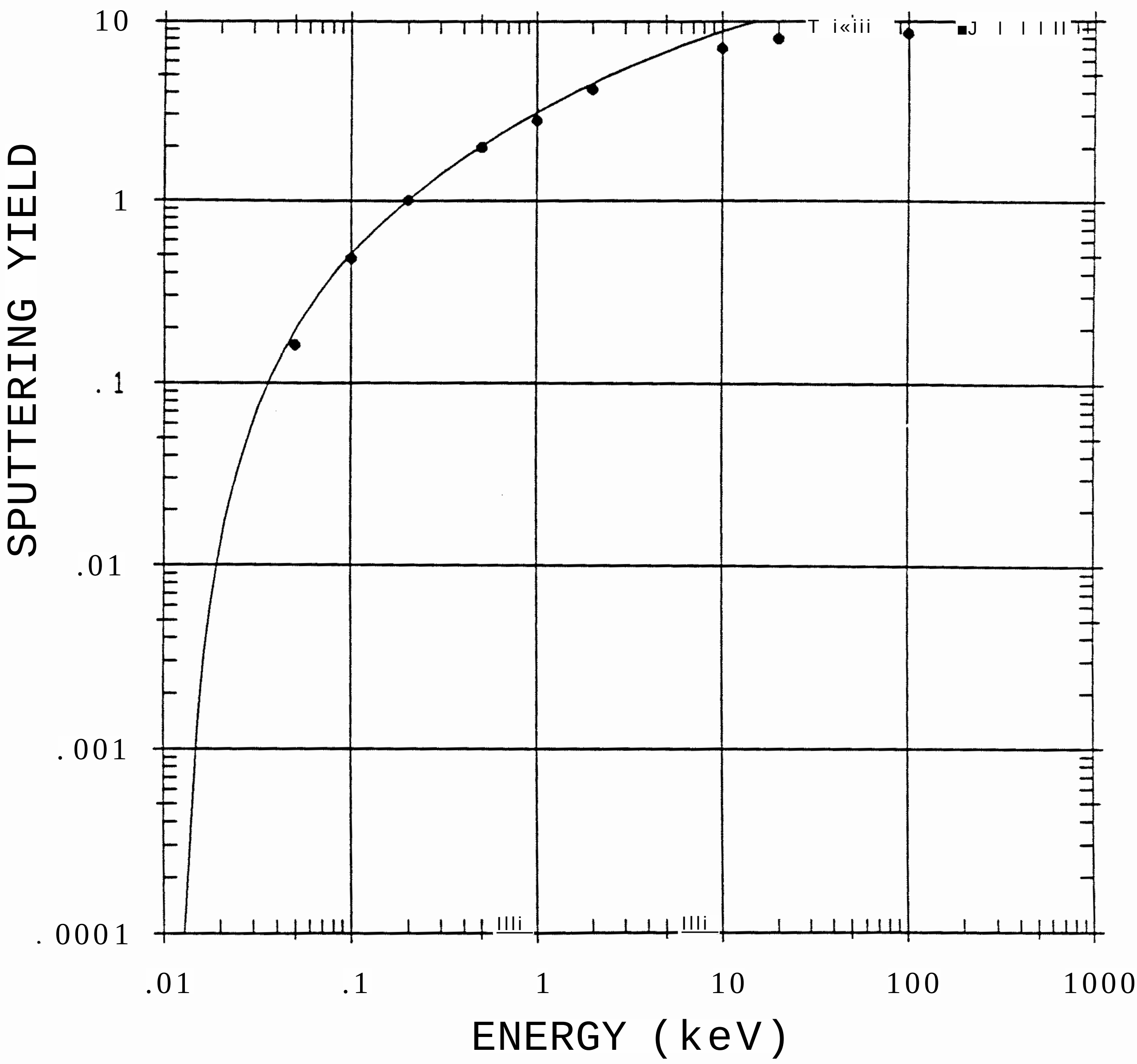


Fig. 37: Energy dependence of the sputtering yield of Sm with Kr. The data are unpublished.

Calculated Data

Target	Proj.	Energy	Angle	Yield	Temp.	p	SBE
Sm	Kr	0.001	0	5.470000	20	7.54	2.16
Sm	Kr	0.050	0	0.162000	20	7.54	2.16
Sm	Kr	0.100	0	0.482000	20	7.54	2.16
Sm	Kr	0.200	0	1.010000	20	7.54	2.16
Sm	Kr	0.500	0	1.980000	20	7.54	2.16
Sm	Kr	1.000	0	2.800000	20	7.54	2.16
Sm	Kr	2.000	0	4.150000	20	7.54	2.16
Sm	Kr	10.000	0	7.080000	20	7.54	2.16
Sm	Kr	20.000	0	7.990000	20	7.54	2.16
Sm	Kr	50.000	0	8.650000	20	7.54	2.16
Sm	Kr	100.000	0	8.550000	20	7.54	2.16
Sm	Kr	200.000	0	7.920000	20	7.54	2.16

Target: Ta

Experimental Data

Target	Projectile	Angle	Symbol	F.h(eV)	Q(atoms/ion)
Ta	H	0	□	737.	$0.800 \cdot 10^{-2}$
Ta	D	0	◇	315.	0.0210
Ta	Be	0	△	90.0	0.0870

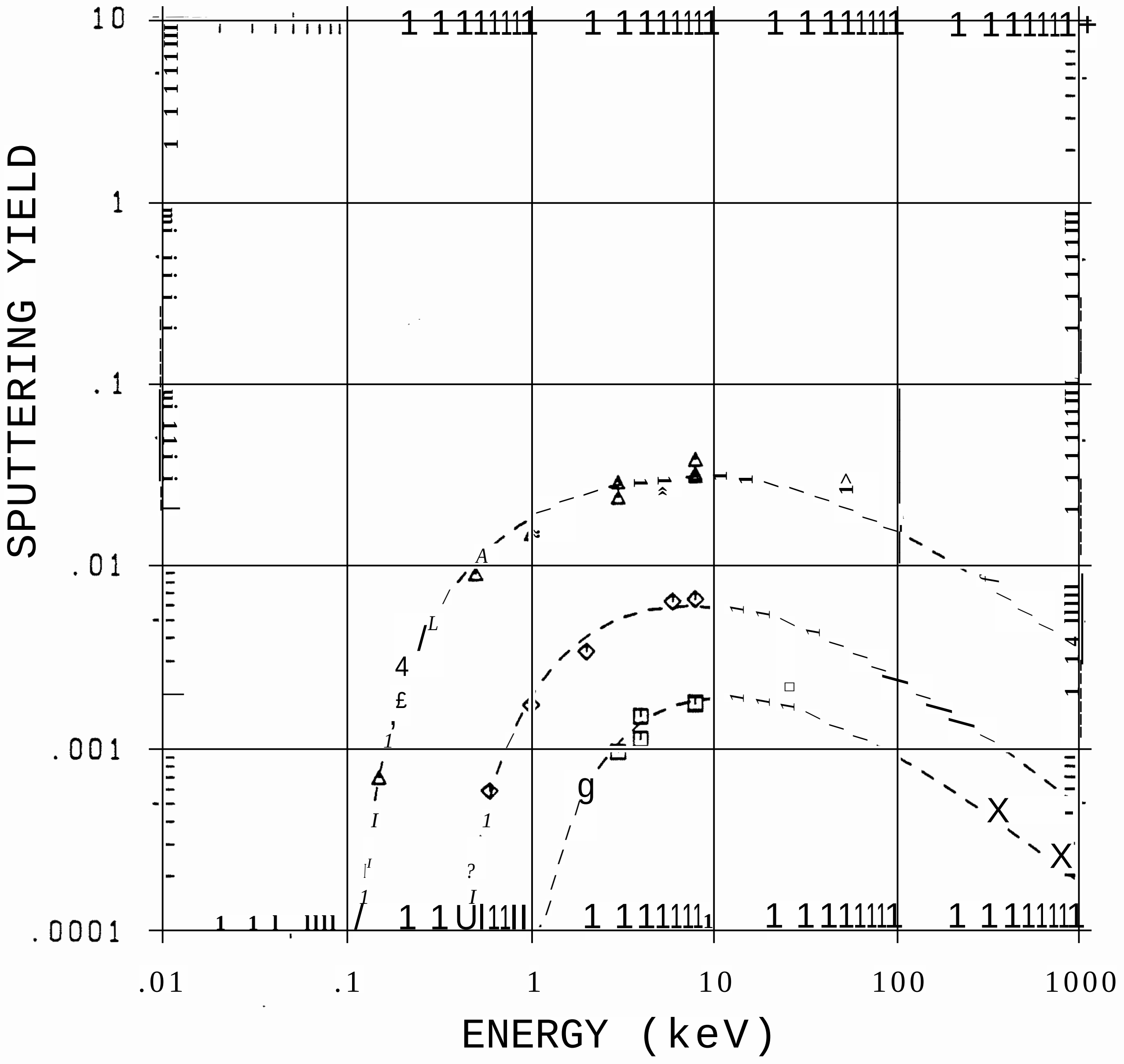


Fig. 38: Energy dependence of the sputtering yield of Ta with H, D and ^{4}He. The data are published in [41,48].

Experimental Data

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
Ta	H	2.000	0	0.00061	20	3			1976
Ta	H	2.000	0	0.00068	20	3			1976
Ta	H	3.000	0	0.00097	20	3			1976
Ta	H	4.000	0	0.00114	20	2			1976
Ta	H	4.000	0	0.00152	20	2			1976
Ta	H	8.000	0	0.00180	20	1	III	47	10.02.1978
Ta	H	8.000	0	0.00177	20	1			1976
Ta	H	25.000	0	0.00232	20	1			1976

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
Ta	D	0.500	0	0.00025	20	3	III	113	20.07.1978
Ta	D	0.600	0	0.00059	20	3	III	114	21.07.1978
Ta	D	1.000	0	0.00175	20	3	III	113	20.07.1978
Ta	D	2.000	0	0.00341	20	3	III	113	21.07.1978
Ta	D	6.000	0	0.00640	20	1			1976
Ta	D	8.000	0	0.00660	20	1	III	48	17.02.1978

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
Ta	He	0.150	0	0.00070	20	1			SOS 1980
Ta	He	0.200	0	0.00293	20	1	III	74	27.04.1978
Ta	He	0.200	0	0.00200	20	1	III	165	29.11.1978
Ta	He	0.300	0	0.00495	20	1	III	74	28.01.1978
Ta	He	0.500	0	0.00907	20	1	III	74	28.04.1978
Ta	He	0.600	0	0.01200	20	1			SOS 1980
Ta	He	1.000	0	0.01510	20	1	III	75	02.05.1978
Ta	He	3.000	0	0.02400	20	1	III	75	02.05.1978
Ta	He	3.000	0	0.02900	20	1			SOS 1980
Ta	He	6.000	0	0.02700	20	1			1976
Ta	He	6.000	0	0.02800	20	1			1976
Ta	He	8.000	0	0.03900	20	1	III	43	31.01.1978
Ta	He	8.000	0	0.03140	20	1	III	43	31.01.1978
Ta	He	8.000	0	0.03250	20	1	III	44	01.02.1978
Ta	He	50.000	0	0.02780	20	1			PHARAO76
Ta	He	100.000	0	0.02010	20	1			PHARAO76

Target: Ta

Experimental Data

Target	Projectile	Angle	Symbol	$E_{th}(eV)$	Q(atoms/ion)
Ta	Ne	0	□	36.2	2.60
Ta	Ar	0	*O*	32.2	6.90
Ta	Kr	0	o	30.4	14.1
Ta	Xe	0	A	36.2	20.1

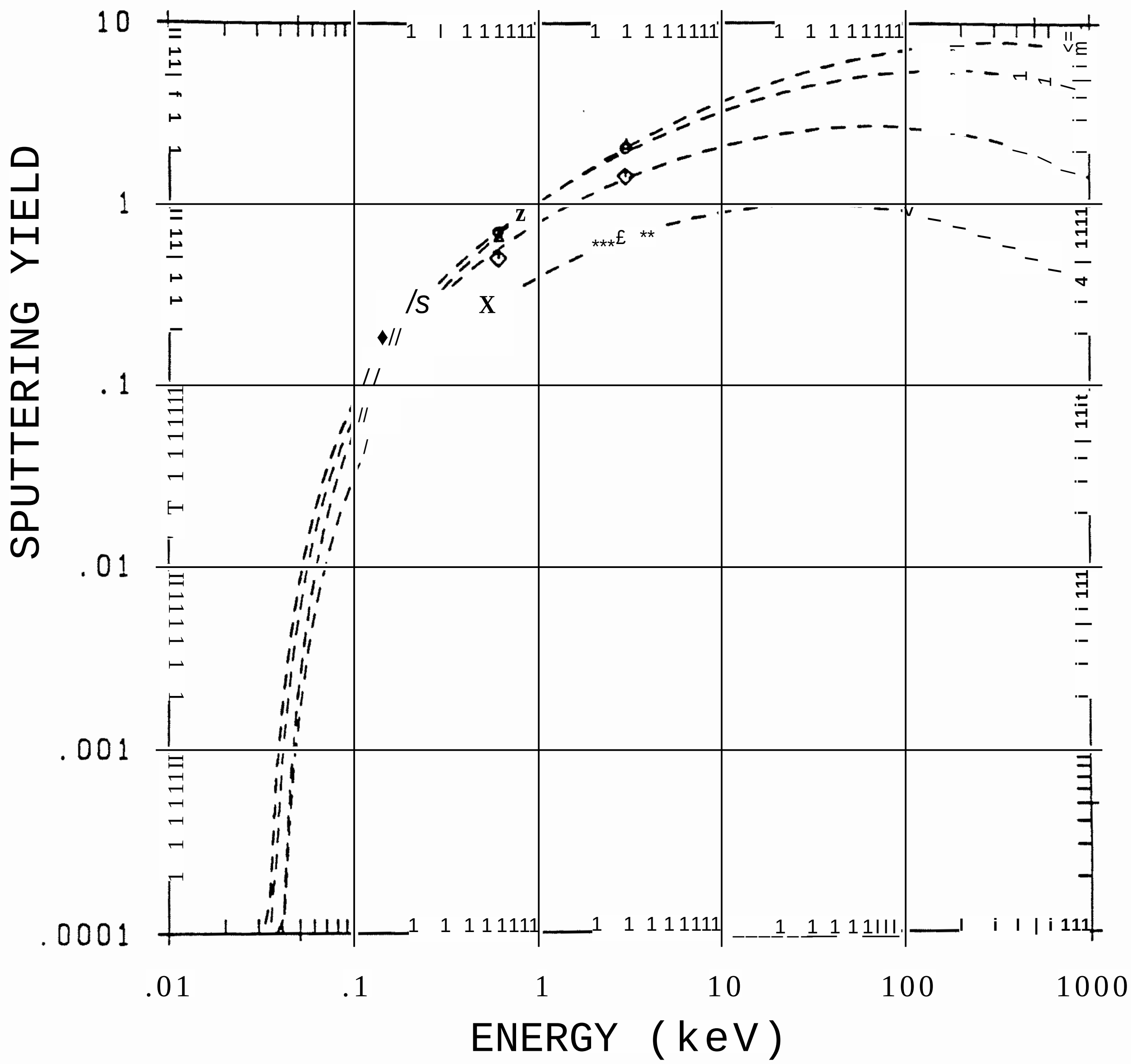


Fig. 39: Energy dependence of the sputtering yield of Ta with Ne , Ar , Kr and Xe. The data are published in [60].

Experimental Data

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
Ta	Ne	0.150	0	0.07000	20	1			HECHTL1980
Ta	Ne	0.600	0	0.28000	20	1			HECHTL1980
Ta	Ne	3.000	0	0.65000	20	1			HECHTL1980

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
Ta	Ar	0.150	0	0.20000	20	1			HECHTL1980
Ta	Ar	0.600	0	0.50000	20	1			HECHTL1980
Ta	Ar	3.000	0	1.40000	20	1			HECHTL1980

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
Ta	Kr	0.150	0	0.19000	20	1			HECHTL1980
Ta	Kr	0.600	0	0.69000	20	1			HECHTL1980
Ta	Kr	3.000	0	2.00000	20	1			HECHTL1980

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
Ta	Xe	0.150	0	0.15000	20	1			HECHTL1980
Ta	Xe	0.600	0	0.66000	20	1			HECHTL1980
Ta	Xe	3.000	0	2.10000	20	1			HECHTL1980

Experimental Data

Target	Projectile	Angle	Symbol	$E_{th}(eV)$	Q(atoms/ion)
Ti	H	0	□	69.2	0.0157
Ti	D	0	0	33.2	0.0542

Calculated Data

Target	Projectile	Angle	Symbol	E<x(eV)	Q(atoms/ion)
Ti	D	0	♦	33.9	0.0754
Ti	Ti	0	▶	40.4	4.63

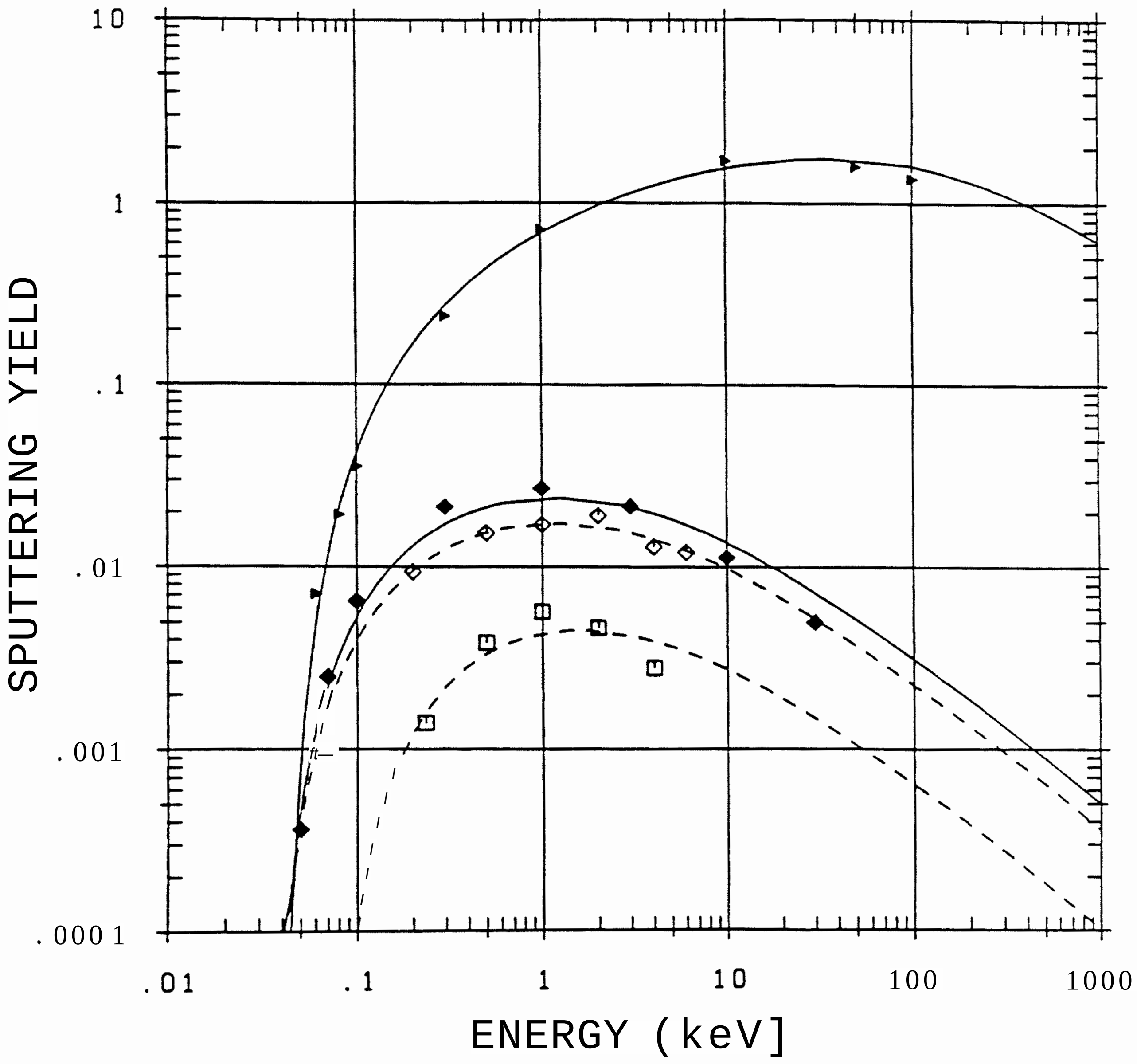


Fig. 40: Energy dependence of the sputtering yield of Ti with H, D and Ti. The experimental data using the weight loss method were measured at 600°C to avoid weight increase due to hydrogen retention at room temperature [41]. They are used to calibrate data obtained by Laser fluorescence spectroscopy [61].

Experimental Data

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
Ti	H	0.233	0	0.00140	600	3	VII	23	15.11.1983
Ti	H	0.500	0	0.00385	600	3	VII	24	22.11.1983
Ti	H	1.000	0	0.00569	600	3	VII	22	14.11.1983
Ti	H	2.000	0	0.00465	600	3	VII	23	21.11.1983
Ti	H	4.000	0	0.00280	600	1	VII	24	21.11.1983

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
Ti	D	0.200	0	0.00938	600	3	VII	24	22.11.1983
Ti	D	0.500	0	0.01540	600	3	VII	25	23.11.1983
Ti	D	1.000	0	0.01720	600	3	VII	25	23.11.1983
Ti	D	2.000	0	0.01930	600	3	VII	25	23.11.1983
Ti	D	4.000	0	0.01290	600	1	VII	31	30.11.1983
Ti	D	6.000	0	0.01210	600	1	VII	26	23.11.1983

Calculated Data

Target	Proj.	Energy	Angle	Yield	Temp.	P	SBE
Ti	D	0.050	0	0.000364	20	4.52	4.89
Ti	D	0.070	0	0.002490	20	4.52	4.89
Ti	D	0.100	0	0.006530	20	4.52	4.89
Ti	D	0.300	0	0.021400	20	4.52	4.89
Ti	D	1.000	0	0.027200	20	4.52	4.89
Ti	D	3.000	0	0.021700	20	4.52	4.89
Ti	D	10.000	0	0.011300	20	4.52	4.89
Ti	D	30.000	0	0.005000	20	4.52	4.89

Target	Proj.	Energy	Angle	Yield	Temp.	P	SBE
Ti	Ti	0.060	0	0.007140	20	4.52	4.89
Ti	Ti	0.080	0	0.019600	20	4.52	4.89
Ti	Ti	0.100	0	0.036200	20	4.52	4.89
Ti	Ti	0.300	0	0.241000	20	4.52	4.89
Ti	Ti	1.000	0	0.716000	20	4.52	4.89
Ti	Ti	10.000	0	1.730000	20	4.52	4.89
Ti	Ti	50.000	0	1.620000	20	4.52	4.89
Ti	Ti	100.000	0	1.390000	20	4.52	4.89

Target: Ti

Experimental Data

Target	Projectile	Angle	Symbol	$E_{th}(eV')$	Q(atoms/ion)
~Ti	Be	Ö	Z	351	0.234

Calculated Data

Target	Projectile	Angle	Symbol	Eth(eV)	Q(atoms/ion)
~Ti	He	Ö	I	2L2	0.295
Ti	Ne	0	1	22.0	3.00

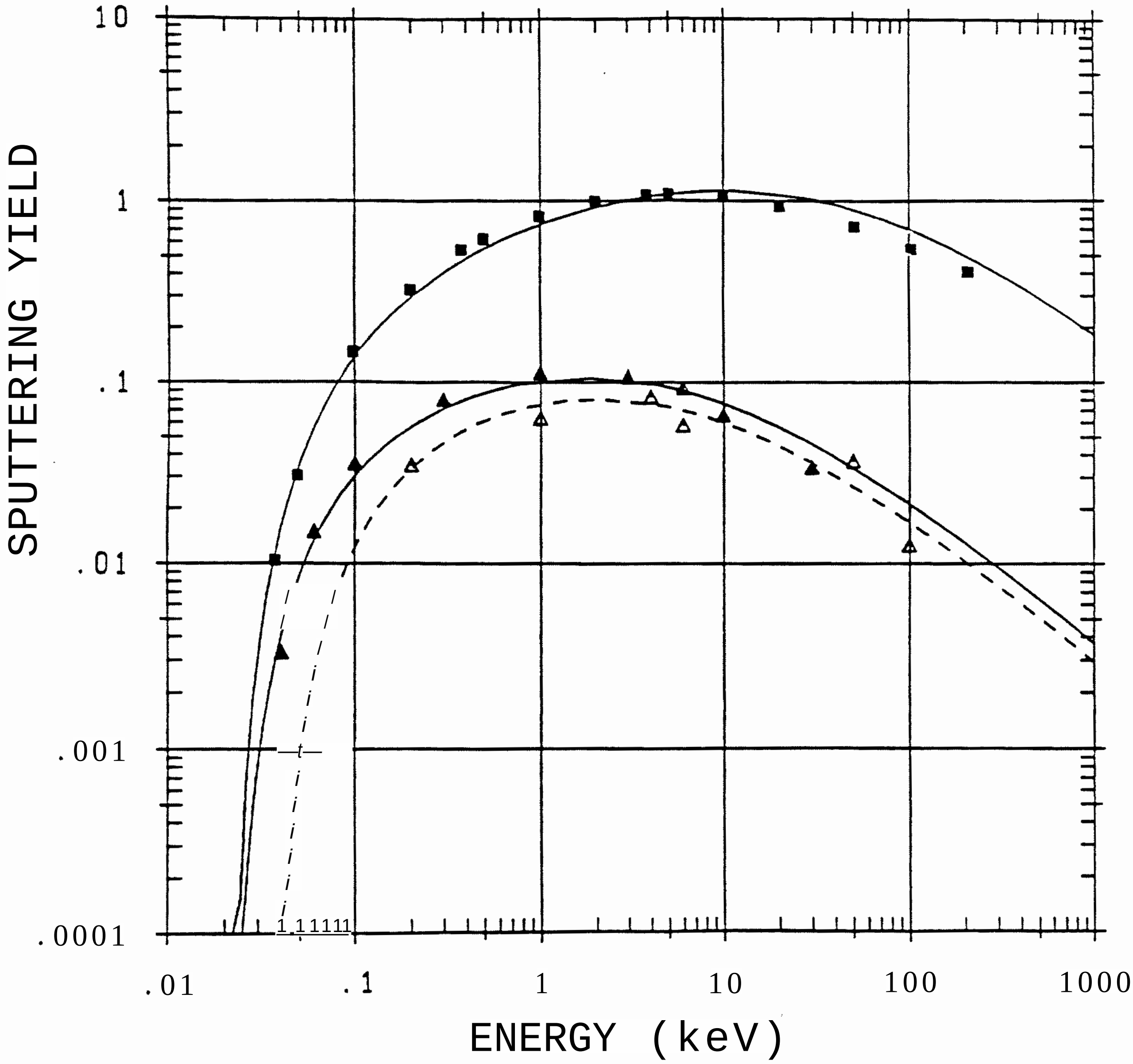


Fig. 41: Energy dependence of the sputtering yield of Ti with He and Ne. The experimental data were measured at 600°C to avoid weight increase due to helium retention at room temperature. The data are published in [41,48,61].

Experimental Data

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
Ti	He	0.200	0	0.03500	600	1	VII	28	24.11.1983
Ti	He	1.000	0	0.06360	600	1	VII	27	24.11.1983
Ti	He	4.000	0	0.08360	600	1	VII	27	24.11.1983
Ti	He	6.000	0	0.09300	600	1	VII	27	24.11.1983
Ti	He	6.000	0	0.05830	600	1	VII	31	30.11.1983
Ti	He	50.000	0	0.03700	20	1			PHARAO82
Ti	He	100.000	0	0.01260	20	1			PHARAO82

Calculated Data

Target	Proj.	Energy	Angle	Yield	Temp.	p	SBE
Ti	He	0.040	0	0.003310	20	4.52	4.89
Ti	He	0.060	0	0.015000	20	4.52	4.89
Ti	He	0.100	0	0.035800	20	4.52	4.89
Ti	He	0.300	0	0.080900	20	4.52	4.89
Ti	He	1.000	0	0.113000	20	4.52	4.89
Ti	He	3.000	0	0.107000	20	4.52	4.89
Ti	He	10.000	0	0.066300	20	4.52	4.89
Ti	He	30.000	0	0.034000	20	4.52	4.89

Target	Proj.	Energy	Angle	Yield	Temp.	P	SBE
Ti	Ne	0.038	0	0.010200	20	4.51	4.89
Ti	Ne	0.050	0	0.030000	20	4.51	4.89
Ti	Ne	0.100	0	0.145000	20	4.51	4.89
Ti	Ne	0.200	0	0.323000	20	4.51	4.89
Ti	Ne	0.380	0	0.533000	20	4.51	4.89
Ti	Ne	0.500	0	0.614000	20	4.51	4.89
Ti	Ne	1.000	0	0.820000	20	4.51	4.89
Ti	Ne	2.000	0	0.998000	20	4.51	4.89
Ti	Ne	3.800	0	1.080000	20	4.51	4.89
Ti	Ne	5.000	0	1.090000	20	4.51	4.89
Ti	Ne	10.000	0	1.080000	20	4.51	4.89
Ti	Ne	20.000	0	0.940000	20	4.51	4.89
Ti	Ne	50.000	0	0.732000	20	4.51	4.89
Ti	Ne	100.000	0	0.551000	20	4.51	4.89
Ti	Ne	200.000	0	0.414000	20	4.51	4.89

Calculated Data

Target	Projectile	Angle	Symbol	$E_{th}(eV)$	Q(atoms/ion)
U	He	0	A	76.3	0.200
U	Ne	0	■	30.0	4.61
U	Ar	0	♦	22.0	11.0
U	u	0	▶	45.1	63.3

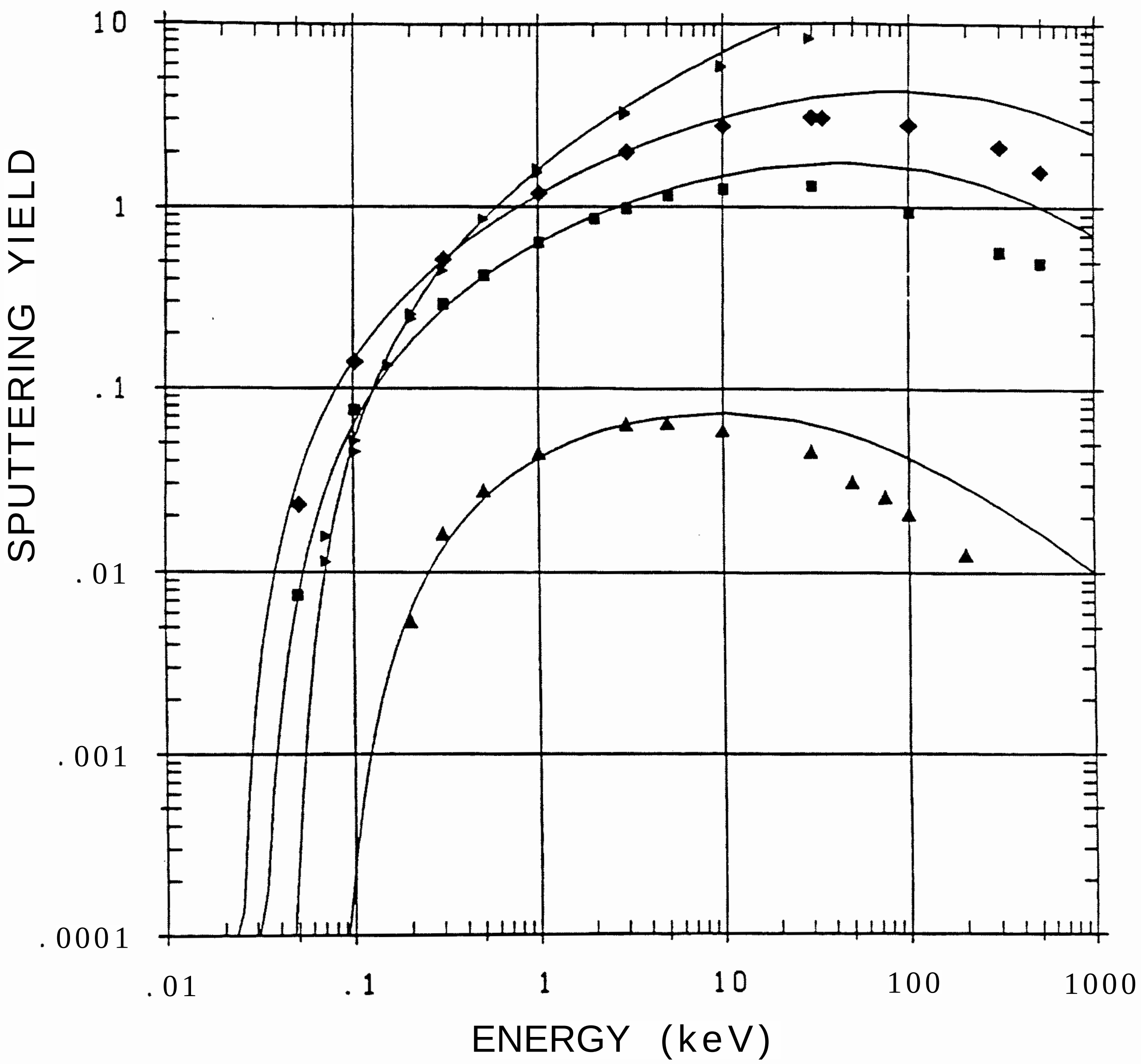


Fig. 42: Energy dependence of the sputtering yield of U with He, Ne, Ar and U. The data are partly published in [38].

Calculated Data

Target	Proj.	Energy	Angle	Yield	Temp.	P	SBE
U	He	0.200	0	0.005400	20	19.07	5.42
U	He	0.300	0	0.016300	20	19.07	5.42
U	He	0.500	0	0.027700	20	19.07	5.42
U	He	1.000	0	0.044500	20	19.07	5.42
U	He	3.000	0	0.064000	20	19.07	5.42
U	He	5.000	0	0.065400	20	19.07	5.42
U	He	10.000	0	0.059400	20	19.07	5.42
U	He	30.000	0	0.045700	20	19.07	5.42
U	He	50.000	0	0.031200	20	19.07	5.42
U	He	75.000	0	0.025900	20	19.07	5.42
U	He	100.000	0	0.020900	20	19.07	5.42
U	He	200.000	0	0.012600	20	19.07	5.42

Target	Proj.	Energy	Angle	Yield	Temp.	P	SBE
U	Ne	0.050	0	0.007300	20	19.07	5.42
U	Ne	0.100	0	0.075600	20	19.07	5.42
U	Ne	0.300	0	0.296000	20	19.07	5.42
U	Ne	0.500	0	0.426000	20	19.07	5.42
U	Ne	1.000	0	0.646000	20	19.07	5.42
U	Ne	2.000	0	0.872000	20	19.07	5.42
U	Ne	3.000	0	0.997000	20	19.07	5.42
U	Ne	5.000	0	1.170000	20	19.07	5.42
U	Ne	10.000	0	1.280000	20	19.07	5.42
U	Ne	30.000	0	1.340000	20	19.07	5.42
U	Ne	100.000	0	0.968000	20	19.07	5.42
U	Ne	300.000	0	0.584000	20	19.07	5.42
U	Ne	500.000	0	0.512000	20	19.07	5.42

Target	Proj.	Energy	Angle	Yield	Temp.	P	SBE
U	Ar	0.050	0	0.022200	20	19.07	5.42
U	Ar	0.100	0	0.137000	20	19.07	5.42
U	Ar	0.300	0	0.507000	20	19.07	5.42
U	Ar	1.000	0	1.190000	20	19.07	5.42
U	Ar	3.000	0	2.000000	20	19.07	5.42
U	Ar	10.000	0	2.770000	20	19.07	5.42
U	Ar	30.000	0	3.080000	20	19.07	5.42
U	Ar	34.300	0	3.050000	20	19.07	5.42
U	Ar	100.000	0	2.770000	20	19.07	5.42
U	Ar	300.000	0	2.100000	20	19.07	5.42
U	Ar	500.000	0	1.540000	20	19.07	5.42

Target	Proj.	Energy	Angle	Yield	Temp.	P	SBE
U	U	0.070	0	0.015300	20	19.07	5.42
U	U	0.070	0	0.011100	20	19.07	5.42
U	U	0.100	0	0.051700	20	19.07	5.42
U	U	0.100	0	0.045000	20	19.07	5.42
U	U	0.150	0	0.138000	20	19.07	5.42
U	U	0.200	0	0.266000	20	19.07	5.42
U	U	0.200	0	0.250000	20	19.07	5.42
U	U	0.300	0	0.460000	20	19.07	5.42
U	U	0.500	0	0.884000	20	19.07	5.42
U	U	1.000	0	1.670000	20	19.07	5.42
U	U	1.000	0	1.600000	20	19.07	5.42
U	U	3.000	0	3.410000	20	19.07	5.42
U	U	3.000	0	3.300000	20	19.07	5.42
U	U	10.000	0	6.120000	20	19.07	5.42
U	U	10.000	0	6.000000	20	19.07	5.42
U	U	30.000	0	8.500000	20	19.07	5.42
U	U	100.000	0	11.400000	20	19.07	5.42

Calculated Data

Target	Projectile	Angle	Symbol	*Eth(eV)*	Q(atoms/ion)
U	Kr	0	•	25.3	24.8
U	Xe	0	▼	33.9	37.9
U	Rn	0	◄	43.3	55.0

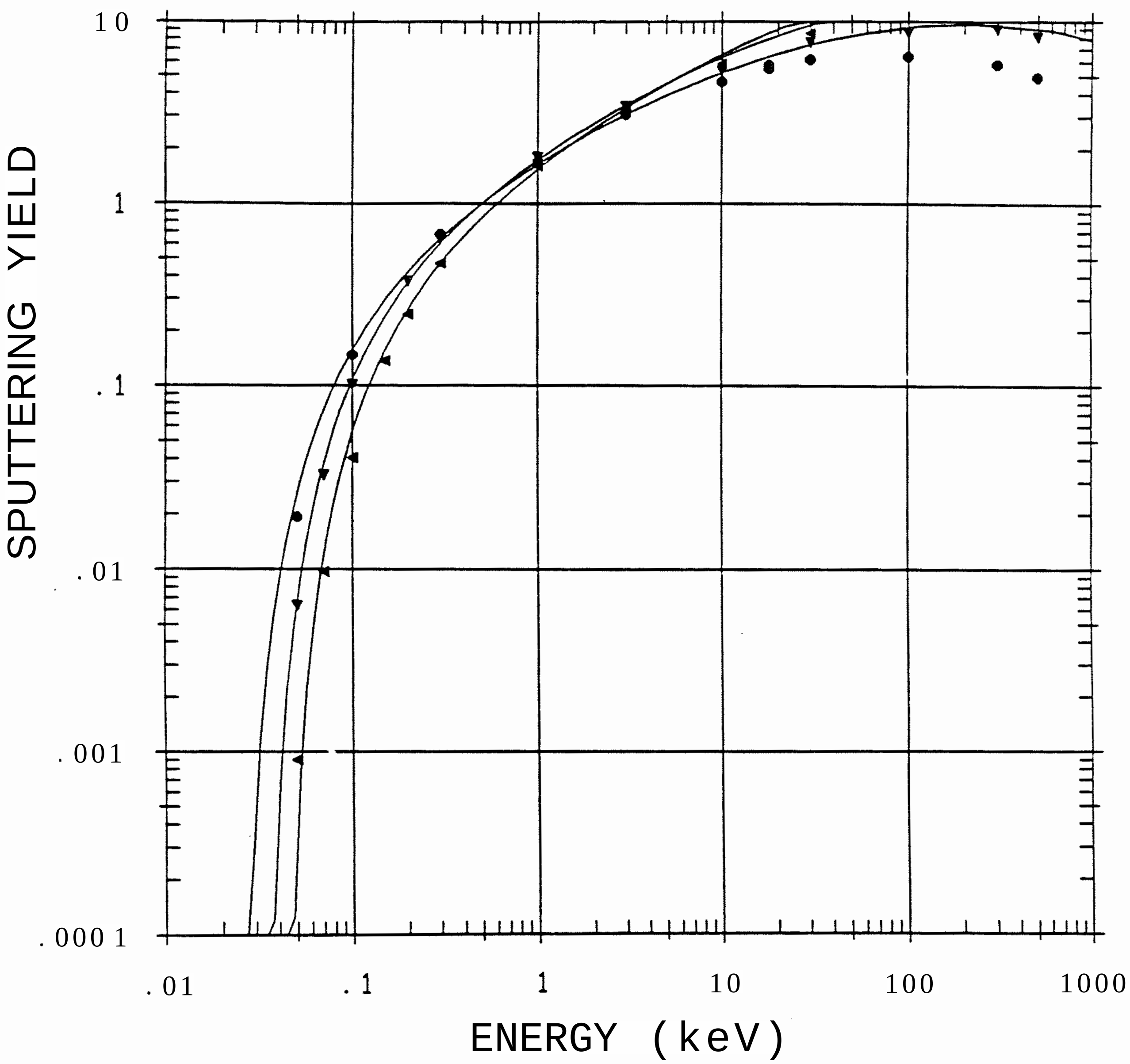


Fig. 43: Energy dependence of the sputtering yield of U with Kr, Xe and Rn. The data are unpublished.

Calculated Data

Target	Proj.	Energy	Angle	Yield	Temp.	p	SBE
U	Kr	0.050	0	0.019300	20	19.07	5.42
U	Kr	0.100	0	0.148000	20	19.07	5.42
U	KT	0.300	0	0.678000	20	19.07	5.42
U	Kr	1.000	0	1.700000	20	19.07	5.42
u	Kr	3.000	0	3.090000	20	19.07	5.42
u	Kr	10.000	0	4.670000	20	19.07	5.42
u	Kr	17.900	0	5.760000	20	19.07	5.42
u	Kr	17.930	0	5.470000	20	19.07	5.42
u	Kr	30.000	0	6.120000	20	19.07	5.42
u	Kr	100.000	0	6.370000	20	19.07	5.42
u	Kr	300.000	0	5.800000	20	19.07	5.42
u	Kr	500.000	0	4.930000	20	19.07	5.42

Target	Proj.	Energy	Angle	Yield	Temp.	P	SBE
ü	x7~	0.050	0	0.006300	20	19.07	5.42
U	Xe	0.070	0	0.032600	20	19.07	5.42
U	Xe	0.100	0	0.101000	20	19.07	5.42
U	Xe	0.200	0	0.372000	20	19.07	5.42
U	Xe	0.300	0	0.633000	20	19.07	5.42
U	Xe	1.000	0	1.800000	20	19.07	5.42
U	Xe	3.000	0	3.410000	20	19.07	5.42
U	Xe	10.000	0	5.350000	20	19.07	5.42
U	Xe	30.000	0	7.580000	20	19.07	5.42
U	Xe	100.000	0	8.620000	20	19.07	5.42
U	Xe	300.000	0	8.980000	20	19.07	5.42
U	Xe	500.000	0	8.130000	20	19.07	5.42

Target	Proj.	Energy	Angle	Yield	Temp.	P	SBE
U	Rn	0.050	0	0.000900	20	19.07	5.42
U	Rn	0.070	0	0.009700	20	19.07	5.42
U	Rn	0.100	0	0.040500	20	19.07	5.42
U	Rn	0.150	0	0.137000	20	19.07	5.42
u	Rn	0.200	0	0.247000	20	19.07	5.42
u	Rn	0.300	0	0.469000	20	19.07	5.42
u	Rn	1.000	0	1.620000	20	19.07	5.42
u	Rn	3.000	0	3.300000	20	19.07	5.42
u	Rn	10.000	0	5.850000	20	19.07	5.42
u	Rn	30.000	0	8.550000	20	19.07	5.42
u	Rn	100.000	0	11.210000	20	19.07	5.42
u	Rn	300.000	0	12.530000	20	19.07	5.42

Target: V

Experimental Data

Target	Projectile	Angle	Symbol	$E_th(eV)$	Q(atoms/ion)
~	T	Ö	Ä	235	0.203

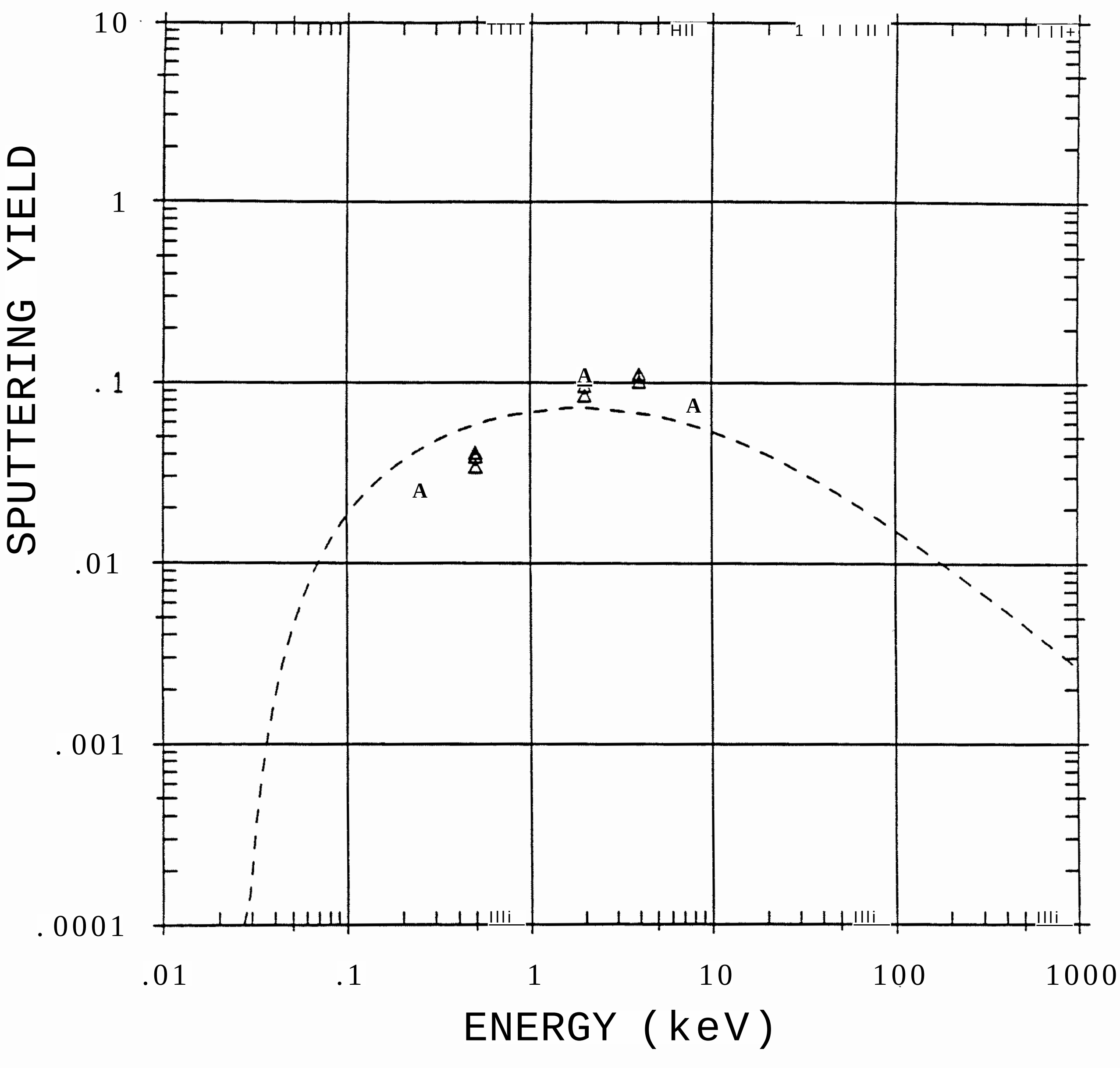


Fig. 44: Energy dependence of the sputtering yield of V with ^4He. The threshold energy was estimated for fitting. The data are published in [1].

Experimental Data

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
V	He	0.250	0	0.02530	20	1	III	11	12.10.1977
V	He	0.500	0	0.03400	20	1	II	183	01.09.1977
V	He	0.500	0	0.04090	20	1	II	183	01.09.1977
V	He	0.500	0	0.03900	20	1	III	9	05.10.1977
V	He	2.000	0	0.08520	20	1	II	181	25.08.1977
V	He	2.000	0	0.09640	560	1	III	11	13.10.1977
V	He	2.000	0	0.11100	380	1	III	12	13.10.1977
V	He	4.000	0	0.10200	20	1	II	177	10.08.1977
V	He	4.000	0	0.11200	20	1	II	177	11.08.1977
V	He	8.000	0	0.07620	20	1	II	182	29.08.1977

Target: W

Experimental Data

Target	Projectile	Angle	Symbol	E<h(eV)	Q(atoms/ion)
W	H	0	□	429.	0.700- IO“2
w	D	0	0	178.	0.0179
w	12c	0	□	27.6	0.780
w	W	0	t>	59.0	30.9

Calculated Data

Target	Projectile	Angle	Symbol	£,*(eV)	Q(atoms/ion)
W	D	0	♦	201.	0.0345
W	T	0	•	129.	0.0654
W	12C	0	■	47.2	1.42
W	W	0	▶	63.0	32.2

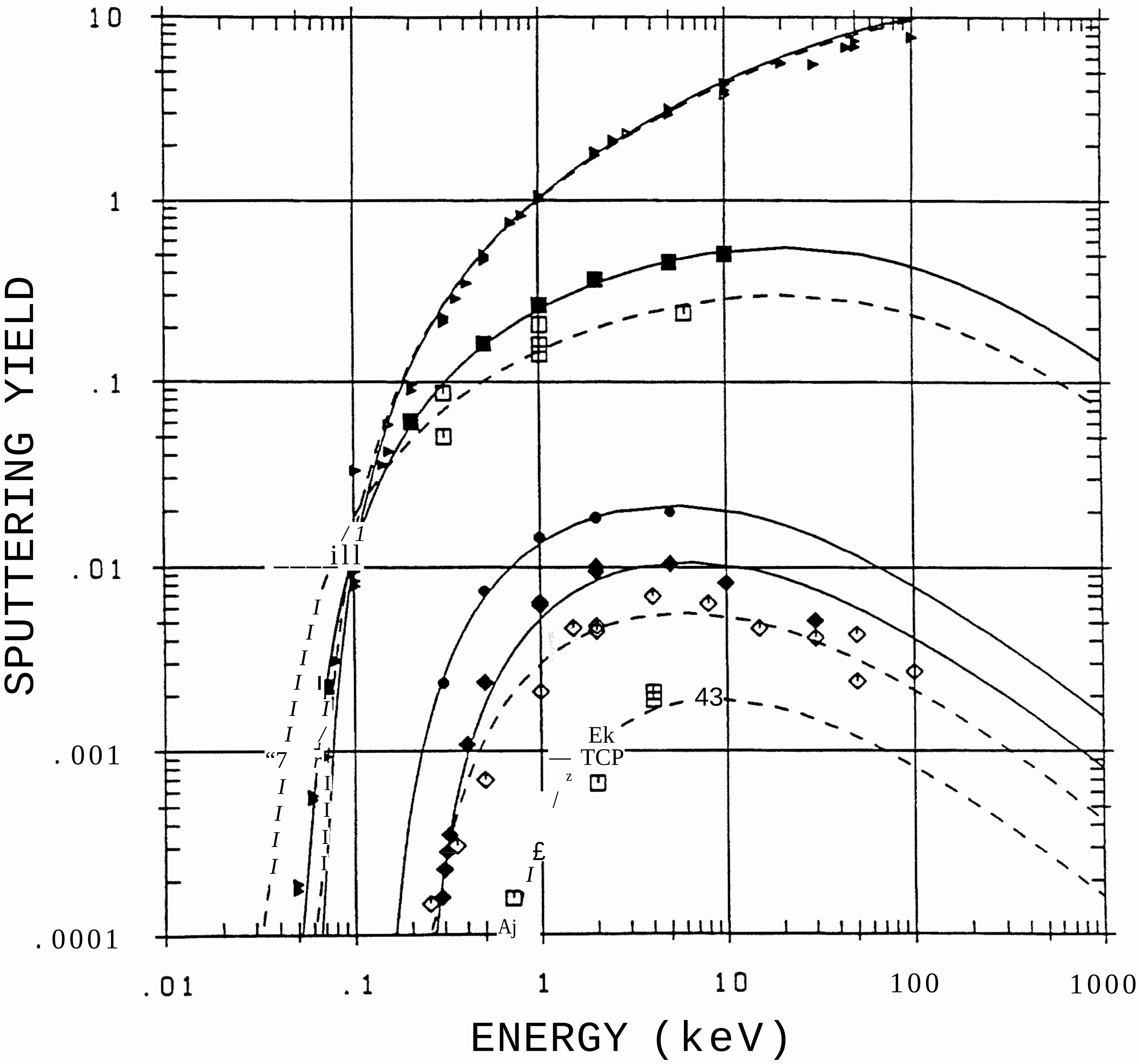


Fig. 45: Energy dependence of the sputtering yield of W with H, D, T, C and W. The data with C were measured at temperatures > 1200°C to avoid built-up of carbon layers. The data are partly published in [38,41,48,53,62,63]

Experimental Data

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
W	H	0.700	0	0.00010	20	3	III	30	08.12.1977
W	H	0.700	0	0.00011	20	3	V	58	05.12.1978
W	H	0.700	0	0.00016	20	3	V	60	14.01.1981
W	H	0.733	0	0.00009	520	3	III	66	12.04.1978
W	H	1.000	0	0.00032	20	3	III	17	02.11.1977
W	H	1.000	0	0.00036	20	3	III	47	14.02.1978
W	H	1.000	0	0.00033	20	3	V	57	02.12.1978
W	H	2.000	0	0.00094	20	3	III	19	07.11.1977
W	H	2.000	0	0.00067	20	3	V	57	01.12.1978
W	H	2.000	0	0.00125	20	3	V	177	26.05.1982
W	H	4.000	0	0.00190	20	2	III	29	06.12.1977
W	H	4.000	0	0.00209	20	2	III	156	09.10.1978
W	H	8.000	0	0.00206	20	1	III	30	07.12.1977
W	H	8.000	0	0.00198	20	3	V	58	04.12.1978

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
W	D	0.250	0	0.00015	20	3	III	33	16.12.1977
W	D	0.350	0	0.00031	20	3	III	33	15.12.1977
W	D	0.500	0	0.00070	20	3	III	23	15.11.1977
W	D	1.000	0	0.00211	20	3	III	23	14.11.1977
W	D	1.500	0	0.00470	20	3	III	87	07.06.1978
W	D	2.000	0	0.00456	20	3	III	21	10.11.1977
W	D	2.000	0	0.00483	20	3	V	61	16.01.1981
W	D	2.000	0	0.00452	20	3	V	64	28.01.1981
W	D	4.000	0	0.00700	20	2	III	33	14.12.1977
W	D	8.000	0	0.00638	20	1	III	32	14.12.1977
W	D	15.000	0	0.00470	20	1			PHARAO77
W	D	30.000	0	0.00415	20	1			PHARAO77
W	D	50.000	0	0.00240	20	1			PHARAO77
W	D	50.000	0	0.00434	20	1			PHARAO82
W	D	100.000	0	0.00270	20	1			PHARAO82

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
W	^{12}C	0.300	0	0.08920	1200	1	X	60	24.04.1989
W	^{12}C	0.300	0	0.05200	1400	1	X	61	25.04.1989
W	^{12}C	1.000	0	0.14600	1400	1	X	57	18.04.1989
W	^{12}C	1.000	0	0.16400	1200	1	X	58	19.04.1989
W	^{12}C	1.000	0	0.21000	1400	1	X	61	25.04.1989
w	^{12}C	6.000	0	0.24200	1200	1	X	59	20.04.1989

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
W	W	0.100	0	0.03300	20	1			HECHTL90
W	W	0.150	0	0.05900	20	1			HECHTL90
W	W	0.300	0	0.22700	20	1			HECHTL90
W	W	1.000	0	1.03000	20	1			HECHTL90
W	W	3.000	0	2.33000	20	1			HECHTL90
W	W	10.000	0	3.82000	20	1			HECHTL90

Calculated Data

Target	Proj.	Energy	Angle	Yield	Temp.	P	SEE
W	D	0.290	0	0.000162	20	19.30	8.68
w	D	0.300	0	0.000233	20	19.30	8.68
w	D	0.300	0	0.000230	20	19.30	8.68
w	D	0.310	0	0.000287	20	19.30	8.68
w	D	0.320	0	0.000355	20	19.30	8.68
w	D	0.400	0	0.001090	20	19.30	8.68
w	D	0.500	0	0.002370	20	19.30	8.68
w	D	1.000	0	0.006500	20	19.30	8.68
w	D	1.000	0	0.006230	20	19.30	8.68
w	D	2.000	0	0.010100	20	19.30	8.68
w	D	2.000	0	0.009540	20	19.30	8.68
w	D	5.000	0	0.010500	20	19.30	8.68
w	D	10.000	0	0.008280	20	19.30	8.68
w	D	30.000	0	0.005130	20	19.30	8.68

Target	Proj.	Energy	Angle	Yield	Temp.	P	SBE
W	T	0.170	0	0.000037	20	19.30	8.68
W	T	0.300	0	0.002350	20	19.30	8.68
w	T	0.500	0	0.007450	20	19.30	8.68
w	T	1.000	0	0.014500	20	19.30	8.68
w	T	2.000	0	0.018500	20	19.30	8.68
w	T	5.000	0	0.020000	20	19.30	8.68

Target	Proj.	Energy	Angle	Yield	Temp.	P	SBE
W	^{12}C	0.070	0	0.002250	20	19.30	8.68
W	^{12}C	0.100	0	0.012300	20	19.30	8.68
W	^{12}C	0.200	0	0.062500	20	19.30	8.68
w	^{12}C	0.500	0	0.166000	20	19.30	8.68
w	^{12}c	1.000	0	0.267000	20	19.30	8.68
w	^{12}c	2.000	0	0.368000	20	19.30	8.68
w	^{12}c	5.000	0	0.454000	20	19.30	8.68
w	^{12}c	10.000	0	0.502000	20	19.30	8.68

Target	Proj.	Energy	Angle	Yield	Temp.	P	SBE
W	W	0.050	0	0.00018	20	19.30	8.68
W	W	0.050	0	0.00017	20	19.30	8.68
W	W	0.060	0	0.00053	20	19.30	8.68
W	W	0.060	0	0.00055	20	19.30	8.68
W	W	0.065	0	0.00093	20	19.30	8.68
W	W	0.070	0	0.00141	20	19.30	8.68
W	W	0.070	0	0.00090	20	19.30	8.68
W	W	0.080	0	0.00299	20	19.30	8.68
W	W	0.100	0	0.00810	20	19.30	8.68
W	W	0.100	0	0.00923	20	19.30	8.68
W	W	0.100	0	0.00760	20	19.30	8.68
W	W	0.140	0	0.03550	20	19.30	8.68
W	W	0.150	0	0.04210	20	19.30	8.68
W	W	0.200	0	0.09820	20	19.30	8.68
W	W	0.200	0	0.09160	20	19.30	8.68
W	W	0.300	0	0.21700	20	19.30	8.68
W	W	0.300	0	0.23360	20	19.30	8.68
W	W	0.350	0	0.29390	20	19.30	8.68
W	W	0.400	0	0.35770	20	19.30	8.68
W	W	0.500	0	0.50930	20	19.30	8.68
W	W	0.500	0	0.47700	20	19.30	8.68
W	W	0.500	0	0.49480	20	19.30	8.68
W	W	0.500	0	0.49500	20	19.30	8.68
W	W	0.700	0	0.75670	20	19.30	8.68
W	W	0.800	0	0.82940	20	19.30	8.68
W	W	1.000	0	1.06100	20	19.30	8.68
W	W	1.000	0	1.06300	20	19.30	8.68
W	W	1.000	0	1.06700	20	19.30	8.68
W	W	1.000	0	1.02000	20	19.30	8.68
W	W	2.000	0	1.79000	20	19.30	8.68
W	W	2.000	0	1.87000	20	19.30	8.68
W	W	2.000	0	1.78000	20	19.30	8.68
W	W	2.500	0	2.15600	20	19.30	8.68
W	W	5.000	0	3.11000	20	19.30	8.68
W	W	5.000	0	2.97500	20	19.30	8.68
W	W	5.000	0	3.18200	20	19.30	8.68
W	W	5.000	0	3.18000	20	19.30	8.68
W	W	10.000	0	4.02100	20	19.30	8.68
W	W	10.000	0	4.34000	20	19.30	8.68
W	W	10.000	0	4.37000	20	19.30	8.68
W	W	20.000	0	5.64000	20	19.30	8.68
W	W	20.000	0	5.67000	20	19.30	8.68
W	W	30.000	0	5.60000	20	19.30	8.68
W	W	45.000	0	6.92000	20	19.30	8.68
W	W	50.000	0	7.51000	20	19.30	8.68
W	W	50.000	0	6.99000	20	19.30	8.68
W	W	100.000	0	7.87000	20	19.30	8.68

Target: W

Experimental Data

Target	Projectile	Angle	Symbol	F,h(eV)	Q(atoms/ion)
W	He	0	A	107.	0.110
W	Ne	0	□	26.0	2.67
w	Kr	0	o	36.0	16.2

Calculated Data

Target	Projectile	Angle	Symbol	£<h(eV)	Q(atoms/ion)
W	Ne	0	■	40.0	3.48

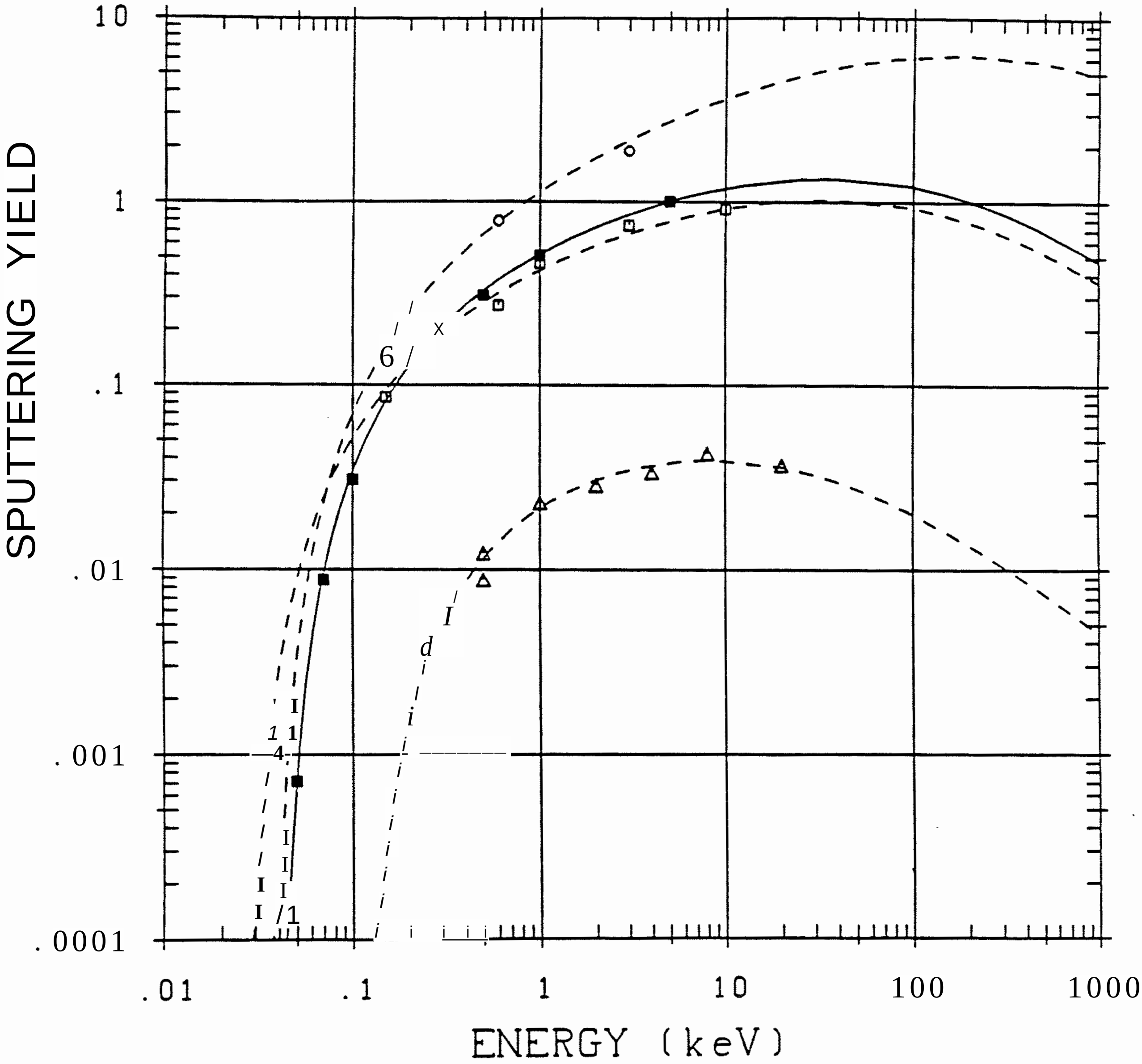


Fig. 46: Energy dependence of the sputtering yield of W with ^{4}He, Ne and Kr. The data are partly published in [41,45,60 1.

Experimental Data

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
W	He	0.250	0	0.00378	20	1	III	31	12.12.1977
W	He	0.500	0	0.00883	20	1	III	32	13.12.1977
W	He	0.500	0	0.01230	20	1	III	39	18.01.1977
W	He	1.000	0	0.02310	20	1	III	32	13.12.1977
W	He	2.000	0	0.02876	20	1	III	31	12.12.1977
W	He	2.000	0	0.02857	20	1	III	39	18.01.1978
W	He	4.000	0	0.03367	20	1	III	31	09.12.1977
W	He	8.000	0	0.04272	20	1	III	30	09.12.1977
W	He	20.000	0	0.03700	20	1			PHARAO76

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
W	Ne	0.150	0	0.08600	20	1			HECHTL79
W	Ne	0.300	0	0.21300	20	1			HECHTL81
W	Ne	0.600	0	0.27200	20	1			HECHTL79
W	Ne	1.000	0	0.46200	20	1			HECHTL81
W	Ne	3.000	0	0.74700	20	1			HECHTL79
W	Ne	10.000	0	0.91300	20	1			HECHTL81

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
W	Kr	0.150	0	0.14200	20	1			HECHTL79
W	Kr	0.600	0	0.78800	20	1			HECHTL79
W	Kr	3.000	0	1.89000	20	1			HECHTL79

Calculated Data

Target	Proj.	Energy	Angle	Yield	Temp.	ρ	SBE
W	Ne	0.050	0	0.000713	20	19.30	8.81
W	Ne	0.070	0	0.008780	20	19.30	8.81
W	Ne	0.100	0	0.030500	20	19.30	8.81
W	Ne	0.500	0	0.308300	20	19.30	8.81
W	Ne	1.000	0	0.507400	20	19.30	8.81
W	Ne	5.000	0	1.004000	20	19.30	8.81

Target: W

Experimental Data

Target	Projectile	Angle	Symbol	F_{th}(eV)	Q(atoms/ion)
W	Ar	0	0	36.5	7.60
W	Xe	0	A	42.8	22.1

Calculated Data

Target	Projectile	Angle	Symbol	E_{th}(eV)	Q(atoms/ion)
W	Ar	0	♦	37.2	8.10
W	Xe	0	A	63.1	25.8

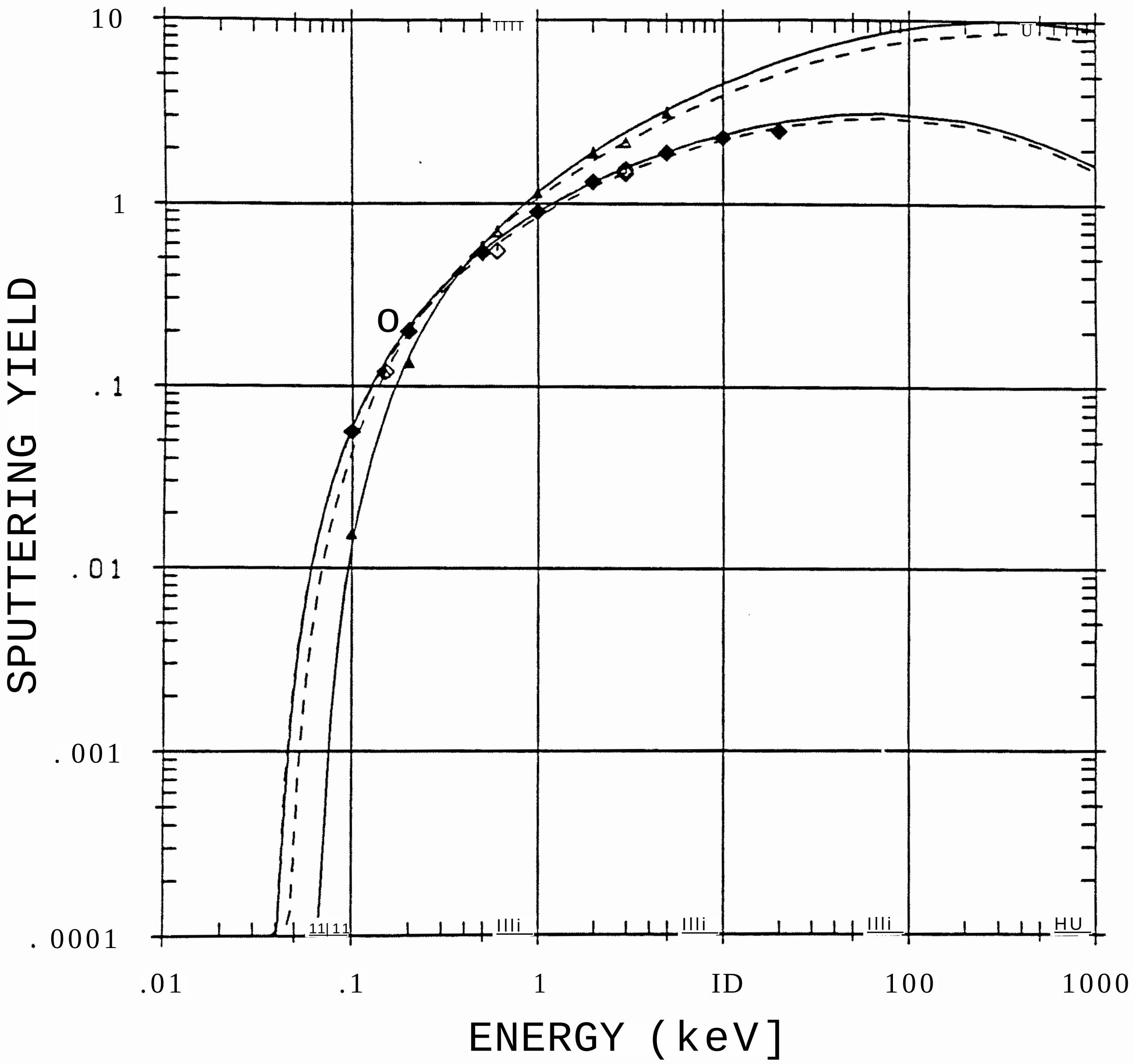


Fig. 47: Energy dependence of the sputtering yield of W with Ar and Xe. The data are published in [601.

Experimental Data

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
W	Ar	0.150	0	0.22000	20	1			HECHTL79
W	Ar	0.150	0	0.12000	20	1			HECHTL79
W	Ar	0.600	0	0.55000	20	1			HECHTL79
W	Ar	3.000	0	1.46000	20	1			HECHTL79
W	Ar	3.000	0	1.53000	20	1			HECHTL79

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
W	Xe	0.150	0	0.11900	20	1			HECHTL79
W	Xe	0.600	0	0.70500	20	1			HECHTL79
W	Xe	3.000	0	2.16000	20	1			HECHTL79

Calculated Data

Target	Proj.	Energy	Angle	Yield	Temp.	ρ	SBE
W	Ar	0.100	0	0.056310	20	19.30	8.80
W	Ar	0.200	0	0.199830	20	19.30	8.80
W	Ar	0.500	0	0.538910	20	19.30	8.80
W	Ar	1.000	0	0.896780	20	19.30	8.80
W	Ar	2.000	0	1.314780	20	19.30	8.80
W	Ar	5.000	0	1.898020	20	19.30	8.80
W	Ar	10.000	0	2.288010	20	19.30	8.80
W	Ar	20.000	0	2.504530	20	19.30	8.80

Target	Proj.	Energy	Angle	Yield	Temp.	ρ	SBE
W	Xe	0.100	0	0.015450	20	19.30	8.68
W	Xe	0.200	0	0.135820	20	19.30	8.68
W	Xe	0.500	0	0.580490	20	19.30	8.68
W	Xe	1.000	0	1.144280	20	19.30	8.68
W	Xe	2.000	0	1.905140	20	19.30	8.68
W	Xe	5.000	0	3.142630	20	19.30	8.68

Target: W

Experimental Data

Target	Projectile	Angle	Symbol	Fih(eV)	Q(atoms/ion)	
W	O	0	V	27.4	2.31	T= 1600°C
W	O	0	V	105.	1.20	T = R.T.
W	OH	0	◃	98.5	1.16	T = R.T.

Calculated Data

Target	Projectile	Angle	Symbol	£<h(eV)	Q(atoms/ion)
W	O	0	▼	41.8	2.33

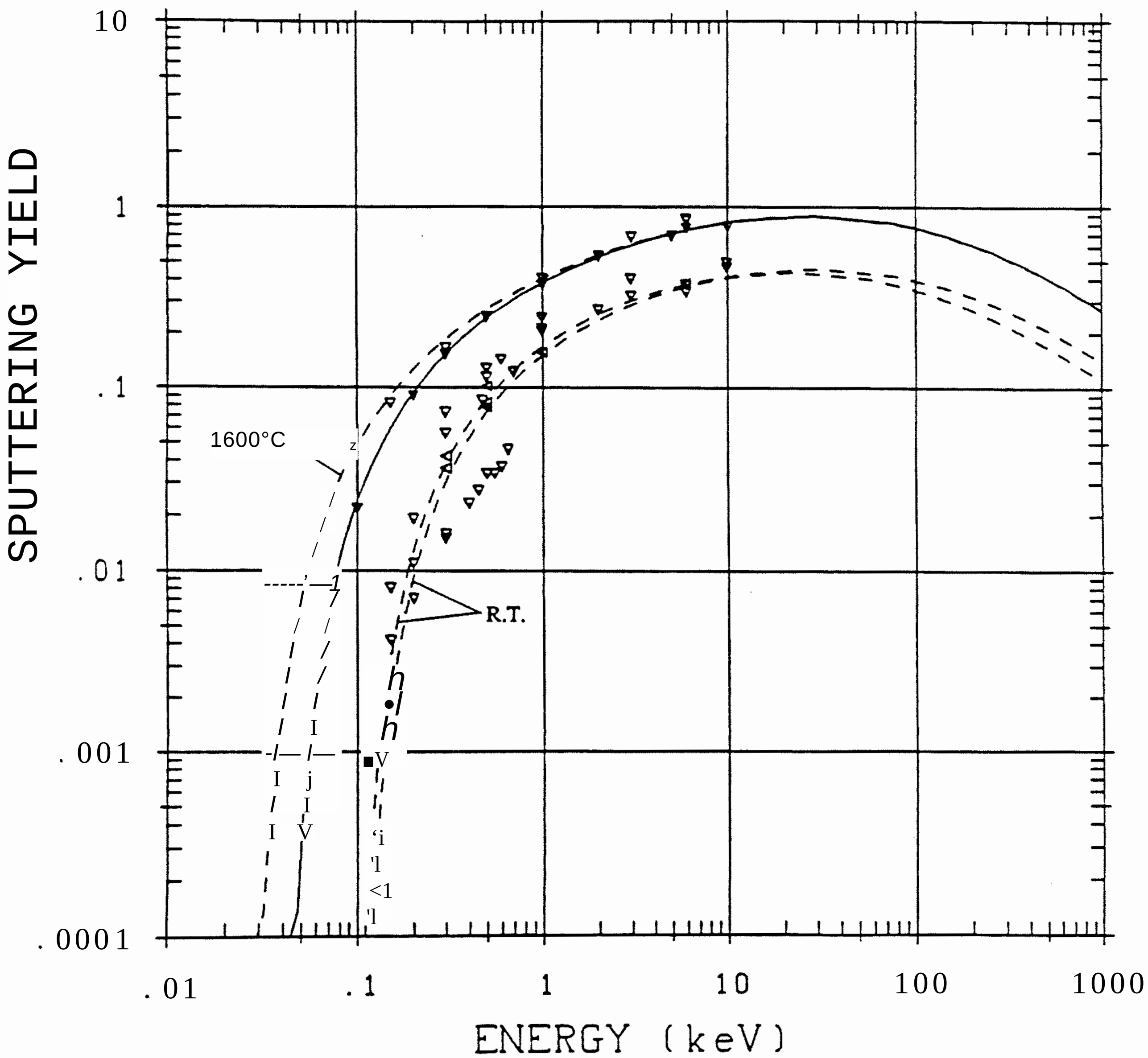


Fig. 48: Energy dependence of the sputtering yield of W with 0 and OH measured at room temperature and at 1600°C. At room temperature oxygen built-up in the surface layers leads to a higher threshold energy. At temperatures above 1600°C sputtering of pure tungsten prevails. These results are published in [45,64].

Experimental Data

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
W	0	0.150	0	0.08200	1600	1			HECHTL90
W	0	0.300	0	0.16500	1600	1			HECHTL90
W	0	1.000	0	0.40000	1600	1			HECHTL90
W	0	3.000	0	0.68000	1600	1			HECHTL90
W	OH	6.000	0	0.86000	1600	1	X	86	11.07.1989
W	OH	6.000	0	0.83500	1820	1	X	87	12.07.1989
W	0	10.000	0	0.78000	1600	1			HECHTL90

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
W	0	0.150	0	0.00420	20	1		0	HECHTL90
W	0	0.150	0	0.00810	20	1		0	HECHTL81
W	0	0.200	0	0.01930	20	1	X	102	10.08.1989
W	0	0.200	0	0.00710	20	1		0	HECHTL90
W	0	0.200	0	0.01100	20	1		0	HECHTL81
W	0	0.300	0	0.05620	20	1	X	101	08.08.1989
W	0	0.300	0	0.07300	20	1	X	107	19.09.1989
W	0	0.300	0	0.01510	20	1		0	HECHTL90
W	0	0.300	0	0.01600	20	1		0	HECHTL81
W	0	0.400	0	0.02340	20	1		0	HECHTL90
W	0	0.450	0	0.02750	20	1		0	HECHTL90
W	0	0.475	0	0.08500	20	1		0	HECHTL90
W	0	0.500	0	0.12800	20	1	X	101	09.08.1989
W	0	0.500	0	0.11400	20	1		0	HECHTL90
W	0	0.500	0	0.03400	20	1		0	HECHTL81
W	0	0.550	0	0.03400	20	1		0	HECHTL81
W	0	0.600	0	0.14300	20	1		0	HECHTL90
W	0	0.600	0	0.03700	20	1		0	HECHTL81
W	0	0.650	0	0.04600	20	1		0	HECHTL81
W	0	0.700	0	0.12200	20	1		0	HECHTL81
W	0	1.000	0	0.20500	20	1	X	100	08.08.1989
W	0	1.000	0	0.24300	20	1		0	HECHTL90
W	0	1.000	0	0.21300	20	1		0	HECHTL81
W	0	2.000	0	0.26900	20	1	X	103	11.08.1989
W	0	3.000	0	0.40000	20	1		0	HECHTL90
W	0	3.000	0	0.32100	20	1		0	HECHTL81
W	0	6.000	0	0.37300	20	1	X	82	04.07 1989
W	0	6.000	0	0.33900	20	1	X	101	09.08.1989
W	0	10.000	0	0.49000	20	1		0	HECHTL90
W	0	10.000	0	0.46200	20	1		0	HECHTL81

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
W	OH	0.300	0	0.03650	20	1	X	82	03.07.1989
W	OH	0.300	0	0.04250	20	1	X	102	10.08 1989
W	OH	0.500	0	0.07830	20	1	X	81	03.07.1989
W	OH	0.500	0	0.10200	20	1	X	100	08.08.1989
W	OH	0.500	0	0.08280	20	1	X	102	09.08.1989
W	OH	1.000	0	0.15700	20	1	X	81	03.07.1989
W	OH	6.000	0	0.37800	20	1	X	81	03.07 1989

Calculated Data

Target	Proj.	Energy	Angle	Yield	Temp.	ρ	SBE
W	O	0.050	0	0.000363	20	19.30	8.68
W	O	0.100	0	0.021700	20	19.30	8.68
W	O	0.200	0	0.090000	20	19.30	8.68
W	O	0.300	0	0.152000	20	19.30	8.68
W	O	0.500	0	0.245000	20	19.30	8.68
W	O	1.000	0	0.371000	20	19.30	8.68
W	O	2.000	0	0.533000	20	19.30	8.68
W	O	5.000	0	0.689000	20	19.30	8.68
W	0	6.000	0	0.764000	20	19.30	8.68

Target: Zr

Experimental Data

Target	Projectile	Angle	Symbol	E,h(eV)	Q(atoms/ion)
Zr	D	0	0	100.	0.0220
Zr	He	0	*A*	52.2	0.129

Calculated Data

Target	Projectile	Angle	Symbol	Fth(eV)	Q(atoms/ion)
Zr	Xe	0	A	45.2	14.3

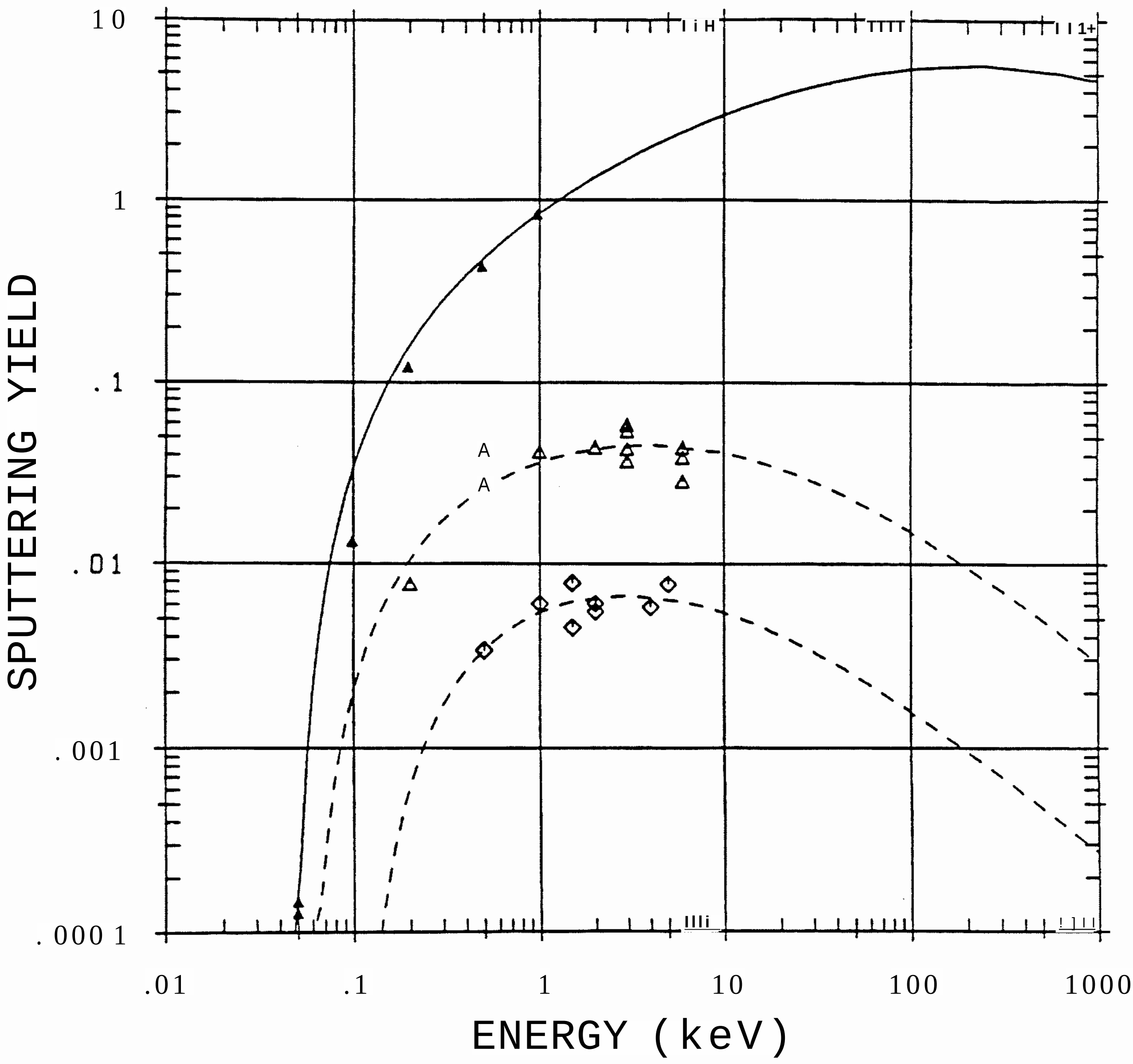


Fig. 49: Energy dependence of the sputtering yield of Zr with D, ^{4}He and Xe. The data for D are taken at temperatures above 300°C to avoid weight increase due to D retention [65]. Most data are unpublished.

Experimental Data

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
Zr	D	0.500	0	0.00335	650	3	VII	35	12.12.1983
Zr	D	0.500	0	0.00340	300	3	VII	93	21.05.1984
Zr	D	1.000	0	0.00605	300	3	VII	93	22.05.1983
Zr	D	1.500	0	0.00450	650	3	VII	34	12.12.1983
Zr	D	1.500	0	0.00782	800	3	VII	36	14.12.1983
Zr	D	1.500	0	0.00793	800	3	VII	39	16.12.1983
Zr	D	2.000	0	0.00548	300	3	VII	92	21.05.1983
Zr	D	2.000	0	0.00606	300	3	VII	92	21.05.1984
Zr	D	4.000	0	0.00581	300	1	VII	93	22.05.1983
Zr	D	5.000	0	0.00776	800	1	VII	40	19.12.1983

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
Zr	He	0.200	0	0.00780	20	1	III	166	30.11.1978
Zr	He	0.500	0	0.02750	20	1	III	166	01.12.1978
Zr	He	0.500	0	0.04300	650	1	VII	35	13.12.1983
Zr	He	1.000	0	0.04200	800	1	VII	39	19.12.1983
Zr	He	2.000	0	0.04430	20	1	III	166	01.12.1978
Zr	He	3.000	0	0.05890	650	1	VII	35	13.12.1983
Zr	He	3.000	0	0.03740	20	1	VII	36	14.12.1983
Zr	He	3.000	0	0.05430	800	3	VII	37	15.12.1983
Zr	He	3.000	0	0.04360	20	1	VII	38	15.12.1983
Zr	He	3.000	0	0.05440	925	1	VII	38	16.12.1983
Zr	He	6.000	0	0.03900	20	1			1979
Zr	He	6.000	0	0.02880	20	1	I	65	02.12.1974
Zr	He	6.000	0	0.04440	800	1	VII	39	19.12.1983

Calculated Data

Target	Proj.	Energy	Angle	Yield	Temp.	P	SBE
Zr	Xe	0.050	0	0.000097	20	6.49	6.33
Zr	Xe	0.050	0	0.000147	20	6.49	6.33
Zr	Xe	0.050	0	0.000127	20	6.49	6.33
Zr	Xe	0.050	0	0.000127	20	6.49	6.33
Zr	Xe	0.100	0	0.013300	20	6.49	6.33
Zr	Xe	0.200	0	0.121300	20	6.49	6.33
Zr	Xe	0.500	0	0.433000	20	6.49	6.33
Zr	Xe	1.000	0	0.846000	20	6.49	6.33

Target: Al_2O_3

Experimental Data

Target	Projectile	Angle	Symbol	£<h(eV)	Q(atoms/ion)
AI2O3	H	0	□	63.0	0.0650
AI2O3	D	0	0	66.0	0.141
AI2O3	He	0	A	112.	0.705

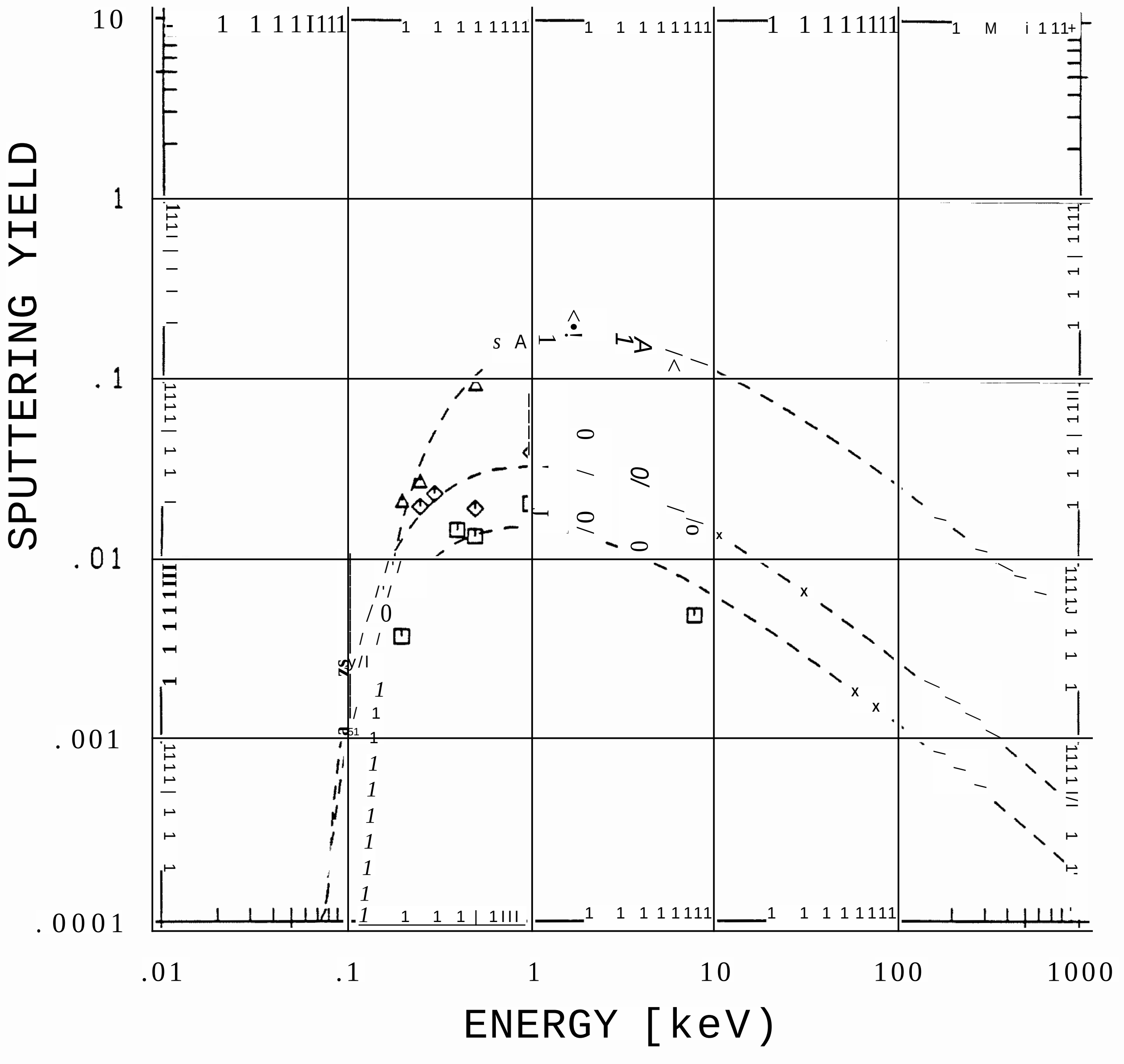


Fig. 50: Energy dependence of the sputtering yield of Al_2O_3 with H, D and ^{4}He. The data are published in [27].

Experimental Data

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
AI2O3	H	0.100	0	0.00110	20	3	III	95	16.06.1978
$A1_2O_3$	H	0.200	0	0.00370	20	3	III	102	28.06.1978
ai_2o_3	H	0.400	0	0.01450	20	3	III	103	29.07.1978
ai_2o_3	H	0.500	0	0.01340	20	3	III	176	26.01.1979
ai_2o_3	H	1.000	0	0.02030	20	3	III	104	03.07.1978
ai_2o_3	H	2.000	0	0.01650	20	3	III	103	30.06.1978
ai_2o_3	H	4.000	0	0.01130	20	2	III	103	30.06.1978
ai_2o_3	H	8.000	0	0.00490	20	1	III	92	13.06.1978

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
$A1_2O_3$	D	0.100	0	0.00240	20	3	III	96	19.06.1978
ai_2o_3	D	0.170	0	0.00500	20	3	III	97	20.06.1978
ai_2o_3	D	0.250	0	0.01950	20	3	III	104	04.07.1978
ai_2o_3	D	0.300	0	0.02300	20	3	III	95	16.06.1978
ai_2o_3	D	0.500	0	0.01900	20	3	III	89	12.06.1978
ai_2o_3	D	1.000	0	0.03890	20	3	III	89	12.06.1978
ai_2o_3	D	2.000	0	0.04700	20	1	III	88	09.06.1978
ai_2o_3	D	4.000	0	0.02860	20	1	III	105	04.07.1978
ai_2o_3	D	8.000	0	0.01400	20	1	III	89	09.06.1978

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
$A1_2O_3$	He	0.200	0	0.02100	20	1	III	101	26.06.1978
ai_2o_3	He	0.250	0	0.02700	20	1	III	98	21.06.1978
ai_2o_3	He	0.500	0	0.09400	20	1	III	101	27.06.1978
ai_2o_3	He	0.900	0	0.16200	20	1	III	99	22.06.1978
ai_2o_3	He	2.000	0	0.22200	20	1	III	100	23.06.1978
ai_2o_3	He	4.000	0	0.15800	20	1	III	91	13.06.1978
ai_2o_3	He	6.000	0	0.12100	20	1	III	91	13.06.1978

Target: B_4C

Experimental Data

Target	Projectile	Angle	Symbol	*Eth(eV)*	Q(atoms/ion)
B_4C	H	0	□	19.0	0.0570
B_4C	D	0	◇	17.0	0.123
B_4C	He	0	△	25.0	0.432

Calculated Data

Target	Projectile	Angle	Symbol	E_{th}(eV)	Q(atoms/ion)
B_4C	H	0	■	26.0	0.0430
B_4C	D	0	◆	20.0	0.0830
B_4C	He	0	▲	23.0	0.237

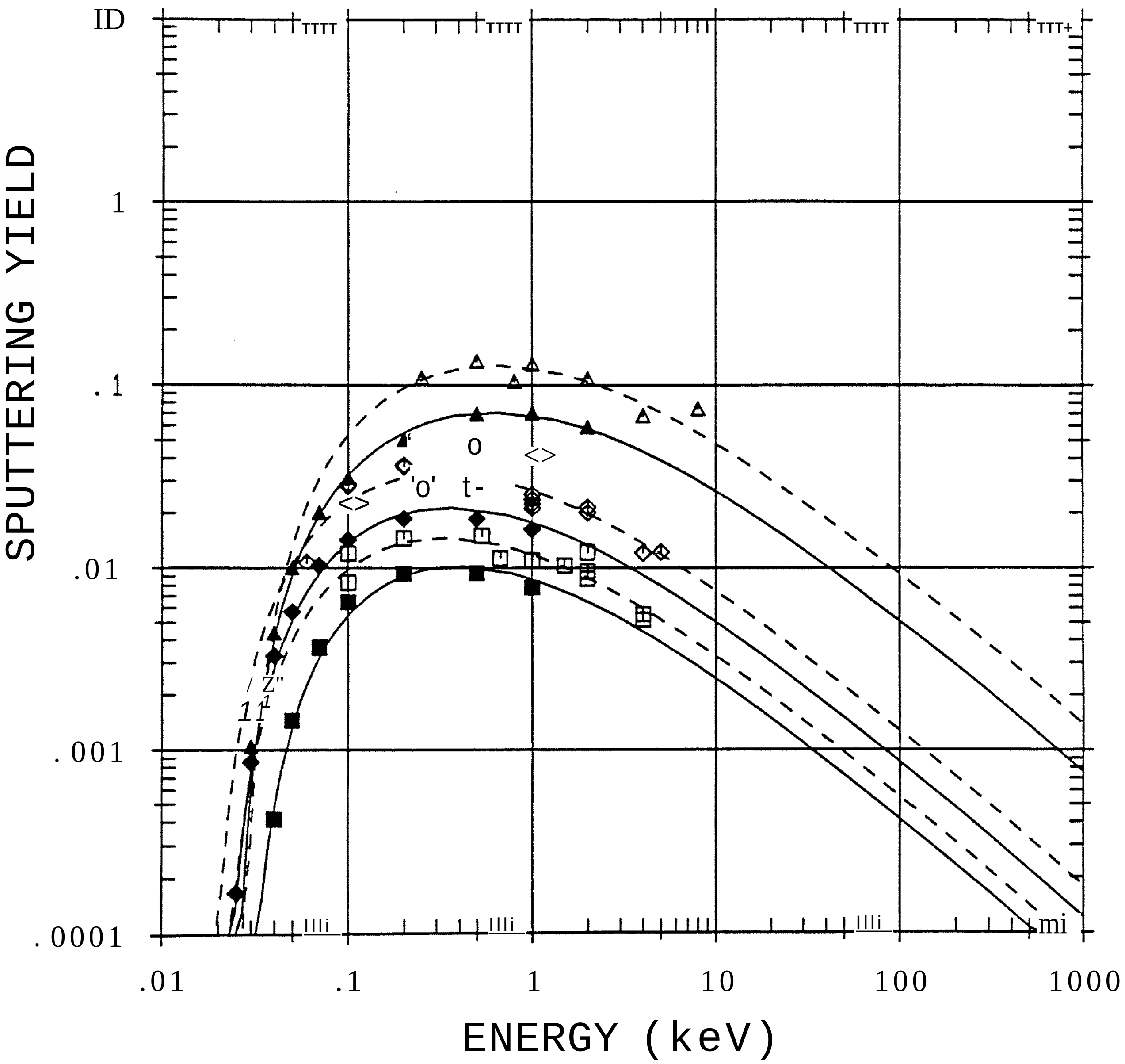


Fig. 51: Energy dependence of the sputtering yield of B_4C with H, D and ^4He. The data are published in [29,41,42].

Experimented Data

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
B«C	H	0.100	0	0.00831	20	3	III	16	27.10.1977
b_4c	H	0.100	0	0.01200	20	3	III	76	08.05.1978
b_4c	H	0.200	0	0.01450	20	3	III	14	19.10.1977
b_4c	H	0.533	0	0.01500	20	3	III	14	19.10.1977
b_4c	H	0.670	0	0.01130	20	3	II	9	20.02.1976
b_4c	H	1.000	0	0.01100	20	3	II	9	19.02.1976
b_4c	H	1.500	0	0.01030	20	3	III	17	28.10.1977
b_4c	H	2.000	0	0.00958	20	3	II	7	16.02.1976
b_4c	H	2.000	0	0.01220	20	3	II	9	18.02.1976
b_4c	H	2.000	0	0.00871	20	2	II	10	23.02.1976
b_4c	H	4.000	0	0.00517	20	2	II	13	03.03.1976
b_4c	H	4.000	0	0.00557	20	2	III	14	21.10.1977

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
B_4C	D	0.060	0	0.01070	20	3	VI	162	07.07.1983
b_4c	D	0.100	0	0.02880	20	3	III	16	27.10.1977
b_4c	D	0.100	0	0.02210	20	3	VI	157	04.07.1983
b_4c	D	0.100	0	0.02800	20	1	X	105	22.08.1989
b_4c	D	0.200	0	0.03680	20	3	III	7	30.09.1977
b_4c	D	0.200	0	0.03610	20	3	III	12	14.10.1977
b_4c	D	0.300	0	0.02770	20	3	X	40	10.02.1989
b_4c	D	0.500	0	0.02820	20	3	III	7	30.09.1977
b_4c	D	0.500	0	0.03240	20	3	III	12	14.10.1977
b_4c	D	0.500	0	0.03090	20	3	VI	160	06.07.1983
b_4c	D	0.500	0	0.04750	500	3	X	42	14.02.1989
b_4c	D	0.500	0	0.02960	20	1	X	103	17.08.1989
b_4c	D	1.000	0	0.02130	20	3	III	7	28.09.1977
b_4c	D	1.000	0	0.02250	500	3	VI	154	30.06.1983
b_4c	D	1.000	0	0.02540	20	3	VI	162	07.07.1983
b_4c	D	1.000	0	0.04020	500	3	X	42	14.02.1989
b_4c	D	1.000	0	0.02380	20	3	X	42	14.02.1989
b_4c	D	2.000	0	0.02010	20	3	III	7	29.09.1977
b_4c	D	2.000	0	0.02150	20	3	VI	161	07.07.1983
b_4c	D	4.000	0	0.01210	20	2	III	13	17.10.1977
b_4c	D	5.000	0	0.01220	20	1	VI	161	06.07.1983

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
B_4C	He	0.250	0	0.11000	20	1	III	15	24.10.1977
b_4c	He	0.500	0	0.13500	20	1	III	15	25.10.1977
b_4c	He	0.800	0	0.10500	20	1	X	106	24.08.1989
b_4c	He	1.000	0	0.13100	20	1	III	15	25.10.1977
b_4c	He	2.000	0	0.10900	20	1	III	17	02.11.1977
b_4c	He	4.000	0	0.06830	20	1	III	16	26.10.1977
b_4c	He	8.000	0	0.07470	20	1	III	18	03.11.1977

Calculated Data

Target	Proj.	Energy	Angle	Yield	Temp.	*p*	SBE
B_4C	H	0.040	0	0.000415	20	2.51	6.06
B_4C	H	0.050	0	0.001450	20	2.51	6.06
B_4C	H	0.070	0	0.003630	20	2.51	6.06
B_4C	H	0.100	0	0.006490	20	2.51	6.06
B_4C	H	0.200	0	0.009330	20	2.51	6.06
B_4C	H	0.500	0	0.009390	20	2.51	6.06
B_4C	H	1.000	0	0.007800	20	2.51	6.06

Target	Proj.	Energy	Angle	Yield	Temp.	*p*	SBE
B_4C	D	0.025	0	0.000166	20	2.51	6.06
B_4C	D	0.030	0	0.000856	20	2.51	6.06
B_4C	D	0.040	0	0.003270	20	2.51	6.06
B_4C	D	0.050	0	0.005720	20	2.51	6.06
B_4C	D	0.070	0	0.010300	20	2.51	6.06
B_4C	D	0.100	0	0.014200	20	2.51	6.06
B_4C	D	0.200	0	0.018600	20	2.51	6.06
B_4C	D	0.500	0	0.018600	20	2.51	6.06
B_4C	D	1.000	0	0.016300	20	2.51	6.06

Target	Proj.	Energy	Angle	Yield	Temp.	*p*	SBE
B_4C	He	0.030	0	0.001040	20	2.51	6.06
B_4C	He	0.040	0	0.004370	20	2.51	6.06
b_4c	He	0.050	0	0.010000	20	2.51	6.06
b_4c	He	0.070	0	0.020100	20	2.51	6.06
b_4c	He	0.100	0	0.031200	20	2.51	6.06
b_4c	He	0.200	0	0.050900	20	2.51	6.06
b_4c	He	0.500	0	0.069600	20	2.51	6.06
b_4c	He	1.000	0	0.070600	20	2.51	6.06
b_4c	He	2.000	0	0.059300	20	2.51	6.06

Experimental Data

Target	Projectile	Angle	Symbol	Fo>(eV)	Q(atoms/ion)
B_4C	^{12}C	0	□		
b_4c	h_2o	0	t>	20.0	1.41
b_4c	Ne	0	□	50.8	1.37

Calculated Data

Target	Projectile	Angle	Symbol	$E_{th}(eV)$	Q(atoms/ion)
B_4C	Ne	0	■	71.5	1.45

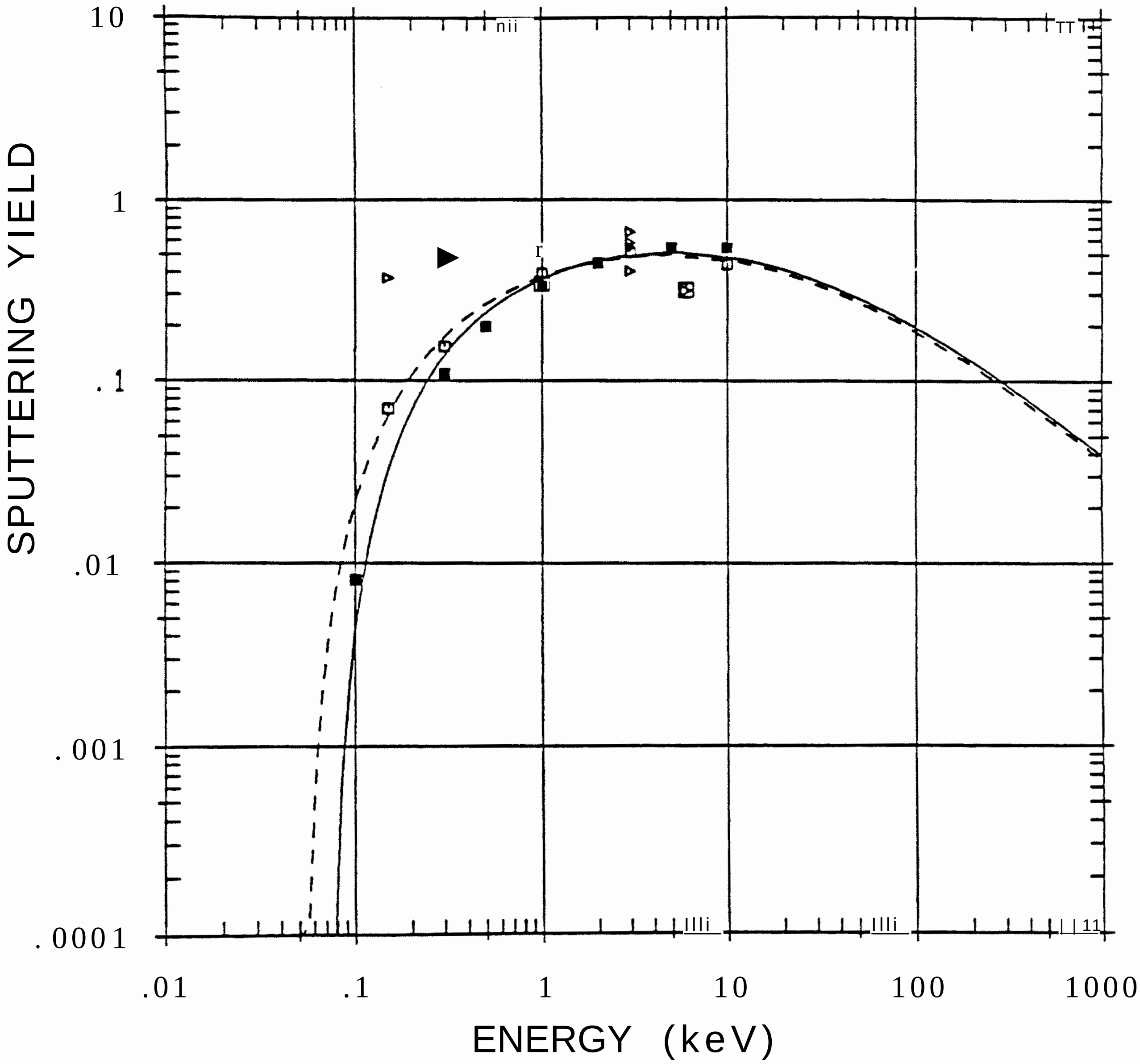


Fig. 52: Energy dependence of the sputtering yield of B_4C with C , H_2O and Ne. The weak energy dependence of the erosion yield for H_2O^+ ions indicates the influence of chemical effects on sputtering. The data are unpublished.

Experimental Data

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
B_4C	^{12}C	1.000	0	0.34200	20	1	X	50	14.03.1989
B_4C	^{12}C	6.000	0	0.31700	20	1	X	48	2.03.1989

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
B_4C	H_2O	0.150	0	0.36900	20	1	X	143	30.01.1990
B_4C	H_2O	0.300	0	0.45200	20	1	X	140	25.01.1990
B_4C	H_2O	1.000	0	0.53000	20	1	X	143	30.01.1990
B_4C	H_2O	3.000	0	0.40300	20	1	X	142	30.01.1990
B_4C	H_2O	3.000	0	0.66500	500	1	X	179	17.04.1990
B_4C	H_2O	3.000	0	0.58000	300	1	X	179	17.04.1990
B_4C	H_2O	3.000	0	0.54500	20	1	X	180	18.04.1990
B_4C	H_2O	6.000	0	0.31400	20	1	X	142	30.01.1990

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
B_4C	Ne	0.150	0	0.07100	20	1			HECHTL1992
B_4C	Ne	0.300	0	0.15400	20	1			HECHTL1992
B_4C	Ne	1.000	0	0.39000	20	1			HECHTL1992
B_4C	Ne	3.000	0	0.51000	20	1			HECHTL1992
B_4C	Ne	10.000	0	0.44000	20	1			HECHTL1992

Calculated Data

Target	Proj.	Energy	Angle	Yield	Temp.	p	SBE
B_4C	Ne	0.100	0	0.008100	20	2.51	6.06
B_4C	Ne	0.300	0	0.109000	20	2.51	6.06
B_4C	Ne	0.500	0	0.198000	20	2.51	6.06
B_4C	Ne	1.000	0	0.334000	20	2.51	6.06
B_4C	Ne	2.000	0	0.446000	20	2.51	6.06
B_4C	Ne	5.000	0	0.540000	20	2.51	6.06
B_4C	Ne	10.000	0	0.541000	20	2.51	6.06

Target: Be B

Experimental Data

Target	Projectile	Angle	Symbol	*Eth(eV)*	Q(atoms/ion)
B B	H	0	□	12.1	0.111
Be B	D	0	0	9.90	0.242
Be_4B	He	0	A	13.9	0.666

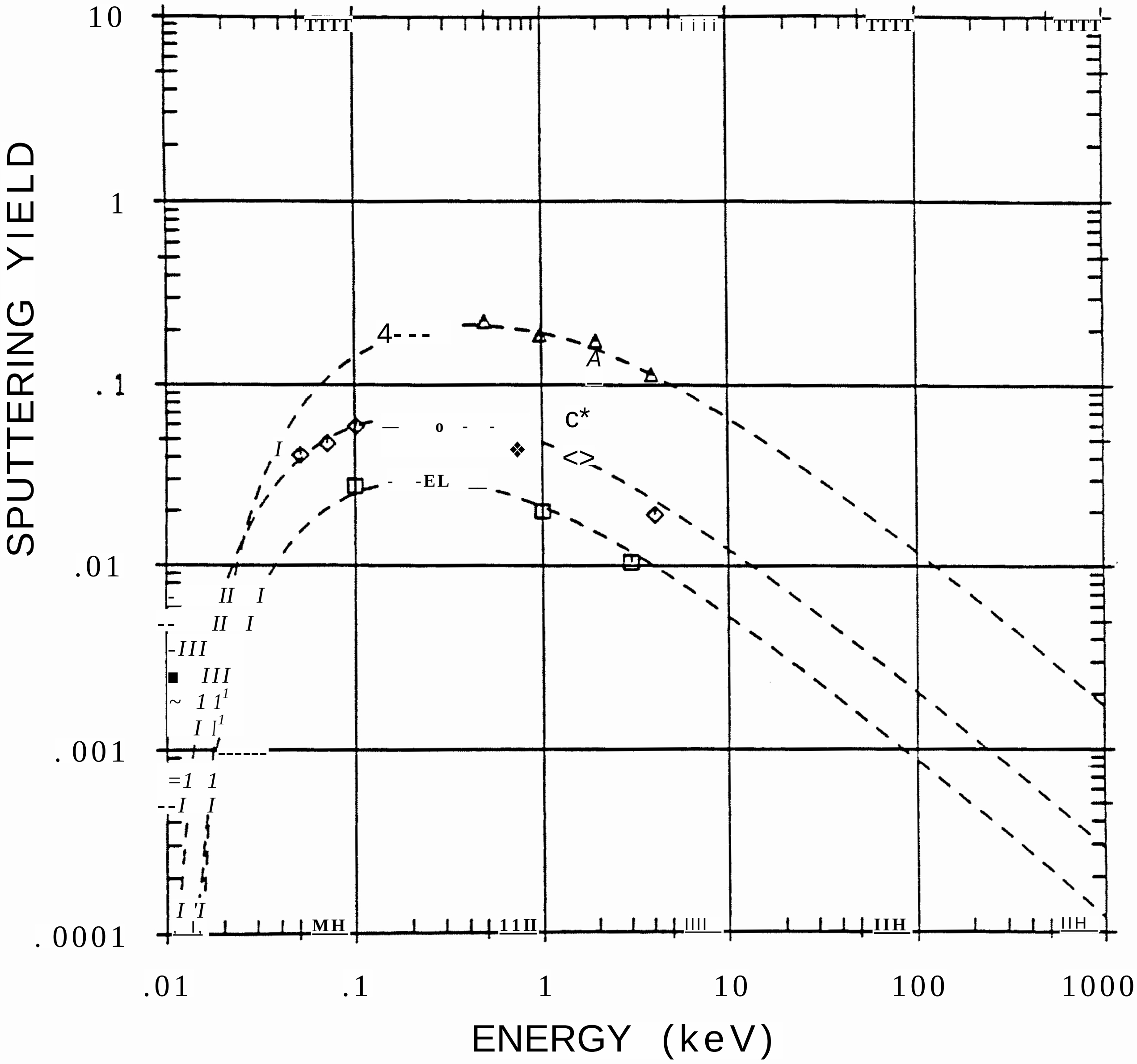


Fig. 53: Energy dependence of the sputtering yield of Be_4B with H, D and ^4He. The data were measured at temperatures > 600°C to avoid surface oxidation. The threshold energies were taken from pure Be (calculated data) for fitting. The data are published in [29].

Experimental Data

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
Be4B	H	0.100	0	0.02750	600	3	VII	52	01.02.1984
Be4B	H	0.300	0	0.03100	600	3	VII	52	02.02.1984
Be$_4$B	H	1.000	0	0.02000	600	3	VII	51	01.02.1984
Be.B	H	3.000	0	0.01040	600	2	VII	52	03.02.1984

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
Be4B	D	0.050	0	0.04140	600	3	VII	49	26.01.1984
Be4B	D	0.070	0	0.04810	600	3	VII	48	24.01.1984
Be4B	D	0.100	0	0.06000	600	3	VII	47	20.01.1984
Be$_4$B	D	0.300	0	0.06300	600	3	VII	46	19.01.1984
Be$_4$B	D	0.750	0	0.04620	600	3	VII	47	23.01.1984
Be4B	D	1.500	0	0.04190	600	3	VII	44	17.01.1984
Be4B	D	1.500	0	0.04190	700	3	VII	45	18.01.1984
Be$_4$B	D	1.500	0	0.06700	750	3	VII	45	18.01.1984
Be4B	D	4.000	0	0.01930	600	1	VII	47	23.01.1984

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
Be4B	He	0.150	0	0.20000	600	1	VII	50	30.01.1984
Be4B	He	0.500	0	0.21600	600	1	VII	51	31.01.1984
Be4B	He	1.000	0	0.18200	600	1	VII	51	31.01.1984
Be$_4$B	He	2.000	0	0.12000	600	1	VII	49	27.01.1984
Be4B	He	2.000	0	0.16800	600	1	VII	50	30.01.1984
Be$_4$B	He	4.000	0	0.11000	600	1	VII	50	30.01.1984

Target: BeO

Experimental Data

Target	Projectile	Angle	Symbol	Fth(eV)	Q(atoms/ion)
BeO	H	0	□	47.0	0.0800
BeO	D	0	. 0	29.0	0.130
BeO	He	0	A	72.0	0.500

Calculated Data

Target	Projectile	Angle	Symbol	$E_{th}(eV)$	Q(atoms/ion)
BeO	O	0	▼	60.3	1.27

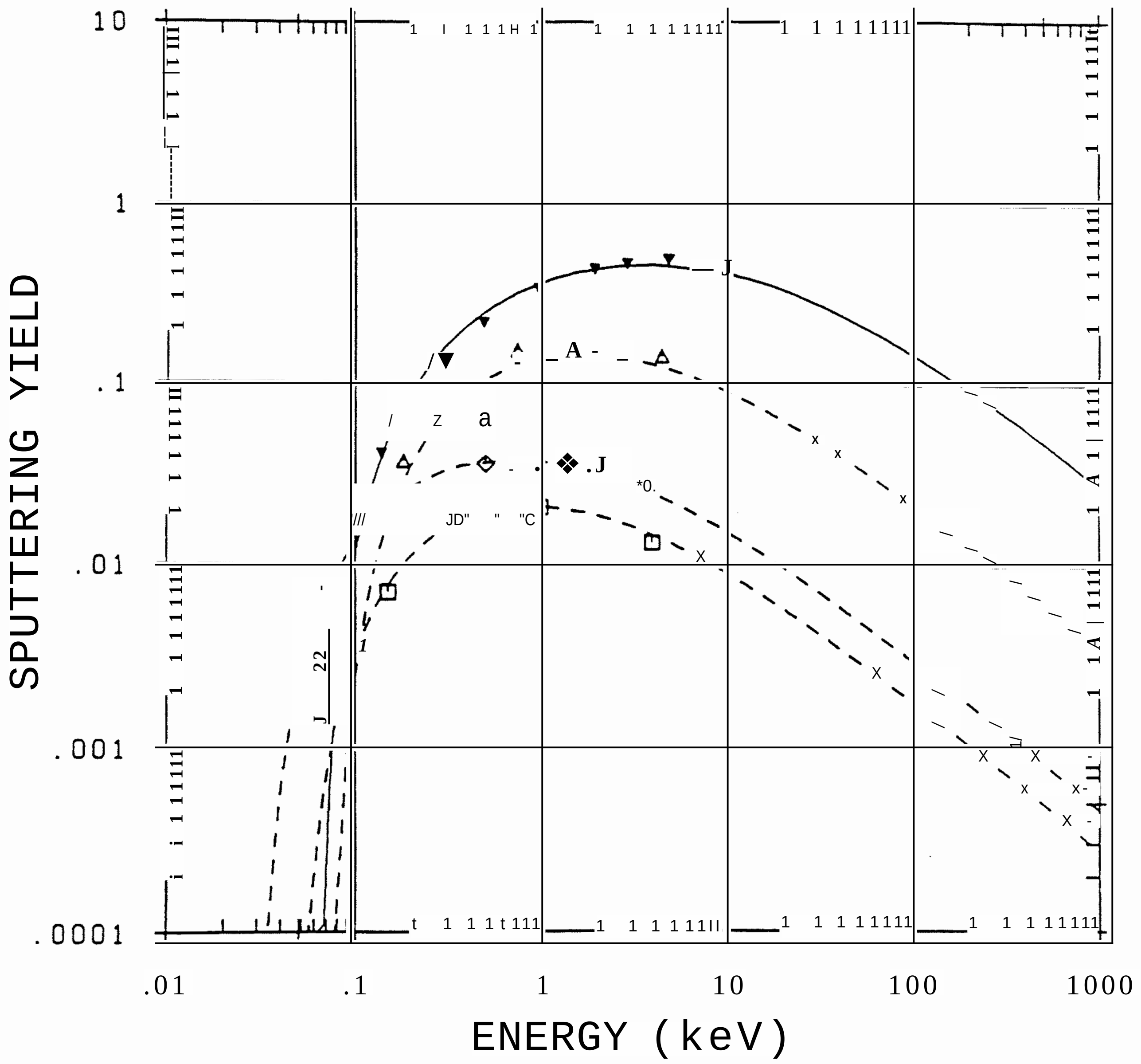


Fig. 54: Energy dependence of the sputtering yield of BeO with H, D, ^{4}He and 0. The data are published in [34],

Experimental Data

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
BeO	H	0.080	0	0.00150	20	1	III	109	12.07.1978
BeO	H	0.150	0	0.00710	20	3	III	108	11.07.1978
BeO	H	0.350	0	0.01830	20	3	III	108	11.07.1978
BeO	H	1.000	0	0.02080	20	3	III	107	10.07.1978
BeO	H	4.000	0	0.01340	20	2	III	108	11.07.1978

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
BeO	D	0.060	0	0.00527	20	3	III	109	13.07.1978
BeO	D	0.150	0	0.01720	20	3	III	110	14.07.1978
BeO	D	0.500	0	0.03600	20	3	III	no	14.07.1978
BeO	D	1.333	0	0.03520	20	3	III	no	17.07.1978
BeO	D	2.666	0	0.03950	20	3	III	109	13.07.1978

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
BeO	He	0.180	0	0.03710	20	1	III	111	17.07.1978
BeO	He	0.300	0	0.06700	20	1	III	106	06.07.1978
BeO	He	0.500	0	0.06420	20	1	III	111	17.07.1978
BeO	He	0.750	0	0.15300	20	1	III	106	07.07.1978
BeO	He	1.500	0	0.15700	20	1	III	107	07.07.1978
BeO	He	4.500	0	0.14300	20	1	III	107	07.07.1978

Calculated Data

Target	Proj.	Energy	Angle	Yield	Temp.	p	SBE
BeO	O	0.100	0	0.018000	20	3.01	3.38
BeO	O	0.140	0	0.041000	20	3.01	3.38
BeO	O	0.200	0	0.079000	20	3.01	3.38
BeO	O	0.300	0	0.132300	20	3.01	3.38
BeO	O	0.500	0	0.214000	20	3.01	3.38
BeO	O	1.000	0	0.326000	20	3.01	3.38
BeO	O	2.000	0	0.420000	20	3.01	3.38
BeO	O	3.000	0	0.450000	20	3.01	3.38
BeO	O	5.000	0	0.473000	20	3.01	3.38
BeO	O	10.000	0	0.423000	20	3.01	3.38

Experimental Data

Target	Projectile	Angle	Symbol	$E_{th}(eV)$	Q(atoms/ion)
SiC	H	0	□	39.5	0.0440
SiC	D	0	◇	30.1	0.119
SiC	He	0	△	37.7	0.367

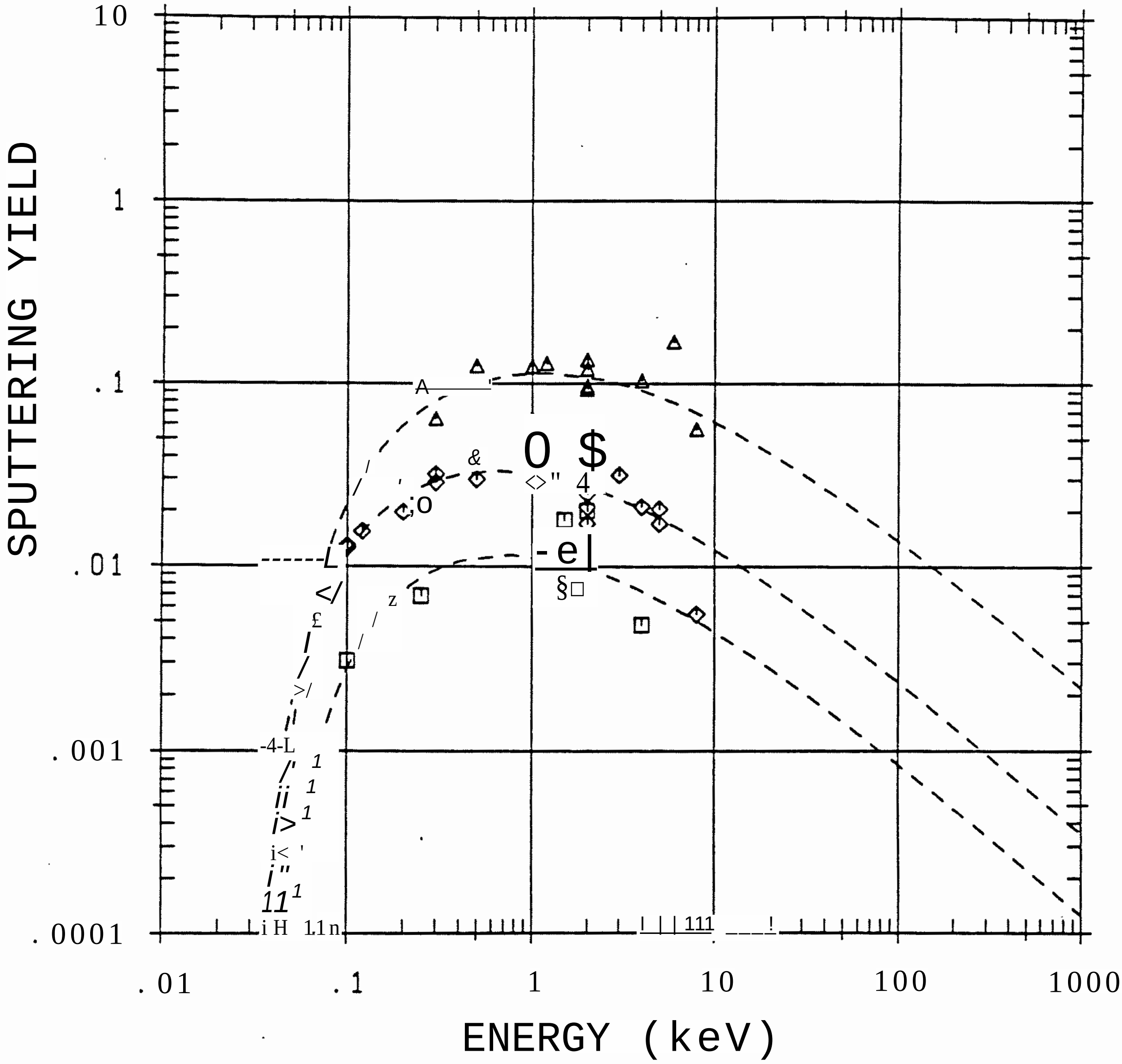


Fig. 55: Energy dependence of the sputtering yield of SiC with H, D and ^{4}He. The wide spread of data for 2 keV D^+ and H^+ is due to investigation on materials with different degrees of surface roughness (single crystals, plasma sprayed materials). The data are published in [41,42].

Experimental Data

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
[illegible]	[illegible]	0.100	0	0.00307	20	3	III	83	05.06.1977
[illegible]	[illegible]	0.250	0	0.00690	20	3	II	172	22.07.1977
[illegible]	[illegible]	1.500	0	0.01180	20	3	II	170	15.07.1977
[illegible]	[illegible]	1.500	0	0.01130	600	3	III	177	05.02.1979
[illegible]	[illegible]	1.500	0	0.01790	210	3	III	178	06.02.1979
[illegible]	[illegible]	1.500	0	0.00736	20	3	III	178	07.02.1979
[illegible]	[illegible]	1.500	0	0.00672	20	3	III	178	08.02.1977
[illegible]	[illegible]	2.000	0	0.00795	556	3	V	39	11.08.1980
[illegible]	[illegible]	2.000	0	0.02010	556	3	V	39	11.08.1980
[illegible]	[illegible]	2.000	0	0.01440	114	3	V	39	12.08.1980
[illegible]	[illegible]	2.000	0	0.00774	210	3	V	172	18.05.1982
[illegible]	[illegible]	2.000	0	0.01200	235	3	V	183	21.06.1982
[illegible]	[illegible]	4.000	0	0.00480	20	2	II	175	03.08.1977

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
[illegible]	[illegible]	0.100	0	0.01260	20	3	III	13	18.10.1977
[illegible]	[illegible]	0.100	0	0.01300	800	3	VI	151	27.06.1983
[illegible]	[illegible]	0.120	0	0.01550	20	3	II	175	04.08.1977
[illegible]	[illegible]	0.200	0	0.01980	800	3	VI	150	27.06.1983
[illegible]	[illegible]	0.200	0	0.01980	800	3	VI	150	27.06.1983
[illegible]	[illegible]	0.250	0	0.02280	20	3	II	173	22.07.1977
[illegible]	[illegible]	0.300	0	0.03200	800	3	VI	151	28.06.1983
[illegible]	[illegible]	0.300	0	0.02880	20	3	VI	151	28.06.1983
[illegible]	[illegible]	0.500	0	0.02990	20	3	II	174	25.07.1977
[illegible]	[illegible]	0.500	0	0.04000	800	3	VI	149	24.06.1983
[illegible]	[illegible]	1.000	0	0.02780	20	3	II	170	15.07.1977
[illegible]	[illegible]	1.000	0	0.03920	20	3	VI	152	28.06.1983
[illegible]	[illegible]	1.000	0	0.03740	800	3	VI	147	23.06.1983
[illegible]	[illegible]	1.000	0	0.04000	500	3	VI	148	23.06.1983
[illegible]	[illegible]	1.000	0	0.03920	20	3	VI	152	28.06.1983
[illegible]	[illegible]	1.000	0	0.04960	500	3	X	168	26.03.1990
[illegible]	[illegible]	1.000	0	0.04530	20	3	X	169	26.03.1990
[illegible]	[illegible]	2.000	0	0.02500	20	3	II	170	15.07.1977
[illegible]	[illegible]	2.000	0	0.04200	616	3	V	33	31.07.1980
[illegible]	[illegible]	2.000	0	0.02840	20	3	V	33	01.08.1980
[illegible]	[illegible]	2.000	0	0.04750	614	3	V	38	07.08.1980
[illegible]	[illegible]	2.000	0	0.01720	120	3	V	175	24.05.1982
[illegible]	[illegible]	2.000	0	0.02110	170	3	V	178	14.06.1982
[illegible]	[illegible]	2.000	0	0.01710	20	3	V	179	14.06.1982
[illegible]	[illegible]	2.000	0	0.03000	200	3	V	180	15.06.1982
[illegible]	[illegible]	3.000	0	0.03170	800	2	VI	149	24.06.1983
[illegible]	[illegible]	4.000	0	0.02120	20	2	II	169	13.07.1977
[illegible]	[illegible]	5.000	0	0.01710	20	1	VI	152	28.06.1983
[illegible]	[illegible]	5.000	0	0.02060	800	1	VI	148	23.06.1983
[illegible]	[illegible]	8.000	0	0.00550	20	1	II	175	01.08.1977

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
SiC	He	0.250	0	0.09500	20	1	II	172	20.07.1977
SiC	He	0.300	0	0.06450	20	1	V	32	28.07.1980
SiC	He	0.500	0	0.12500	20	1	III	22	11.11.1977
SiC	He	1.000	0	0.12400	20	1	II	171	19.07.1977
SiC	He	1.000	0	0.06500	20	1	V	32	28.07.1980
SiC	He	1.200	0	0.12900	20	1	II	174	25.07.1977
SiC	He	2.000	0	0.13500	20	1	II	171	20.07.1977
SiC	He	2.000	0	0.09350	20	1	V	174	24.05.1982
SiC	He	2.000	0	0.09710	20	1	V	182	16.06.1982
SiC	He	2.000	0	0.12000	110	1	V	186	22.06.1982
SiC	He	4.000	0	0.10400	20	1	II	171	19.07.1977
SiC	He	6.000	0	0.17000	20	1	V	44	11.09.1980
SiC	He	8.000	0	0.05660	20	1	II	174	28.07.1977

Experimental Data

Target	Projectile	Angle	Symbol	E<h(eV)	Q(atoms/ion)
SiC	O	0	▽	94.1	1.40
SiC	Ne	0	□	45.1	2.05

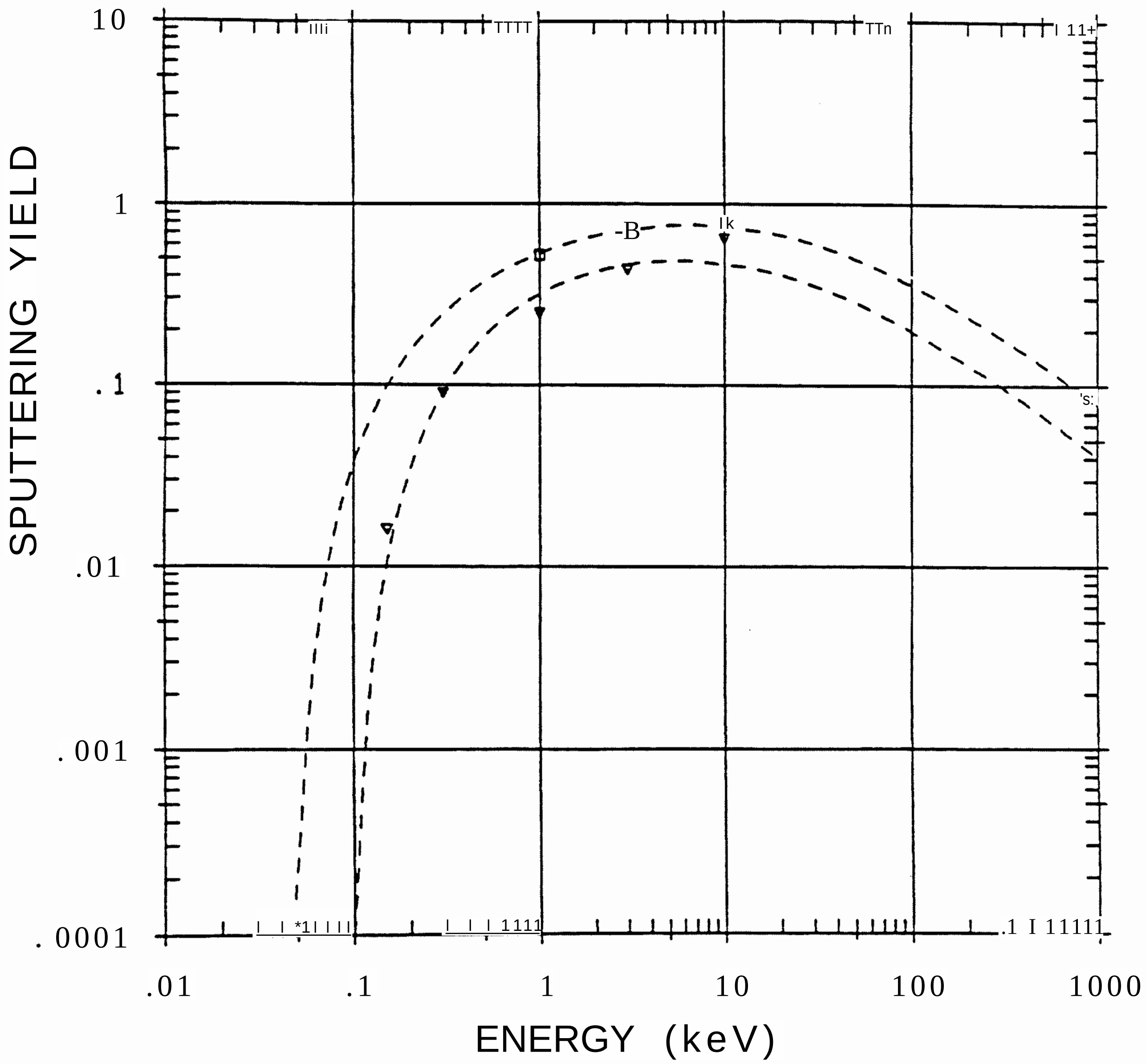


Fig. 56: Energy dependence of the sputtering yield of SiC with O and Ne. The threshold energy for Ne was estimated for fitting. For O^+ bombardment, oxidation leads to a higher threshold energy due to higher binding energy of the oxide. The data are published in [45].

Experimental Data

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
SiC	0	0.150	0	0.01600	20				HECHTL1981
SiC	0	0.300	0	0.09000	20				HECHTL1981
SiC	0	1.000	0	0.24700	20				HECHTL1981
SiC	0	3.000	0	0.43200	20				HECHTL1981
SiC	0	10.000	0	0.64200	20				HECHTL1981

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
SiC	Ne	1.000	0	0.51600	20				HECHTL1981
SiC	Ne	3.000	0	0.72900	20	1	V	45	17.09.1980
SiC	Ne	3.000	0	0.67600	20				HECHTL1981
SiC	Ne	10.000	0	0.77000	20				HECHTL1981

Target: SiO_2

Experimental Data

Target	Projectile	Angle	Symbol	E_{th} (eV)	Q(atoms/ion)
SiO_2	H	0	□	30.2	0.0690
SiO_2	D	0	◇	28.5	0.144
SiO_2	He	0	△	66.3	0.490

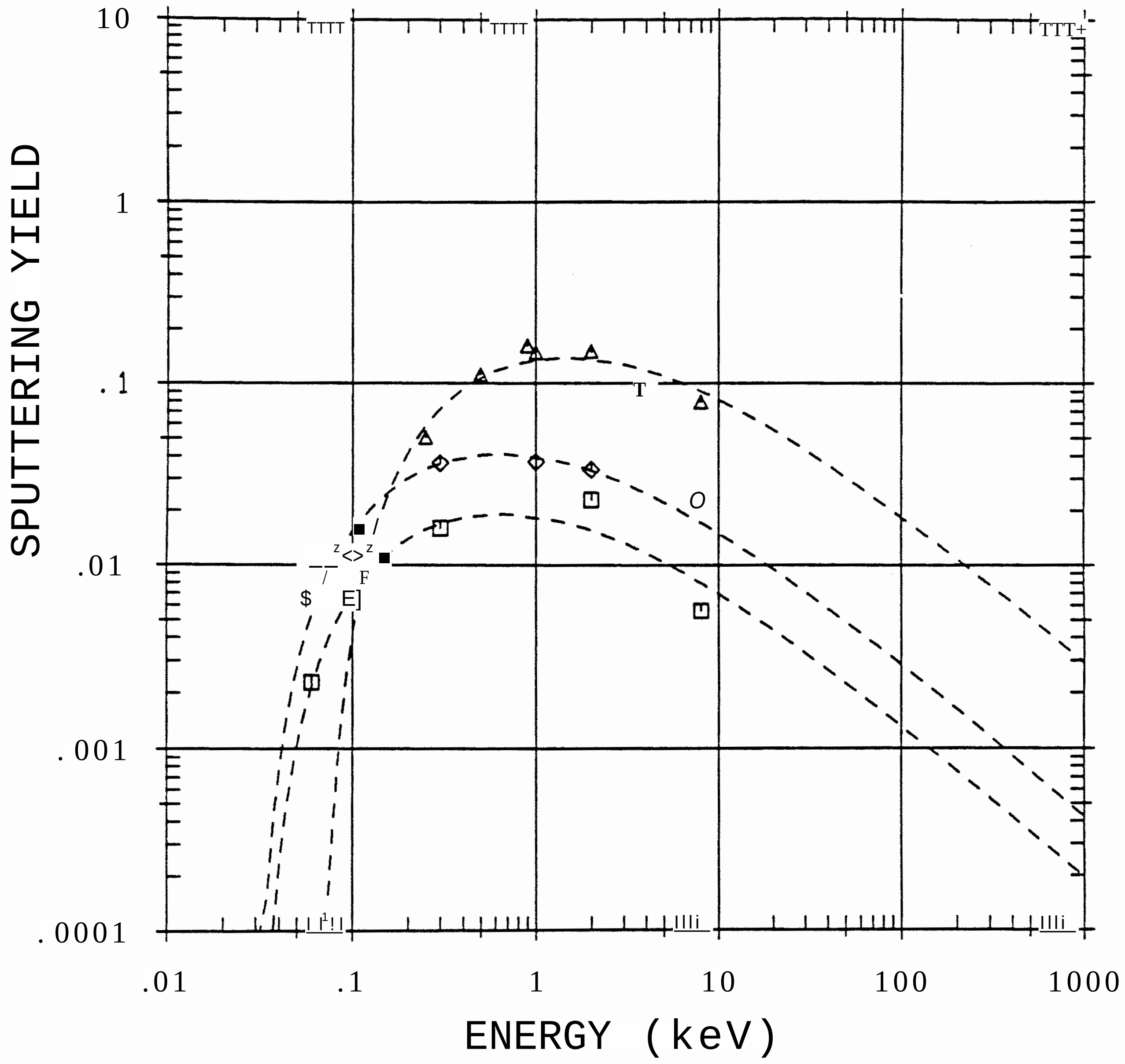


Fig. 57: Energy dependence of the sputtering yield of SiO_2 with H, D and ^{4}He. The data are published in [1],

Experimental Data

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
SiO_2	H	0.060	0	0.00228	20	3	III	101	27.06.1978
SiO_2	H	0.100	0	0.00650	20	3	III	94	16.06.1978
SiO_2	H	0.300	0	0.01600	20	3	III	94	15.06.1978
SiO_2	H	2.000	0	0.02300	20	3	III	92	14.06.1978
SiO_2	H	8.000	0	0.00560	20	1	III	92	14.06.1978

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
SiO_2	D	0.060	0	0.00710	20	3	III	102	28.06.1978
SiO_2	D	0.100	0	0.01100	20	3	III	97	21.06.1978
SiO_2	D	0.300	0	0.03650	20	3	III	96	20.06.1978
SiO_2	D	1.000	0	0.03700	20	3	III	98	21.06.1978
SiO_2	D	2.000	0	0.03360	20	3	III	95	19.06.1978
SiO_2	D	8.000	0	0.02340	20	1	III	97	20.06.1978

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
SiO_2	He	0.250	0	0.05050	20	1	III	98	21.06.1978
SiO_2	He	0.500	0	0.11180	20	1	III	99	22.06.1978
SiO_2	He	0.900	0	0.16200	20	1	III	99	22.06.1978
SiO_2	He	1.000	0	0.14800	20	1	III	105	05.07.1978
SiO_2	He	2.000	0	0.15000	20	1	III	100	23.06.1978
SiO_2	He	4.000	0	0.09440	20	1	III	99	22.06.1978
SiO_2	He	8.000	0	0.07900	20	1	III	100	26.06.1978

Target: TaC

Experimental Data

Target	Projectile	Angle	Symbol	*Eth(eV)*	Q(atoms/ion)
TaC	H	0	□	480.	0.0110
TaC	D	0	0	240.	0.0300
TaC	He	0	A	203.	0.173

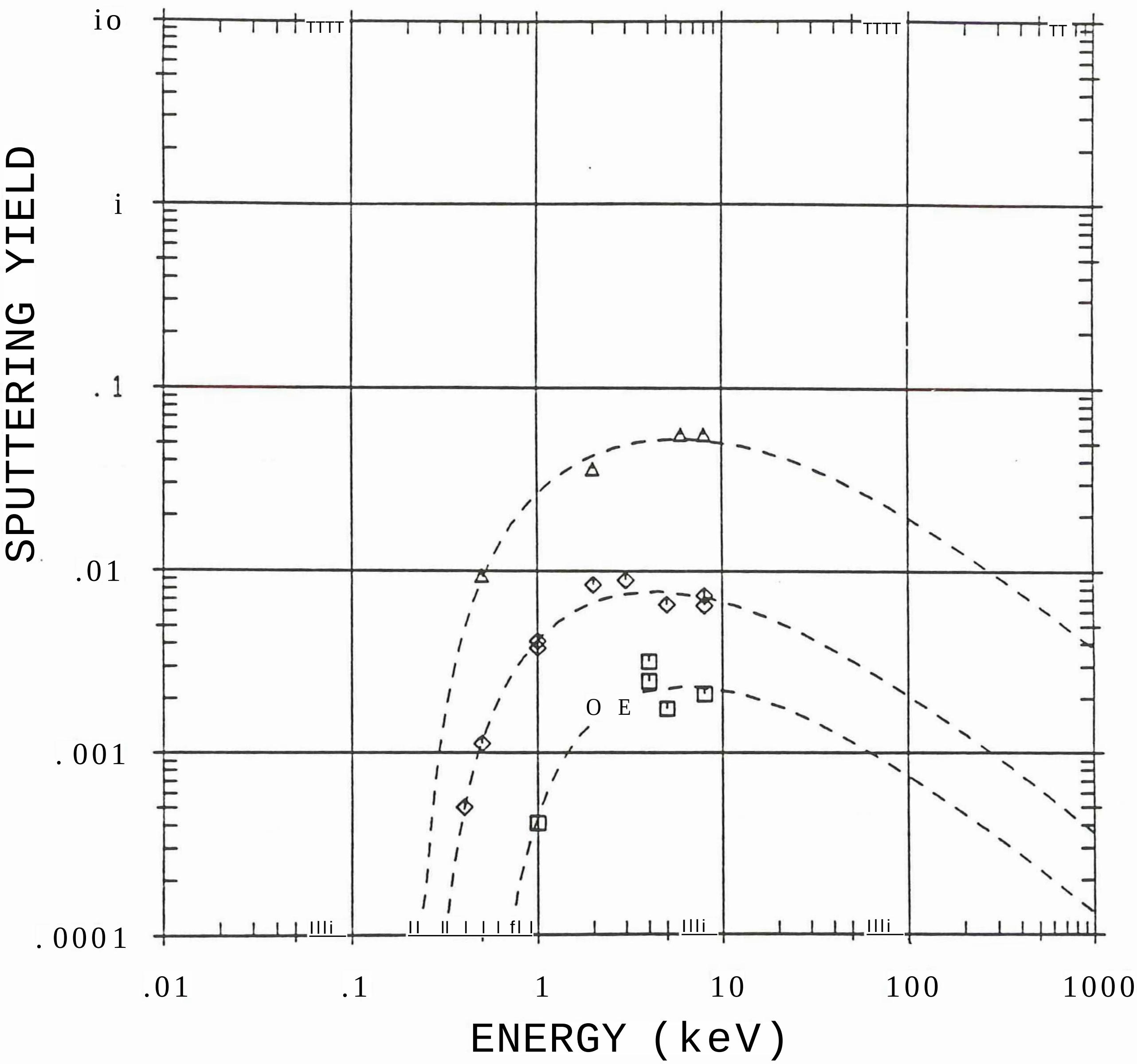


Fig. 58: Energy dependence of the sputtering yield of TaC with H, D and ^{4}He. The data are published in [41].

Experimental Data

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
TaC	H	1.000	0	0.00041	20	3	III	123	09.08.1978
TaC	H	2.000	0	0.00175	20	3	III	125	11.08.1978
TaC	H	3.000	0	0.00190	20	2	III	124	11.08.1978
TaC	H	3.000	0	0.00190	20	2	III	124	11.08.1978
TaC	H	4.000	0	0.00249	20	2	III	130	30.08.1978
TaC	H	4.000	0	0.00319	20	2	III	157	13.10.1978
TaC	H	5.000	0	0.01750	20	1	III	127	23.08.1978
TaC	H	8.000	0	0.00212	20	1	III	123	08.08.1978

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
TaC	D	0.400	0	0.00050	20	3	III	120	01.08.1978
TaC	D	0.500	0	0.00112	20	3	III	119	31.07.1978
TaC	D	1.000	0	0.00412	20	3	III	121	03.08.1978
TaC	D	1.000	0	0.00378	20	3	III	122	07.08.1978
TaC	D	2.000	0	0.00839	20	3	III	120	01.08.1978
TaC	D	3.000	0	0.00890	20	2	III	122	07.08.1978
TaC	D	5.000	0	0.00655	20	1	III	121	03.08.1978
TaC	D	8.000	0	0.00648	20	3	III	120	02.08.1978
TaC	D	8.000	0	0.00734	20	3	III	121	04.08.1978

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
TaC	He	0.500	0	0.00942	20	1	III	127	22.08.1978
TaC	He	2.000	0	0.03630	20	1	III	126	12.08.1978
TaC	He	6.000	0	0.05600	20	1	III	125	21.08.1978
TaC	He	8.000	0	0.05600	20	2	III	126	21.08.1978

Target: Ta_2O_5

Experimental Data

Target	Projectile	Angle	Symbol	$E_{th}(eV)$	Q(atoms/ion)
TajOg	H	0	□	553.	0.0290
TajOs	D	0	0	250.	0.0560
TajOs	He	0	A	129.	0.233

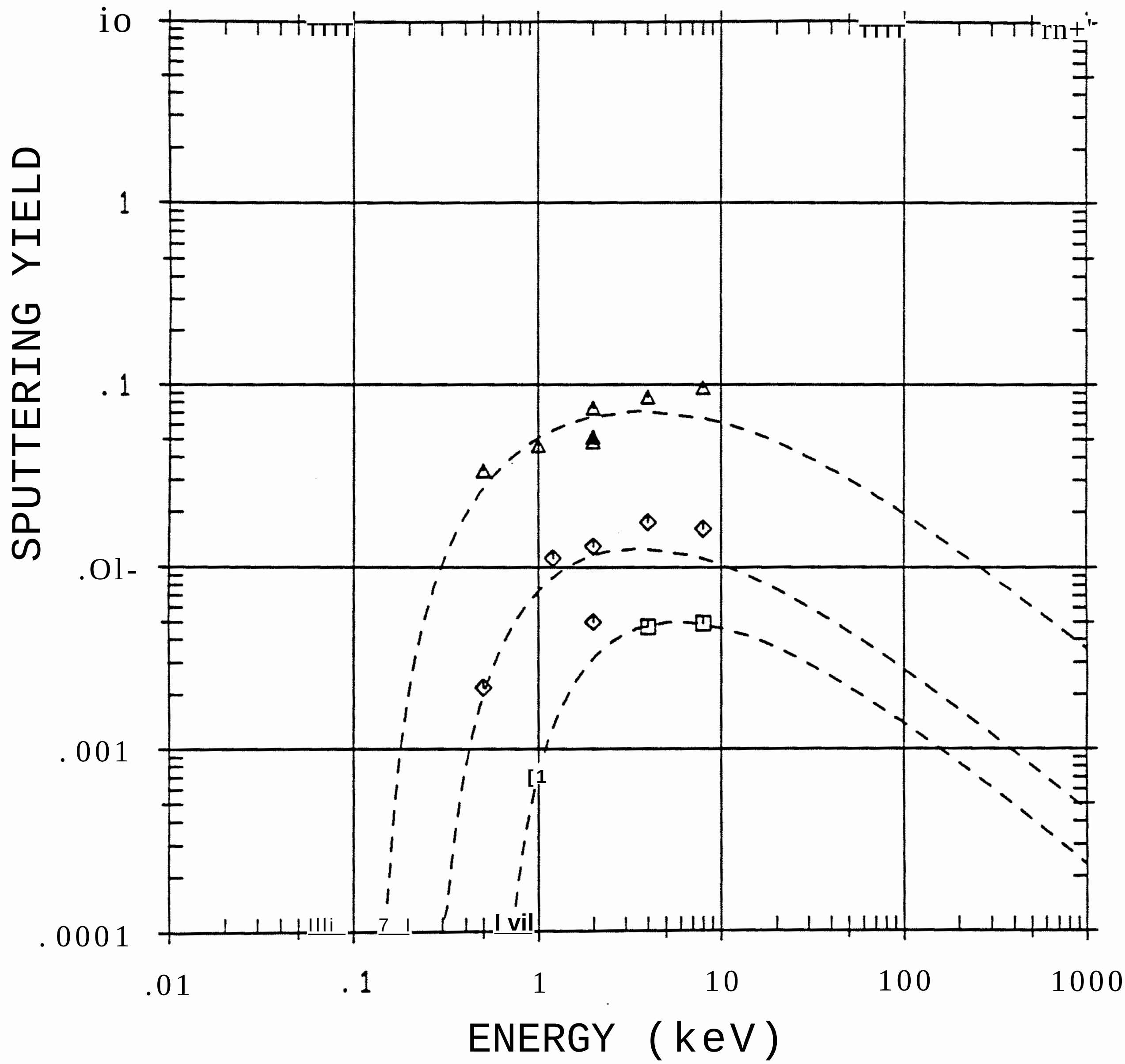


Fig. 59: Energy dependence of the sputtering yield of Ta_2O_5 with H, D and ^{4}He. The data are published in [1],

Experimental Data

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
Ta_2O_5	H	1.000	0	0.00074	20	3	III	145	20.09.1978
Ta_2O_5	H	4.000	0	0.00470	20	2	III	146	21.09.1978
Ta_2O_5	H	8.000	0	0.00492	20	1	III	146	21.09.1978

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
Ta_2O_5	D	0.500	0	0.00218	20	3	III	132	1.09.1978
Ta_2O_5	D	1.200	0	0.01120	20	3	III	131	31.08.1978
Ta_2O_5	D	2.000	0	0.00500	20	3	III	131	30.08.1978
Ta_2O_5	D	2.000	0	0.01300	20	3	III	131	31.08.1978
Ta_2O_5	D	4.000	0	0.01760	20	2	III	132	31.08.1978
Ta_2O_5	D	8.000	0	0.01620	20	1	III	132	31.08.1978

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
Ta 2Os	He	0.500	0	0.03370	20	1	III	144	19.09.1978
Ta 20$	He	1.000	0	0.04610	20	3	III	144	19.09.1978
Ta 2O 5	He	2.000	0	0.07450	20	1	III	144	19.09.1978
Ta 2Os	He	2.000	0	0.05130	20	1	III	83	14.10.1978
Ta 2Os	He	2.000	0	0.04840	20	1	III	89	31.10.1978
Ta 2Os	He	4.000	0	0.08550	20	1	III	145	20.09.1978
Ta 2Os	He	8.000	0	0.09620	20	1	III	145	21.09.1978

Target: TiB_2

Experimental Data

Target	Projectile	Angle	Symbol	$E_{th}(eV)$	Q(atoms/ion)
TiB_2	H	0	□	109.	0.0500
TiB_2	D	0	◇	87.0	0.0900
TiB_2	He	0	△	68.0	0.350

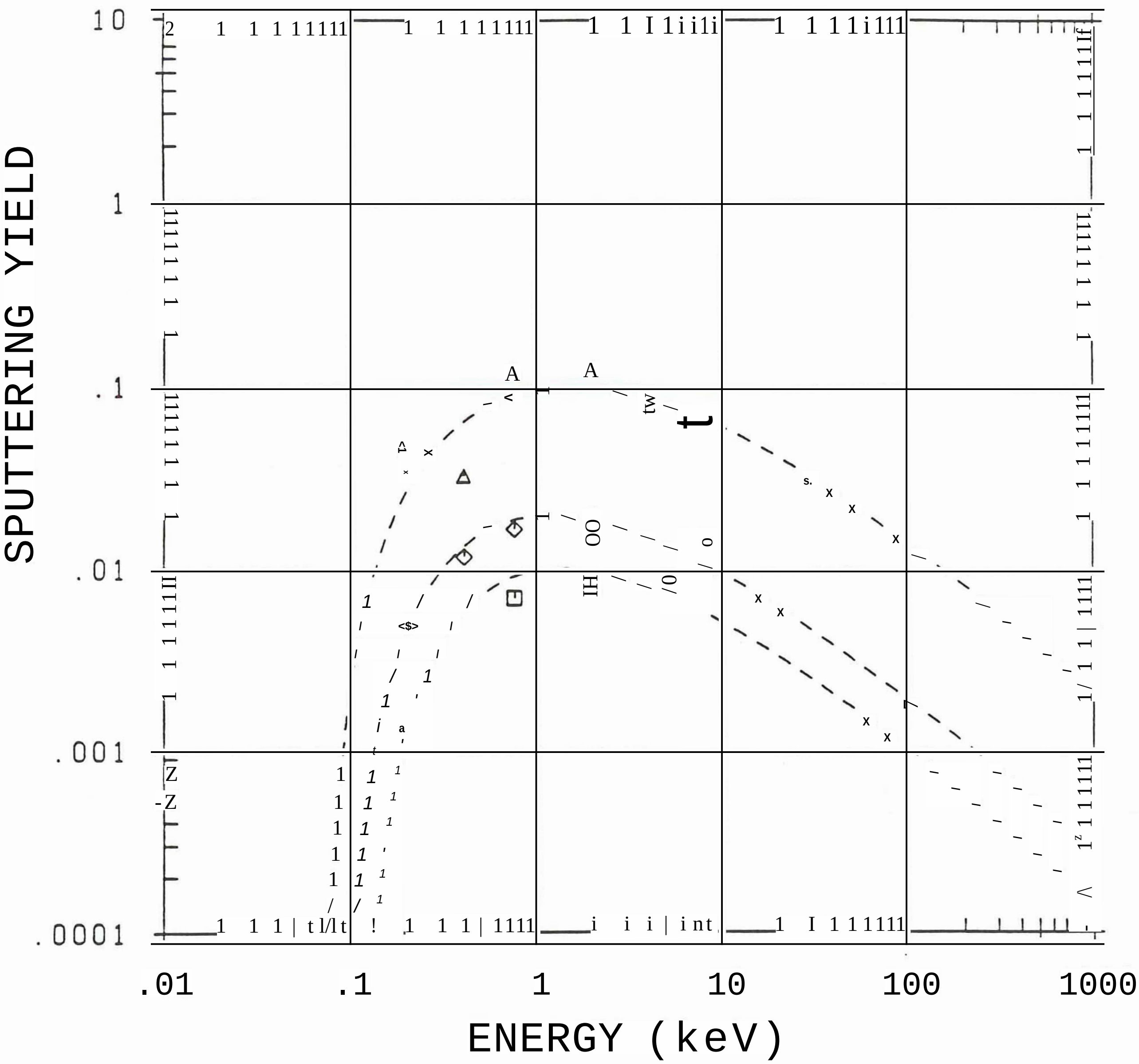


Fig. 60: Energy dependence of the sputtering yield of TiB_2 with H, D and ^4He. The data are unpublished.

Experimental Data

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
TiB_2	H	0.200	0	0.00150	100	3	III	109	20.09.1979
TiB_2	H	0.750	0	0.00700	100	3	III	105	04.09.1979
TiB_2	H	2.000	0	0.00890	100	3	III	110	27.09.1979
TiB_2	H	2.000	0	0.00818	100	3	VI	137	30.03.1982
TiB_2	H	6.000	0	0.00905	20	3	III	104	03.09.1979
TiB_2	H	8.000	0	0.01000	100	1	III	106	07.09.1979

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
TiB_2	D	0.200	0	0.00506	100	3	III	109	19.09.1979
TiB_2	D	0.200	0	0.00510	20	3	IX	115	20.10.1987
TiB_2	D	0.400	0	0.01180	100	3	VI	137	29.03.1982
TiB_2	D	0.750	0	0.01680	100	3	III	113	03.10.1979
TiB_2	D	2.000	0	0.01960	100	3	III	107	10.09.1979
TiB_2	D	2.000	0	0.01860	100	3	III	110	01.10.1979
TiB_2	D	2.000	0	0.01928	20	3	VI	138	31.03.1982
TiB_2	D	2.000	0	0.01540	20	3	IX	116	21.10.1987
TiB_2	D	8.000	0	0.01540	100	1	III	109	18.09.1979

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
TiB_2	He	0.200	0	0.04680	100	1	III	106	06.09.1979
TiB_2	He	0.400	0	0.03270	20	1	VI	138	31.03.1982
TiB_2	He	0.750	0	0.12200	100	1	III	105	05.09.1979
TiB_2	He	2.000	0	0.12700	190	1	III	106	06.09.1979
TiB_2	He	4.000	0	0.08000	20	1	VI	138	31.03.1982
TiB_2	He	8.000	0	0.07440	100	1	III	105	05.09.1979

Target: TiC

Experimental Data

Target	Projectile	Angle	Symbol	Fth(eV)	Q(atoms/ion)
TiC	H	0	□	97.0	0.0290
TiC	D	0	0	54.0	0.0610
TiC	He	0	A	29.0	0.221

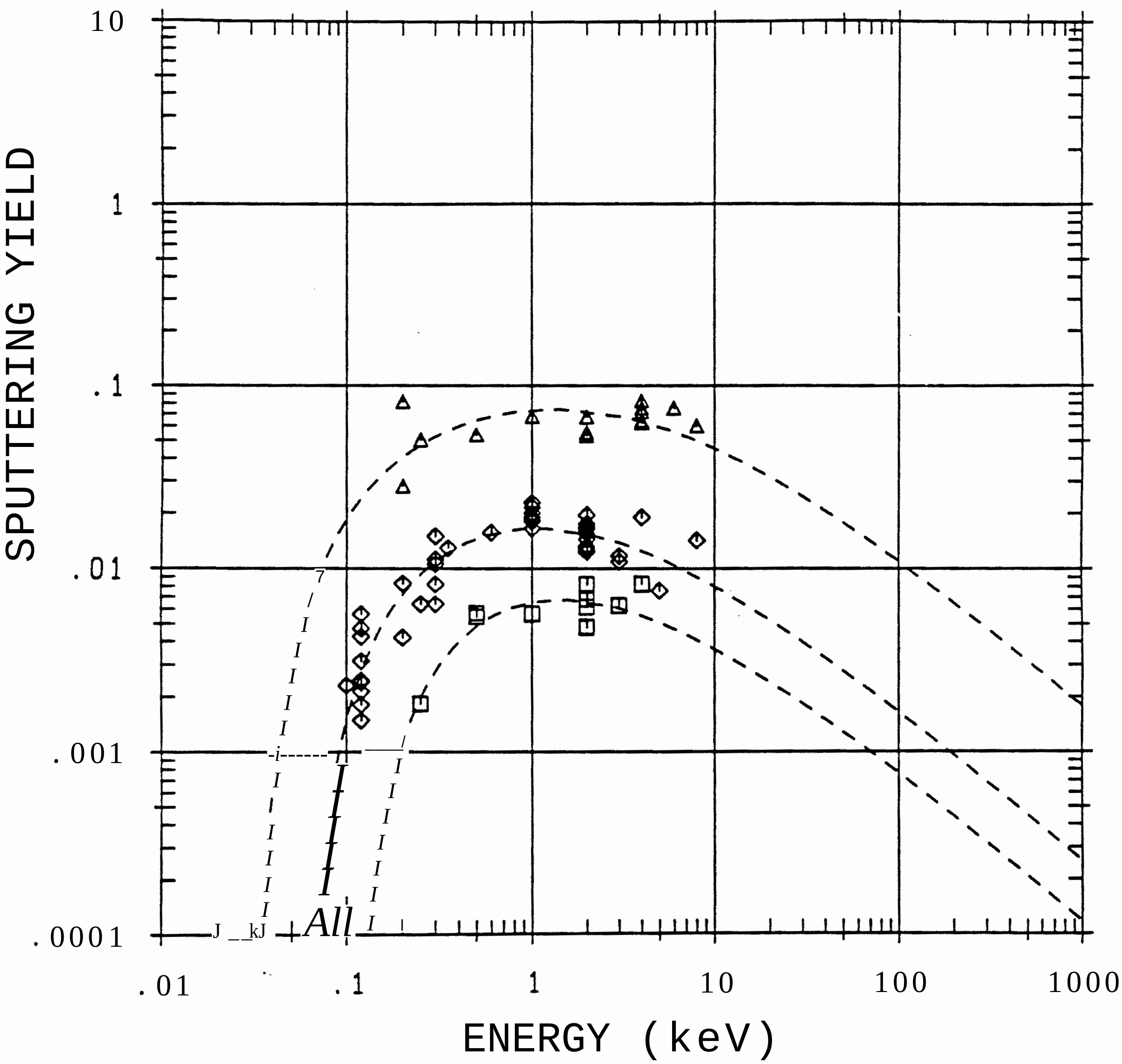


Fig. 61: Energy dependence of the sputtering yield of TiC with H, D and ^{4}He. The data are measured at room temperature. At this temperature the sputtering yield is influenced by oxide formation. For temperatures above 800°C oxygen diffuse into the bulk leading to an increase of the sputtering yield. The wide spread of the data for D bombardment originates from investigations at different oxygen partial pressure. The data are published in [41,42,61].

Experimental Data

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
TiC	H	0.250	0	0.00183	20	3	III	4	16.09.1977
TiC	H	0.500	0	0.00572	20	3	III	3	16.09.1977
TiC	H	0.500	0	0.00545	20	3	VI	85	09.11.1982
TiC	H	1.000	0	0.00566	20	3	VI	84	09.11.1982
TiC	H	2.000	0	0.00680	20	3	II	155	16.06.77
TiC	H	2.000	0	0.00480	20	3	IV	148	25.01.1980
TiC	H	2.000	0	0.00477	150	3	IV	152	31.01.1980
TiC	H	2.000	0	0.00822	20	3	IV	184	05.05.1980
TiC	H	2.000	0	0.00617	20	3	V	140	01.04.1982
TiC	H	3.000	0	0.00628	20	3	III	3	15.09.1977
TiC	H	4.000	0	0.00824	20	2	III	5	21.09.1977

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
TiC	D	0.100	0	0.00230	20	3	VI	144	20.06.1983
TiC	D	0.1[illegible]0	0	0.00313	20	3	III	4	19.09.1977
TiC	D	0.1[illegible]0	0	0.00240	20	3	VII	174	07.02.1985
TiC	D	0.1[illegible]0	0	0.00213	20	3	VII	179	12.02.1985
TiC	D	0.120	0	0.00148	20	3	VII	183	18.02.1985
TiC	D	0.120	0	0.00562	20	3	VII	186	25.02.1985
TiC	D	0.120	0	0.00424	20	3	VII	188	26.02.1985
TiC	D	0.120	0	0.00471	20	3	VIII	5	04.03.1985
TiC	D	0.120	0	0.00246	20	3	VIII	31	22.04.1985
TiC	D	0.120	0	0.00181	20	3	VIII	32	24.04.1985
TiC	D	0.200	0	0.00420	20	3	II	156	21.06.77
TiC	D	0.200	0	0.00828	20	3	VI	143	16.06.1983
TiC	D	0.250	0	0.00640	20	3	V	141	02.04.1982
TiC	D	0.300	0	0.00640	20	3	VII	174	07.02.1985
TiC	D	0.300	0	0.01060	20	3	VII	179	13.02.1985
TiC	D	0.300	0	0.00820	20	3	VII	182	18.02.1985
TiC	D	0.300	0	0.01120	20	3	VII	184	25.02.1985
TiC	D	0.300	0	0.01500	20	3	VII	187	26.02.1985
TiC	D	0.350	0	0.01290	20	3	III	7	28.09.1977
TiC	D	0.600	0	0.01570	20	3	II	157	22.06.77
TiC	D	1.000	0	0.01830	20	3	VII	175	11.02.1985
TiC	D	1.000	0	0.01650	20	3	VII	178	12.02.1985
TiC	D	1.000	0	0.01840	20	3	VII	182	15.02.1985
TiC	D	1.000	0	0.01900	20	3	VII	183	18.02.1985
TiC	D	1.000	0	0.01800	20	3	VII	184	25.02.1985
TiC	D	1.000	0	0.02000	20	3	VII	186	26.02.1985
TiC	D	1.000	0	0.02160	20	3	VII	188	26.02.1985
TiC	D	1.000	0	0.02280	20	3	VIII	5	05.03.1985
TiC	D	2.000	0	0.01680	20	3	II	154	08.06.77
TiC	D	2.000	0	0.01620	20	3	IV	148	25.01.1980
TiC	D	2.000	0	0.01700	20	3	IV	149	28.01.1980
TiC	D	2.000	0	0.01260	20	3	V	64	29.01.1981
TiC	D	2.000	0	0.01310	20	3	V	65	02.02.1981
TiC	D	2.000	0	0.01440	0	3	V	86	15.07.1981

Ti	D	2.000	0	0.01320	0	3	V	87	17.07.1981
Ti	D	2.000	0	0.01550	20	3	V	139	01.04.1982
Ti	D	2.000	0	0.01640	20	3	V	140	02.04.1982
Ti	D	2.000	0	0.01680	20	3	V	148	28.04.1982
Ti	D	2.000	0	0.01230	20	3	VII	174	07.02.1985
Ti	D	2.000	0	0.01760	20	3	VII	178	12.02.1985
Ti	D	2.000	0	0.01950	20	3	VII	181	15.02.1985
Ti	D	2.000	0	0.01700	20	3	VII	189	27.02.1985
Ti	D	2.000	0	0.01270	200	3	VIII	38	12.06.1985
Ti	D	3.000	0	0.01090	20	2	VI	145	21.06.1983
Ti	D	3.000	0	0.01170	20	3	VII	173	07.02.1985
Ti	D	4.000	0	0.01900	20	2	III	4	19.09.1977
Ti	D	5.000	0	0.00757	20	1	VI	145	21.06.1983
Ti	D	8.000	0	0.01420	20	1	III	5	20.09.1977

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
TiC	He	0.200	0	0.08160	20	1	II	156	22.06.77
TiC	He	0.200	0	0.02820	20	1	III	6	27.09.1977
TiC	He	0.250	0	0.05040	20	1	III	2	14.09.1977
TiC	He	0.500	0	0.05370	20	1	III	2	14.09.1977
TiC	He	1.000	0	0.06770	20	1	III	1	13.09.1977
TiC	He	2.000	0	0.05540	20	1	IV	148	24.01.1980
TiC	He	2.000	0	0.05330	20	1	V	168	13.05.1982
TiC	He	2.000	0	0.06740	20	1	V	170	14.05.1982
TiC	He	4.000	0	0.07200	20	1	III	3	15.09.1977
TiC	He	4.000	0	0.08260	20	1	III	6	27.09.1977
TiC	He	4.000	0	0.06270	130	1	IV	152	31.01.1980
TiC	He	4.000	0	0.06460	20	3	V	65	30.01.1981
TiC	He	4.000	0	0.07530	20	1	V	139	01.04.1982
TiC	He	6.000	0	0.07550	20	1	V	146	26.04.1982
TiC	He	8.000	0	0.06030	20	1	III	1	12.09.1977

Target: TiC

Experimental Data

Target	Projectile	Angle	Symbol	$E_{th}(eV)$	Q(atoms/ion)
"TiC	Ö	Ö	V	1Ö?	L47
TiC	Ne	0	□	24.0	1.80

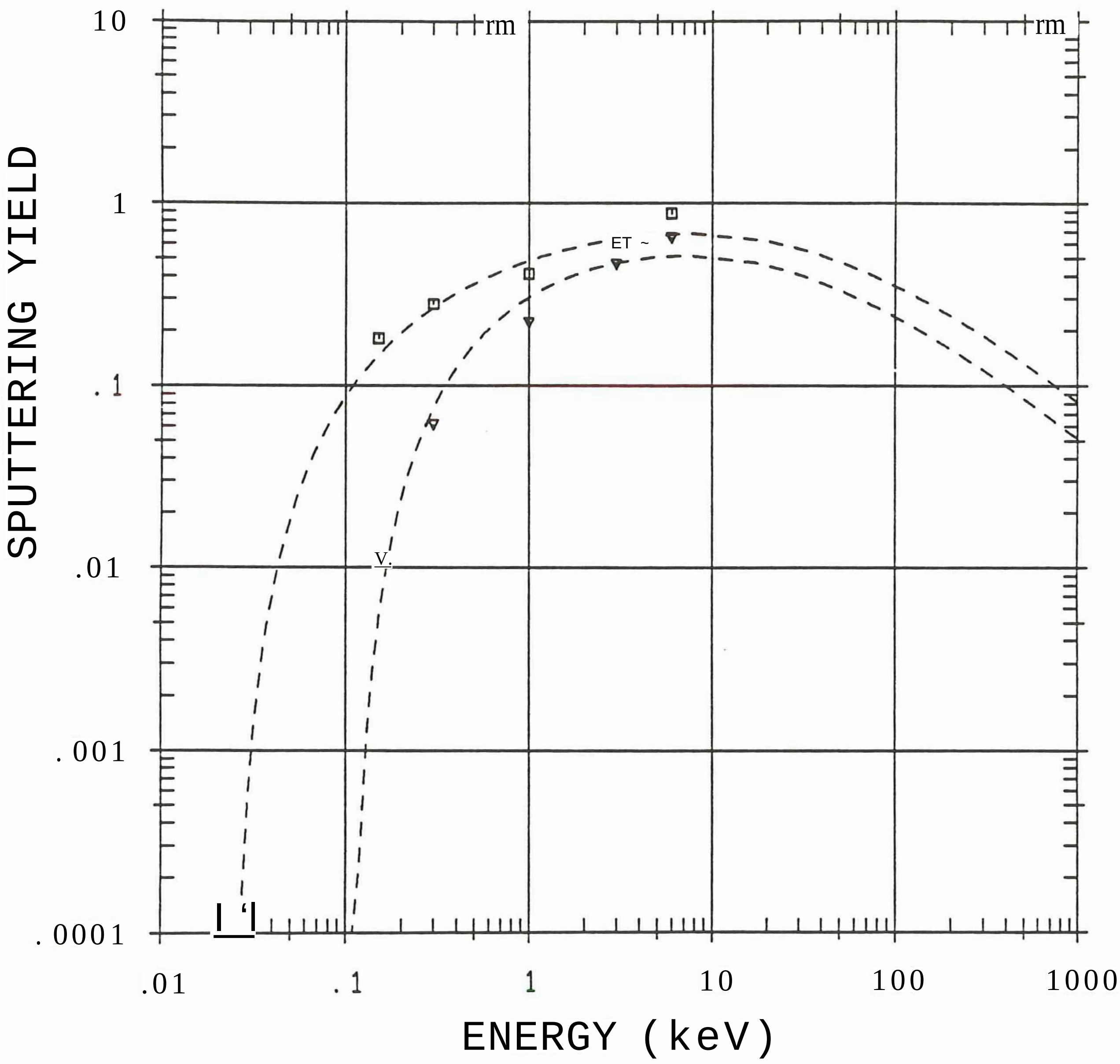


Fig. 62: Energy dependence of the sputtering yield of TiC with O and Ne measured at room temperature. For 0+ bombardment, oxidation leads to a higher threshold energy as expected due to a higher binding energy of the oxide. The data are published in [45].

Experimental Data

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
TiC	0	0.150	0	0.01100	20				HECHTL1981
TiC	0	0.300	0	0.06100	20				HECHTL1981
TiC	0	1.000	0	0.22000	20				HECHTL1981
TiC	0	3.000	0	0.46000	20				HECHTL1981
TiC	0	6.000	0	0.64400	20				HECHTL1981

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
TiC	Ne	0.150	0	0.18100	20				HECHTL1981
TiC	Ne	0.300	0	0.27900	20				HECHTL1981
TiC	Ne	1.000	0	0.40800	20				HECHTL1981
TiC	Ne	3.000	0	0.60700	20				HECHTL1981
TiC	Ne	6.000	0	0.88000	20				HECHTL1981

Target: WC

Experimental Data

Target	Projectile	Angle	Symbol	$E_{th}(eV)$	Q(atoms/ion)
WC	H	0	□	480.	0.0200
WC	D	0	0	171.	0.0400
WC	He	0	A	116.	0.200

Calculated Data

Target	Projectile	Angle	Symbol	$E_{th}(eV)$	Q(atoms/ion)
WC	He	0	**A**	114.	0.250

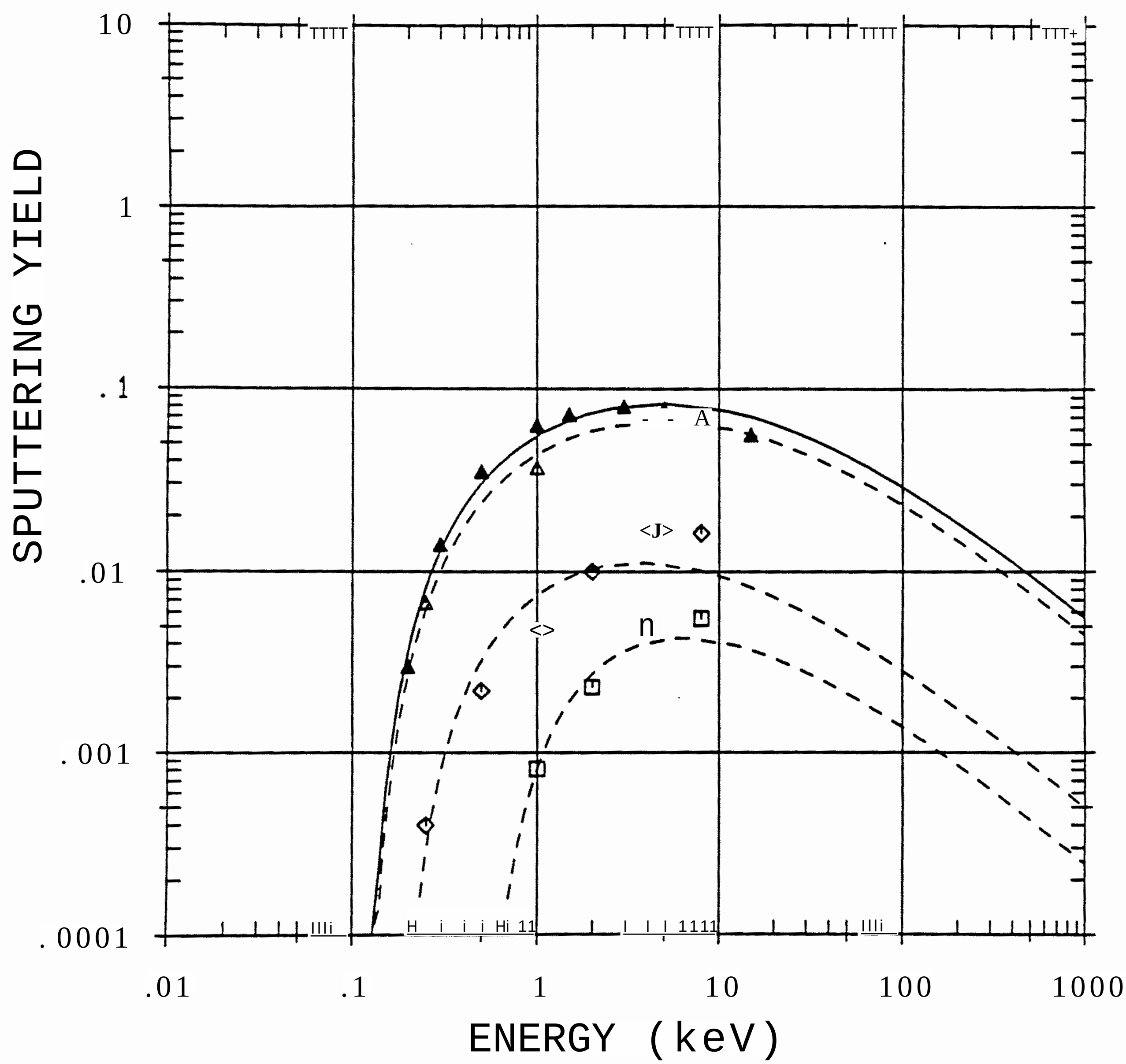


Fig. 63: Energy dependence of the sputtering yield of WC with H, D and ^{4}He. The data are published in [41].

Experimental Data

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
WC	H	1.000	0	0.00081	20	3	III	79	11.05.1978
WC	H	2.000	0	0.00231	20	3	III	82	01.06.1978
WC	H	4.000	0	0.00500	20	2	III	78	11.05.1978
WC	H	8.000	0	0.00555	20	1	III	82	01.06.1978

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
WC	D	0.250	0	0.00040	20	3	III	80	30.05.1978
WC	D	0.500	0	0.00220	20	3	III	80	30.05.1978
WC	D	1.000	0	0.00480	20	3	III	81	31.05.1978
WC	D	2-000	0	0.01000	20	3	III	81	31.05.1978
WC	D	4.000	0	0.01710	20	2	III	81	31.05.1978
WC	D	8.000	0	0.01620	20	1	III	82	31.05.1978

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
WC	He	0.250	0	0.00680	20	1	III	78	10.05.1978
WC	He	1.000	0	0.03680	20	1	III	78	10.05.1978
WC	He	8.000	0	0.07000	20	1	III	77	10.05.1978

Calculated Data

Target	Proj.	Energy	Angle	Yield	Temp.	P	SBE
WC	He	0.200	0	0.003000	20	15.60	8.00
WC	He	0.300	0	0.014000	20	15.60	8.00
WC	He	0.500	0	0.035000	20	15.60	8.00
WC	He	1.000	0	0.063000	20	15.60	8.00
WC	He	1.500	0	0.072000	20	15.60	8.00
WC	He	3.000	0	0.080000	20	15.60	8.00
WC	He	5.000	0	0.078000	20	15.60	8.00
WC	He	15.000	0	0.056000	20	15.60	8.00

Target: ZrC

Experimental Data

Target	Projectile	Angle	Symbol	$E_{th}(eV)$	Q(atoms/ion)
ZrC	H	0	□	132.	$0.600 \cdot 10^{-2}$
ZrC	D	0	◇	74.0	0.0150
ZrC	He	0	△	70.0	0.161

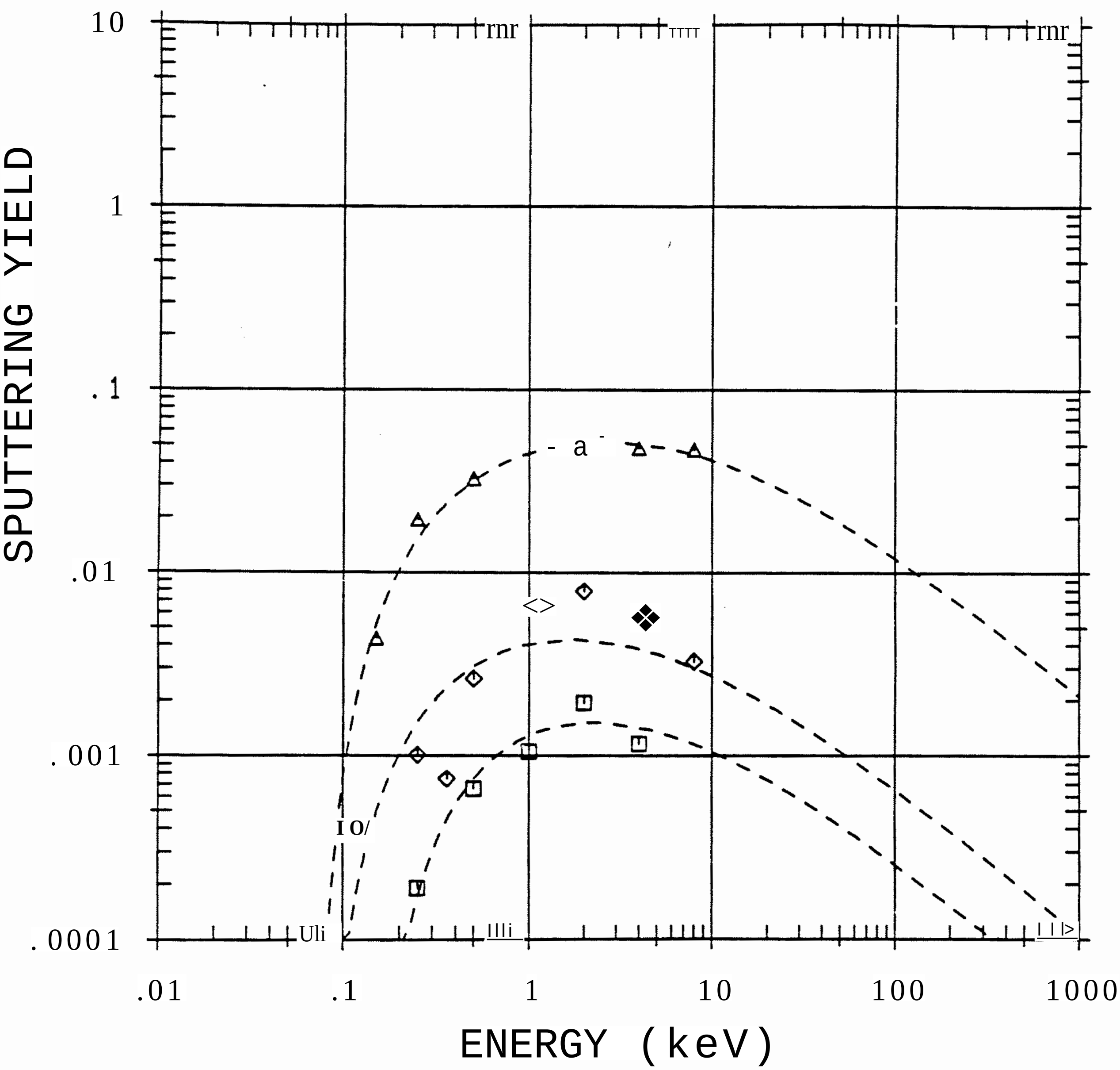


Fig. 64: Energy dependence of the sputtering yield of ZrC with H, D and ^{4}He. The data are published in [1].

Experimental Data

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
ZrC	H	0.250	0	0.00019	20	3	III	136	07.09.1978
ZrC	H	0.500	0	0.00066	20	3	III	135	07.09.1978
ZrC	H	1.000	0	0.00105	20	3	III	137	12.09.1978
ZrC	H	2.000	0	0.00194	20	3	III	136	11.09.1978
ZrC	H	4.000	0	0.00116	20	2	III	136	08.09.1978

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
ZrC	D	0.120	0	0.00039	20	3	III	133	04.09.1978
ZrC	D	0.250	0	0.00101	20	3	III	134	05.09.1978
ZrC	D	0.360	0	0.00075	20	3	III	139	15.09.1978
ZrC	D	0.500	0	0.00263	20	3	III	134	05.09.1978
ZrC	D	1.000	0	0.00630	20	3	III	134	06.09.1978
ZrC	D	2.000	0	0.00790	20	3	III	133	05.09.1978
ZrC	D	4.000	0	0.00544	20	3	III	135	06.09.1978
ZrC	D	8.000	0	0.00327	20	1	III	135	06.09.1978

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
ZrC	He	0.150	0	0.00436	20	1	III	139	14.09.1978
ZrC	He	0.250	0	0.01950	20	1	III	137	12.09.1978
ZrC	He	0.500	0	0.03260	20	1	III	137	12.09.1978
ZrC	He	2.000	0	0.04776	20	1	III	138	13.09.1978
ZrC	He	4.000	0	0.04800	20	1	III	138	14.09.1978
ZrC	He	8.000	0	0.04710	20	1	III	138	13.09.1978

Target: INCONEL

Experimental Data

Target	Projectile	Angle	Symbol	*Eth(eV)*	Q(atoms/ion)
INCONEL	H	0	□	50.7	0.0350
INCONEL	D	0	0	39.8	0.111
INCONEL	He	0	A	35.0	0.460

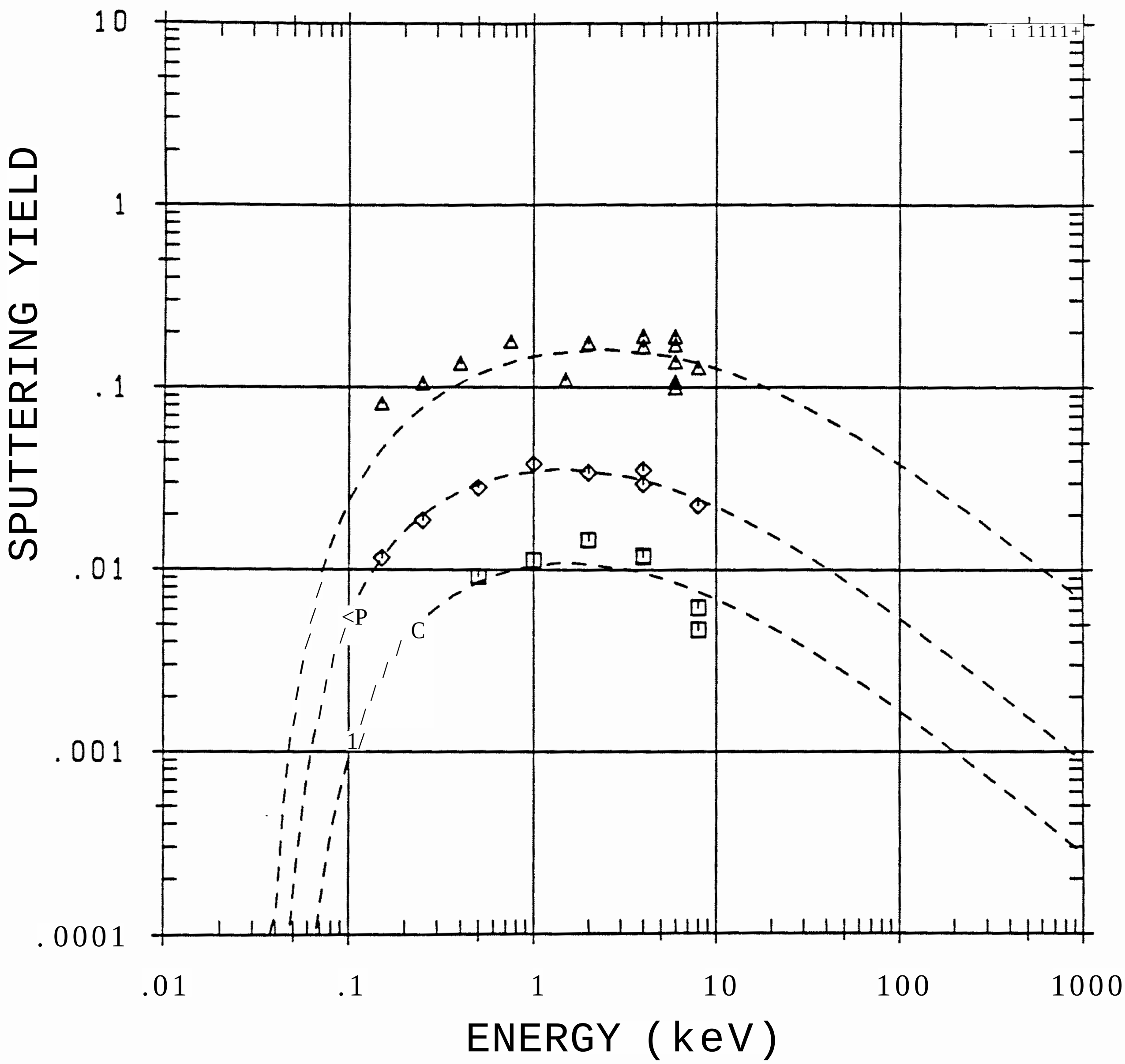


Fig. 65: Energy dependence of the sputtering yield of stainless steel (INCONEL 600) with H, D and “He. The threshold energy for He was taken from SS316 (Fig. 66). The data are published in [571.

Experimental Data

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
SSINCO	H	0.250	0	0.00470	20	3	II	102	27.01.77
SSINCO	H	0.500	0	0.00920	20	3	II	102	27.01.77
SSINCO	H	1.000	0	0.01130	20	3	II	101	26.01.77
SSINCO	H	2.000	0	0.01460	20	3	II	101	25.01.77
SSINCO	H	4.000	0	0.01200	20	2	II	101	26.01.77
SSINCO	H	4.000	0	0.01180	20	2	II	112	24.02.77
SSINCO	H	8.000	0	0.00470	20	1	II	101	25.01.77
SSINCO	H	8.000	0	0.00620	20	1	II	102	28.01.77

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
SSINCO	O	0.100	0	0.00570	20	3	II	100	24.01.77
SSINCO	O	0.150	0	0.01160	20	3	II	100	21.01.77
SSINCO	O	0.250	0	0.01870	20	3	II	99	21.01.77
SSINCO	O	0.500	0	0.02840	20	3	II	136	21.04.77
SSINCO	O	1.000	0	0.03830	20	3	II	100	24.01.77
SSINCO	O	2.000	0	0.03430	20	3	II	99	21.01.77
SSINCO		4.000	0	0.02970	20	2	II	100	24.01.77
SSINCO		4.000	0	0.03550	20	2	II	112	24.02.77
SSINCO		8.000	0	0.02270	20	1	II	136	21.04.77

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
SSINCO	He	0.150	0	0.08200	20	1	II	113	01.03.77
SSINCO	He	0.250	0	0.10500	20	1	II	104	01.02.77
SSINCO	He	0.400	0	0.13500	20	1	II	113	01.03.77
SSINCO	He	0.750	0	0.17800	20	1	II	103	31.01.77
SSINCO	He	1.500	0	0.11000	20	1	II	113	24.02.77
SSINCO	He	2.000	0	0.17500	20	1	II	103	01.02.77
SSINCO	He	4.000	0	0.19100	20	1	II	103	31.01.77
SSINCO	He	4.000	0	0.16700	20	1	II	111	24.02.77
SSINCO	He	6.000	0	0.09960	20	1	II	114	04.03.77
SSINCO	He	6.000	0	0.10700	20	1	II	115	04.03.77
SSINCO	He	6.000	0	0.13800	20	1	II	115	07.03.77
SSINCO	He	6.000	0	0.17000	20	1	II	115	07.03.77
SSINCO	He	6.000	0	0.19000	20	1	II	116	07.03.77
SSINCO	He	8.000	0	0.12800	20	1	II	103	31.01.77

Experimental	Data				
Target	**Projectile**	**Angle**	**Symbol**	$E_{th}(eV)$	**Q(atoms/ion)**
SS316	E	0	□	65.0	0.0320
SS316	D	0	0	39.0	0.0740
SS316	He	0	A	35.0	0.383
SS316	0	0	V	69.6	1.31

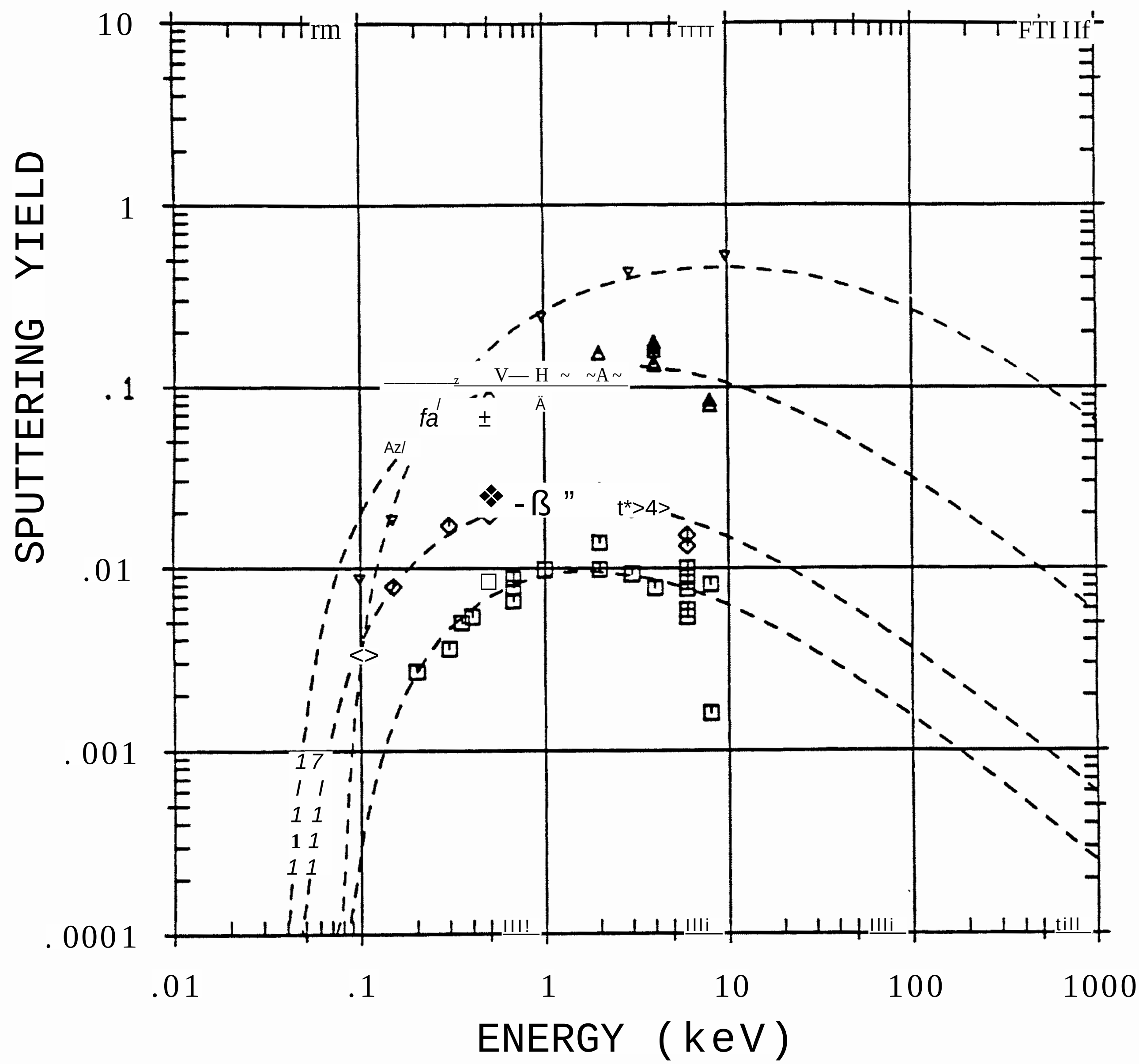


Fig. 66: Energy dependence of the sputtering yield of stainless steel (SS316) with H, D , ^{4}He and O. For O^{+} bombardment, oxidation leads to a higher threshold energy as expected due to higher binding energy of the oxide. The data are published in [45,51,57,661.

Experimental Data

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
SS316	H	0.200	0	0.00270	20	3	II	117	10.03.77
SS316	H	0.300	0	0.00360	20	3	II	118	15.03.77
SS316	H	0.350	0	0.00500	20	3	II	119	17.03.77
SS316	H	0.400	0	0.00540	20	3	II	121	18.03.77
SS316	H	0.500	0	0.00860	20	3	II	116	10.03.77
SS316	H	0.670	0	0.00660	20	3	II	19	13.04.76
SS316	H	0.670	0	0.00780	650	3	II	47	12.07.76
SS316	H	0.670	0	0.00880	550	3	II	47	14.07.76
SS316	H	1.000	0	0.00980	20	3	II	19	14.04.76
SS316	H	1.000	0	0.02200	20	3	IV	99	24.06.1979
SS316	H	2.000	0	0.01380	660	3	II	52	21.07.76
SS316	H	2.000	0	0.00983	20	3	V	53	20.10.1980
SS316	H	3.000	0	0.00930	20	2	II	19	13.04.76
SS316	H	4.000	0	0.00780	20	2	II	116	09.03.77
SS316	H	6.000	0	0.00540	20	1	II	19	12.04.76
SS316	H	6.000	0	0.00890	660	1	II	53	21.07.76
SS316	H	6.000	0	0.00840	500	1	II	60	31.08.76
SS316	H	6.000	0	0.00770	400	1	II	60	01.09.76
SS316	H	6.000	0	0.00590	200	1	II	60	01.09.76
SS316	H	6.000	0	0.01000	500	1	II	61	07.09.76
SS316	H	8.000	0	0.00160	20	1	II	116	08.03.77
SS316	H	8.000	0	0.00815	20	1	IV	101	31.07.1979

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
SS316	[illegible]	0.100	0	0.00330	20	3	II	136	22.04.77
SS316	[illegible]	0.150	0	0.00790	20	3	II	125	01.04.77
SS316	[illegible]	0.300	0	0.01710	20	3	II	118	14.03.77
SS316	[illegible]	0.500	0	0.01940	20	3	II	61	07.09.76
SS316	[illegible]	0.500	0	0.02520	20	3	II	117	14.03.77
SS316	[illegible]	1.000	0	0.02600	20	3	11	42	24.06.76
SS316	[illegible]	2.000	0	0.02660	20	3	II	42	29.06.76
SS316	[illegible]	2.000	0	0.02620	20	3	V	2	13.05.1980
SS316		3.000	0	0.02100	20	2	II	117	11.03.77
SS316		4.000	0	0.02180	20	2	II	125	31.03.77
SS316		6.000	0	0.01520	20	1	II	61	07.09.76
SS316		6.000	0	0.01320	20	1	II	118	15.03.77

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
SS316	He	0.150	0	0.04830	20	1	II	138	28.04.77
SS316	He	0.250	0	0.07040	20	1	II	114	02.03.77
SS316	He	0.500	0	0.09290	20	1	II	114	03.03.77
SS316	He	0.500	0	0.07230	20	1	II	137	25.04.77
SS316	He	0.500	0	0.09270	20	1	II	137	27.04.77
SS316	He	1.000	0	0.08400	20	1	II	113	01.03.77
SS316	He	1.000	0	0.12200	20	1	II	119	17.03.77
SS316	He	2.000	0	0.15500	20	1	II	61	07.09.76
SS316	He	2.000	0	0.12300	20	1	II	138	28.04.77
SS316	He	4.000	0	0.16000	500	1	II	54	27.07.76
SS316	He	4.000	0	0.16700	300	1	II	54	27.07.76
SS316	He	4.000	0	0.13300	20	1	II	54	27.07.76
SS316	He	4.000	0	0.13900	20	1	II	139	02.05.77
SS316	He	4.000	0	0.17600	20	1	III	41	24.01.78
SS316	He	4.000	0	0.17800	20	1	III	41	24.01.78
SS316	He	4.000	0	0.16800	20	1	III	41	24.01.78
SS316	He	8.000	0	0.08540	20	1	II	59	17.08.76
SS316	He	8.000	0	0.08000	20	1	II	138	29.04.77

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
SS316	0	0.100	0	0.00910	20	1			HECHTL1981
SS316	0	0.150	0	0.01960	20	1			HECHTL1981
SS316	0	0.300	0	0.07050	20	1			HECHTL1981
SS316	0	0.600	0	0.12500	20	1			HECHTL1981
SS316	0	1.000	0	0.25600	20	1			HECHTL1981
SS316	0	3.000	0	0.45000	20	1			HECHTL1981
SS316	0	10.000	0	0.55000	20	1			HECHTL1981

Target: USB

Experimental Data

Target	Projectile	Angle	Symbol	E_th(eV)	Q(atoms/ion)
C/USB15	D	0	◊		

Calculated Data

Target	Projectile	Angle	Symbol	E_th(eV)	Q(atoms/ion)
C/USB15	D	Ö	♦	19~5	0.0540

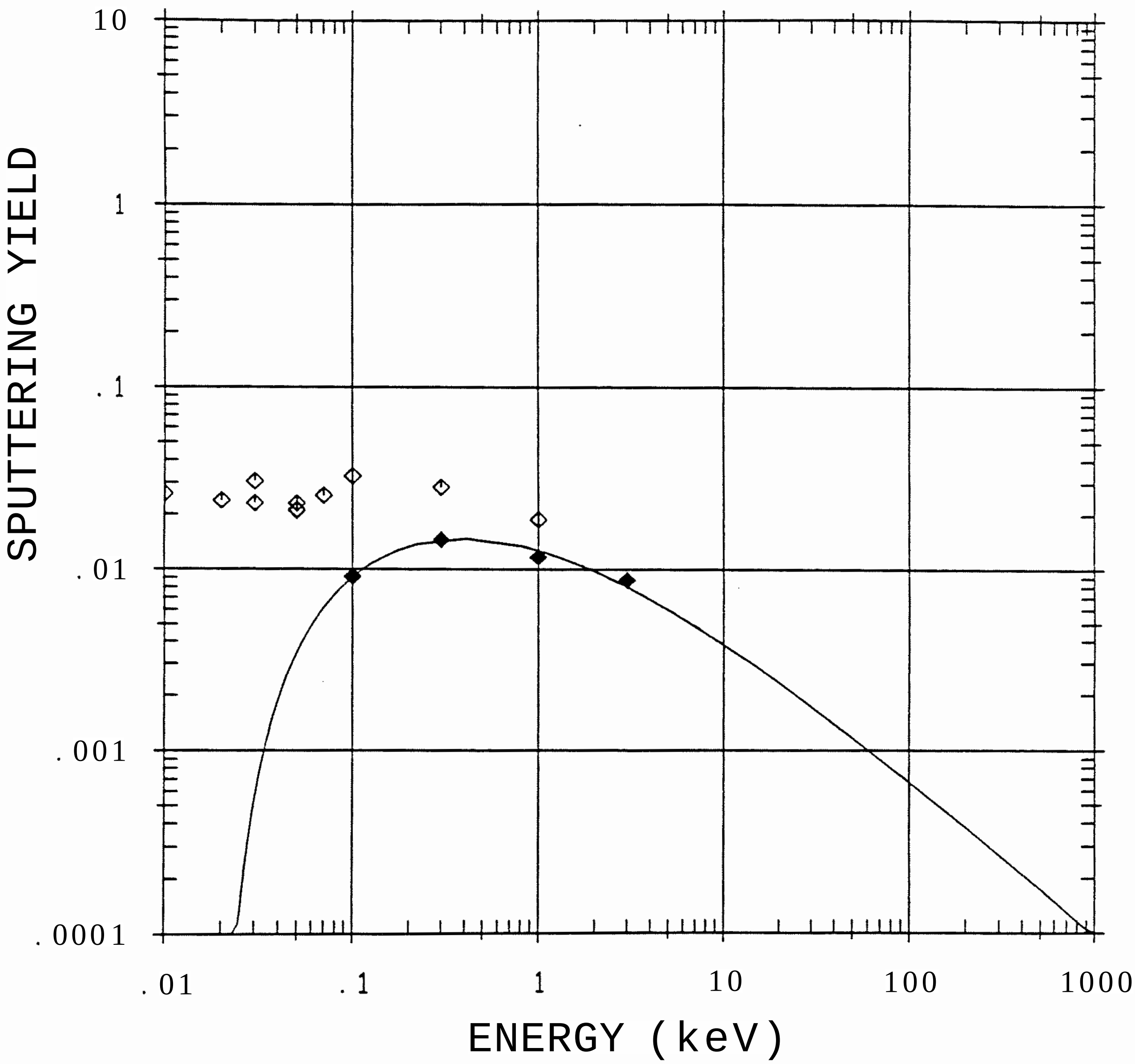


Fig. 67: Energy dependence of the sputtering yield of boron doped graphite USB15 (15 at.% B) with D. Only data measured at room temperature are plotted. At ion energies below 100 eV chemical sputtering is observed leading to high sputtering yields below the expected threshold. The data are published in [67].

Experimental Data

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
C/USB15	D	0.010	0	0.02600	20	3	XI	106	20.02.1992
C/USB15	D	0.020	0	0.02380	20	3	X	147	13.02.1990
C/USB15	D	0.030	0	0.02310	20	3	XI	101	18.11.1991
C/USB15	D	0.030	0	0.03050	20	3	XI	103	19.02.1992
C/USB15	D	0.050	0	0.02100	20	3	X	147	12.02.1990
C/USB15	D	0.050	0	0.02300	20	3	XI	101	14.11.1991
C/USB15	D	0.050	0	0.02120	20	3	XI	102	17.02.1992
C/USB15	D	0.070	0	0.02550	20	3	XI	101	11.11.1991
C/USB15	D	0.100	0	0.03260	20	3	X	147	14.02.1990
C/USB15	D	0.300	0	0.02830	20	3	X	187	08.05.1990
C/USB15	D	1.000	0	0.01880	20	3	X	119	30.10.1989

Calculated Data

Target	Proj.	Energy	Angle	Yield	Temp.	P	SBE
C/USB15	D	0.100	0	0.009110	20	2.00	7.10
C/USB15	D	0.300	0	0.014500	20	2.00	7.10
C/USB15	D	1.000	0	0.011700	20	2.00	7.10
C/USB15	D	3.000	0	0.008750	20	2.00	7.10

5.2 Angular dependence of the sputtering yield.

The angular dependence of the sputtering yield for given incident energies presented for the ion target combinations given in table 2. The data for elemental materials and compounds are listed again alphabetically .These results are showed in figs. 68 - 140. Experimental and calculated data are fitted separately with Yamamura's formula (12). References to the original publications are given in the figure captions.

Table 2: Sputtering Data at oblique incidence for the following ion-target combinations

targets	*H*	*D*	*T*	^{4}*He*	*C*	*O*	*self*	*Na*	*K*	*Ne*	*Ar*	*Kr*	*Xe*
Ag		x						x	x				
Au	x	x						x	x				
B		x					x						
Be			x	x	x		x						
C	x	x	x	x	x		x						x
Cu	x	x					x				*x*		
Fe	x												
Ga							x						
In	x						x						
Li			x				x						
Mo	x	x		x			x				*x*		
Ni	x	x		x			x						
Si				x									
Ta	x												
Ti				x						x			
U	x											x	
W	x					x	x						
B_4C		x		x	x								
BeO						x							
SiC	x	x		x									
TiC	x	x		x									
USB15		x											

Projectile: D

Experimental Data						
Target	Projectile	Energy	Symbol	y(0)	*a*	f
Tg	D	0.100	□	0.00570	6T9	L47

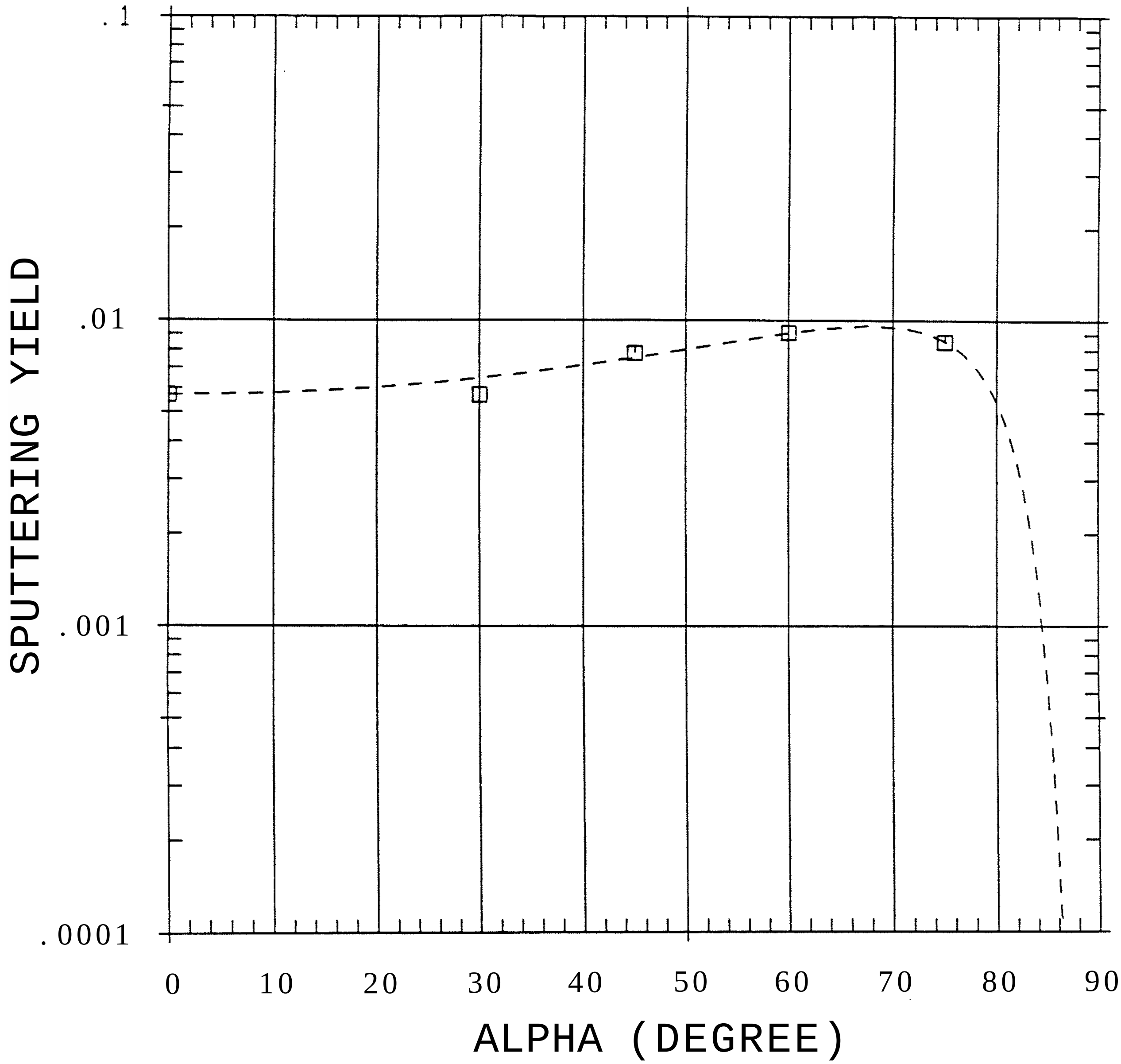


Fig. 68: Angular dependence of the sputtering yield of Ag with 100 eV D ions. The data are unpublished.

Experimental Data

Target	.Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
Ag	D	0.100	0	0.00570	20	3	IX	9	3.9.86
Ag	D	0.100	30	0.00570	20	3	IX	10	4.9.86
Ag	D	0.100	45	0.00780	20	3	IX	9	2.9.86
Ag	D	0.100	60	0.00910	20	3	IX	10	4.9.86
Ag	D	0.100	75	0.00850	20	3	IX	10	3.9.86

Calculated Data

Target	Projectile	Energy	Symbol	y(0)	a	f
~Ag	Ni	30.000	▶	2.34000	7T5	T20
Ag	K	30.000	■	4.76000	76.1	2.16

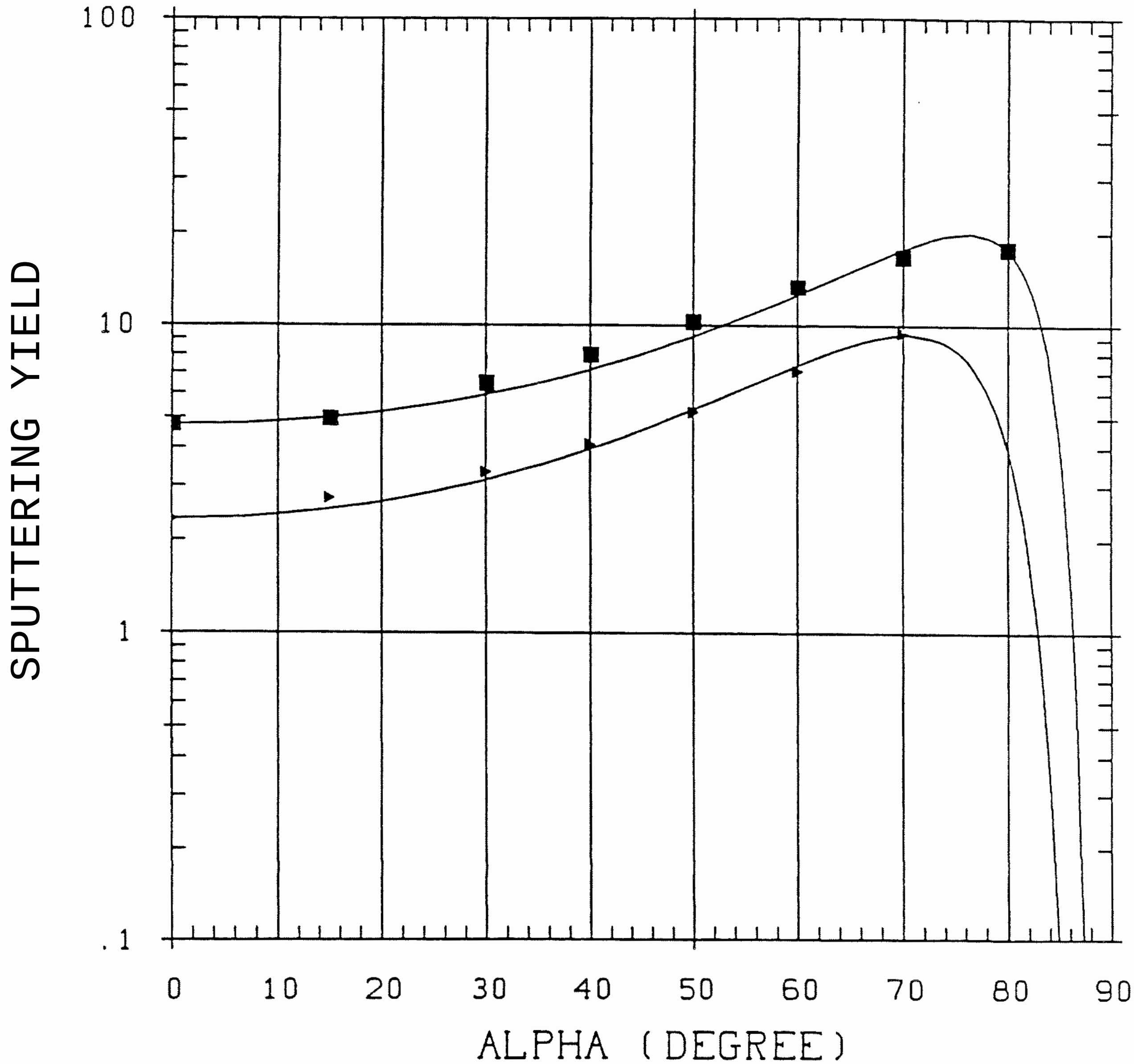


Fig. G9: Angular dependence of the sputtering yield of Ag with 30 keV Na and K ions. The data are unpublished.

Calculated Data

Target '	Proj.	Energy	Angle	Yield	Temp.	*p*	SEE
Ag	Na	30.000	0	2.3400	20	10.500	2.970
Ag	Na	30.000	15	2.7400	20	10.500	2.970
Ag	Na	30.000	30	3.3300	20	10.500	2.970
Ag	Na	30.000	40	4.1100	20	10.500	2.970
Ag	Na	30.000	50	5.2200	20	10.500	2.970
Ag	Na	30.000	60	7.0800	20	10.500	2.970
Ag	Na	30.000	70	9.4200	20	10.500	2.970

Target	Proj.	Energy	Angle	Yield	Temp.	*p*	SBE
Ag	K	30.000	0	4.76000	20	10.500	2.970
Ag	K	30.000	15	4.99000	20	10.500	2.970
Ag	K	30.000	30	6.52000	20	10.500	2.970
Ag	K	30.000	40	8.05000	20	10.500	2.970
Ag	K	30.000	50	10.30000	20	10.500	2.970
Ag	K	30.000	60	13.40000	20	10.500	2.970
Ag	K	30.000	70	16.80000	20	10.500	2.970
Ag	K	30.000	80	17.89999	20	10.500	2.970

Projectile: H

Experimental Data

Target	Projectile	Energy	Symbol	y(0)	*a*	f
Au	H	1.000	□	0.00664	78.1	1.34
Au	H	4.000	>	0.01400	78.5	1.82

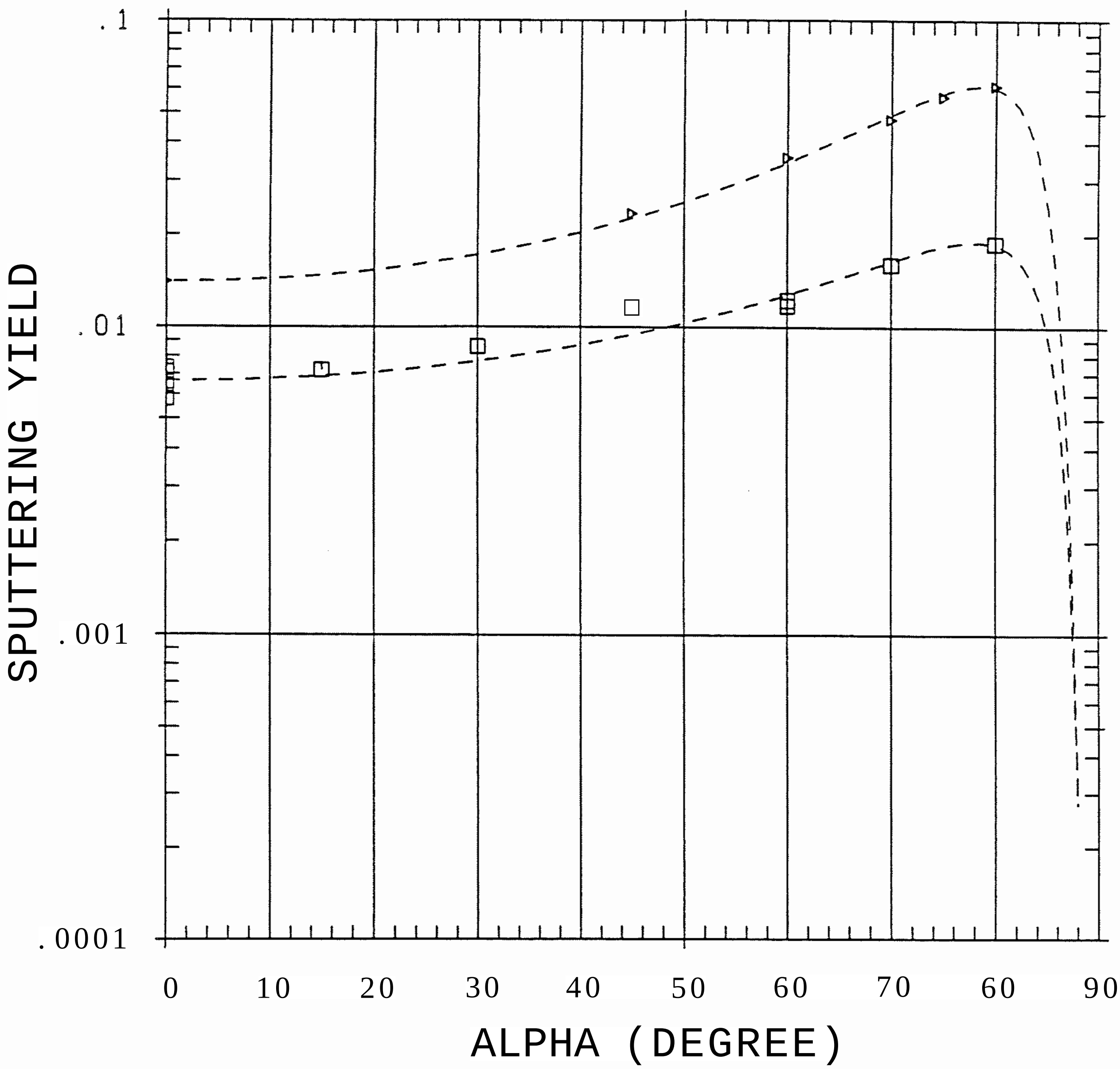


Fig. 70: Angular dependence of the sputtering yield of Au with 1 and 4 keV H ions. The value of Y(0) for 4 keV H was extrapolated from the energy dependence at normal incidence (fig. 10). The normalized data are published in [68].

Experimental Data

Target	' Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
Au	H	1.000	0	0.00730	20	3	11	56	12.08.76
Au	H	1.000	0	0.00580	20	3	II	77	16.10.76
Au	H	1.000	0	0.00710	20	3	II	134	18.04.77
Au	H	1.000	0	0.00660	20	3	V	56	24.11.80
Au	II	1.000	0	0.00639	20	3	V	57	26.11.80
Au	H	1.000	15	0.00720	20	3	II	133	18.04.77
Au	H	1.000	30	0.00860	20	3	II	130	13.04.77
Au	H	1.000	45	0.01150	20	3	II	128	05.04.77
Au	H	1.000	60	0.01170	20	3	II	129	06.04.77
Au	H	1.000	60	0.01220	20	3	II	158	23.06.77
Au	H	1.000	70	0.01600	20	3	II	139	03.05.77
Au	H	1.000	80	0.01880	20	3	II	145	10.05.77

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
Au	H	4.000	0	0.01400	20				GUESS
Au	H	4.000	45	0.02350	20	2	III	24	18.11.77
Au	H	4.000	60	0.03570	20	2	III	24	18.11.77
Au	H	4.000	70	0.04750	20	2	III	24	21.11.77
Au	H	4.000	75	0.05640	20	2	III	25	23.11.77
Au	H	4.000	80	0.06140	20	2	III	25	21.11.77

Experimental Data

Target	Projectile	Energy	Symbol	y(0)	a	f
Au	D	0.150	0	0.00082	78.8	0.56
Au	D	Q.200	o	0.00190	80.0	0.64

Calculated Data

Target	Projectile	Energy	Symbol	y(0)	a	f
Au	D	0.130	A	0.00024	41.1	1.24
Au	D	0.140	■	0.00049	42.7	1.09
Au	D	0.150	♦	0.00080	42.9	1.00
Au	D	0.200	•	0.00305	51.9	1.07

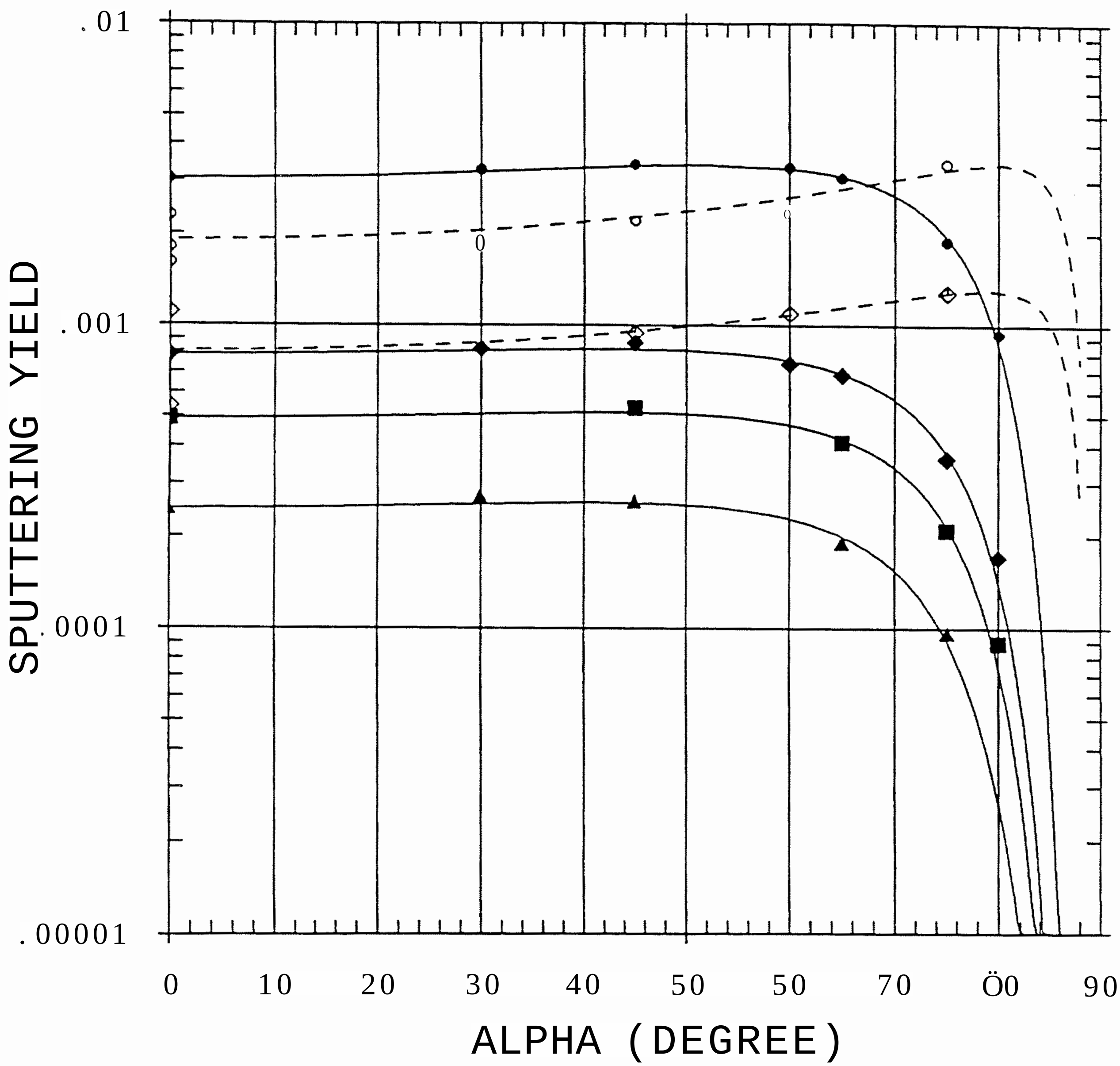


Fig. 71: Angular dependence of the sputtering yield of Au with 130 , 140 , 150 and 200 eV D ions The data are unpublished.

Experimental Data

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
Au	D	0.150	0	0.00110	20	3	II	80	25.10.76
Au	D	0.150	0	0.00054	20	3	IX	31	24.11.86
Au	D	0.150	45	0.00094	20	3	IX	30	20.11.86
Au	• D	0.150	60	0.00109	20	3	IX	30	19.11.86
Au	D	0.150	75	0.00128	20	3	IX	29	18.11.86

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
Au	D	0.200	0	0.00230	20	3	II	75	07.10.76
Au	D	0.200	0	0.00180	20	3	IX	31	24.11.86
Au	D	0.200	0	0.00160	20	3	IX	115	19.10.87
Au	D	0.200	30	0.00188	20	3	IX	29	17.11.86
Au	D	0.200	45	0.00220	20	3	IX	27	11.11.86
Au	D	0.200	60	0.00241	20	3	IX	28	13.11.86
Au	D	0.200	75	0.00344	20	3	IX	27	12.11.86

Calculated Data

Target	Proj.	Energy	Angle	Yield	Temp.	P	SBE
Au	D	0.130	0	0.00024	20	19.300	3.800
Au	D	0.130	30	0.00027	20	19.300	3.800
Au	D	0.130	45	0.00026	20	19.300	3.800
Au	D	0.130	65	0.00019	20	19.300	3.800
Au	D	0.130	75	0.00010	20	19.300	3.800

Target	Proj.	Energy	Angle	Yield	Temp.	P	SBE
Au	D	0.140	0	0.00049	20	19.300	3.800
Au	D	0.140	45	0.00053	20	19.300	3.800
Au	D	0.140	65	0.00041	20	19.300	3.800
Au	D	0.140	75	0.00021	20	19.300	3.800
Au	D	0.140	80	0.00009	20	19.300	3.800

Target	Proj.	Energy	Angle	Yield	Temp.	P	SBE
Au	D	0.150	0	0.00080	20	19.300	3.800
Au	D	0.150	30	0.00084	20	19.300	3.800
Au	D	0.150	45	0.00087	20	19.300	3.800
Au	D	0.150	60	0.00075	20	19.300	3.800
Au	D	0.150	65	0.00069	20	19.300	3.800
Au	D	0.150	75	0.00036	20	19.300	3.800
Au	D	0.150	80	0.00017	20	19.300	3.800

Target	Proj.	Energy	Angle	Yield	Temp.	P	SBE
Au	D	0.200	0	0.00305	20	19.300	3.800
Au	D	0.200	30	0.00327	20	19.300	3.800
Au	D	0.200	45	0.00341	20	19.300	3.800
Au	D	0.200	60	0.00334	20	19.300	3.800
Au	D	0.200	65	0.00308	20	19.300	3.800
Au	D	0.200	75	0.00189	20	19.300	3.800
Au	D	0.200	80	0.00094	20	19.300	3.800

Projectile: D

Experimental Data

Target	Projectile	Energy	Symbol	y(o)	α	f
Au	D	0.300	□	0.00686	70.7	0.94
Au	D	1.000	o	0.02860	76.0	1.59
Au	D	3.000	A	0.04130	82.5	1.05

Calculated Data

Target	Projectile	Energy	Symbol	y(o)	a	f
Au	D	0.300	■	0.00784	65.3	0.99
Au	D	0.500	◆	0.01600	75.8	1.13
Au	D	1.000	•	0.02510	79.9	1.44

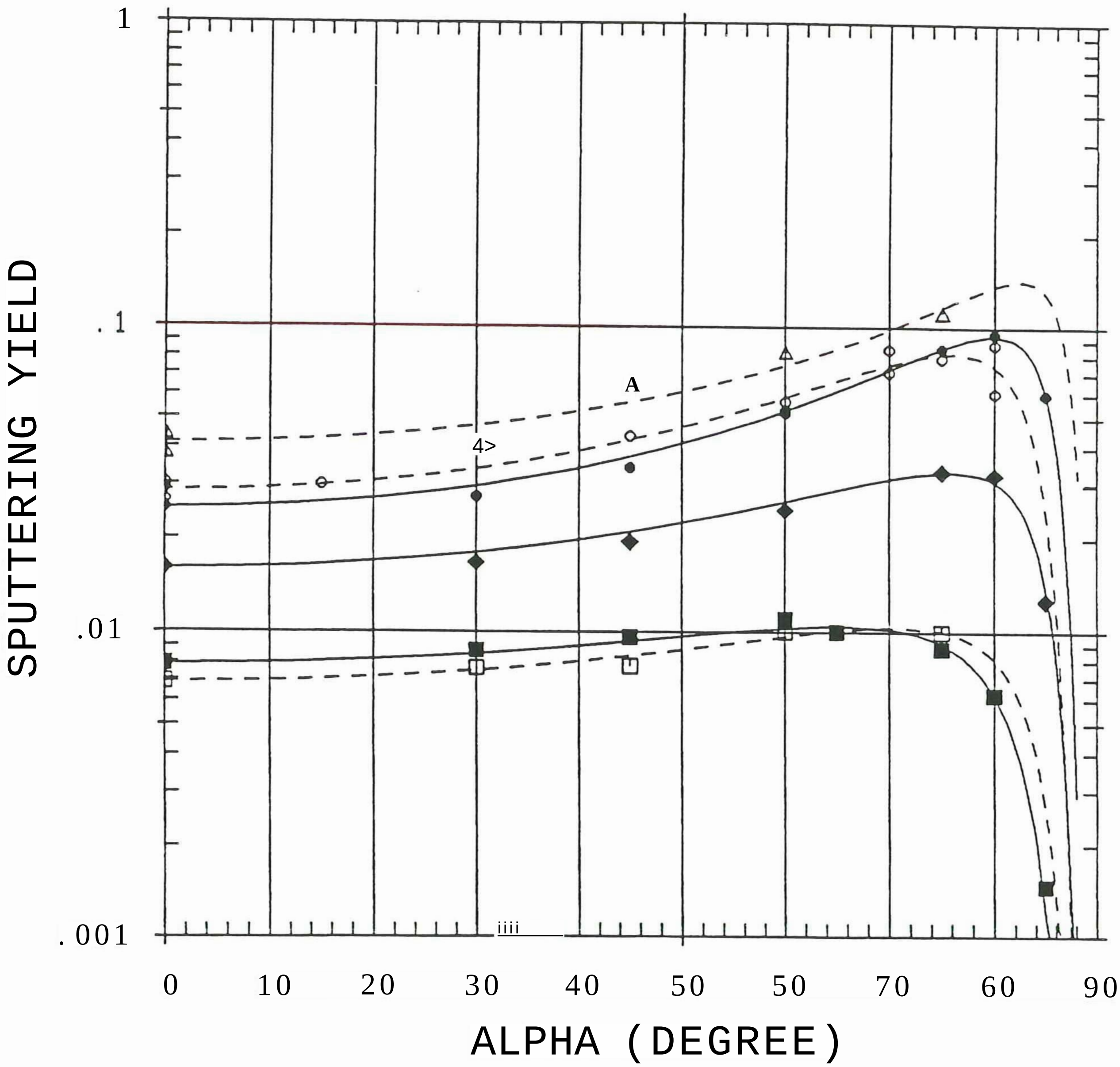


Fig. 72: Angular dependence of the sputtering yield of Au with 0.3 , 0.5 , 1 and 3 keV D ions. The value of a_{opt} for 3 keV D was estimated for fitting. The data are partly published in [12,68].

Experimental Data

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
Au	D	0.300	0	0.00686	20	3	VIII	181	20.08.86
Au	D	0.300	30	0.00761	20	3	IX	11	25.09.86
Au	D	0.300	45	0.00772	20	3	VIII	182	21.08.86
Au	D	0.300	60	0.01000	20	3	VIII	182	22.08.86
Au	D	0.300	75	0.01000	20	3	VIII	182	25.08.86

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
Au	D	1.000	0	0.02660	20	3	II	77	16.10.76
Au	D	1.000	0	0.02900	20	3	vni	181	21.08.86
Au	D	1.000	0	0.03020	20	3			1979
Au	D	1.000	15	0.03000	20	3	II	135	20.04.77
Au	D	1.000	30	0.04030	20	3	II	131	14.04.77
Au	D	1.000	45	0.04350	20	3	II	127	04.04.77
Au	D	1.000	60	0.05330	20	3	II	128	04.04.77
Au	D	1.000	60	0.05670	20	3	II	157	23.06.77
Au	D	1.000	70	0.08460	20	3	II	144	09.05.77
Au	D	1.000	70	0.07100	20	3	II	166	11.07.77
Au	D	1.000	75	0.07900	20	3	II	145	10.05.77
Au	D	1.000	80	0.06070	20	3	II	144	09.05.77
Au	D	1.000	80	0.08770	20	3	II	164	05.07.77

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
Au	D	3.000	0	0.04430	20	2	VIII	181	21.08.86
Au	D	3.000	0	0.03830	20	2	IX	30	20.11.86
Au	D	3.000	45	0.06400	20	2	IX	29	17.11.86
Au	D	3.000	60	0.08270	20	2	IX	28	13.11.86
Au	D	3.000	75	0.11100	20	2	IX	28	13.11.86

Calculated Data

Target	Proj.	Energy	Angle	Yield	Temp.	P	SBE
Au	D	0.300	0	0.00784	20	19.300	3.800
Au	D	0.300	30	0.00868	20	19.300	3.800
Au	D	0.300	45	0.00959	20	19.300	3.800
Au	D	0.300	60	0.01100	20	19.300	3.800
Au	D	0.300	65	0.01000	20	19.300	3.800
Au	D	0.300	75	0.00881	20	19.300	3.800
Au	D	0.300	80	0.00625	20	19.300	3.800
Au	D	0.300	85	0.00147	20	19.300	3.800

Target	Proj.	Energy	Angle	Yield	Temp.	P	SBE
Au	D	0.500	0	0.01600	20	19.300	3.800
Au	D	0.500	30	0.01670	20	19.300	3.800
Au	D	0.500	45	0.01960	20	19.300	3.800
Au	D	0.500	60	0.02490	20	19.300	3.800
Au	D	0.500	75	0.03330	20	19.300	3.800
Au	D	0.500	80	0.03251	20	19.300	3.800
Au	D	0.500	85	0.01267	20	19.300	3.800

Target	Proj.	Energy	Angle	Yield	Temp.	P	SBE
Au	D	1.000	0	0.02510	20	19.300	3.800
Au	D	1.000	30	0.02740	20	19.300	3.800
Au	D	1.000	45	0.03430	20	19.300	3.800
Au	D	1.000	60	0.05210	20	19.300	3.800
Au	D	1.000	75	0.08490	20	19.300	3.800
Au	D	1.000	80	0.09546	20	19.300	3.800
Au	D	1.000	85	0.05977	20	19.300	3.800

Projectile: Na K

Calculated Data

Target	Projectile	Energy	Symbol	y(0)	*a*	f
~Äu	fü	30.000	▶	2.20000	76Ä	2T7
Au	K	30.000	■	4.72000	75.9	1.71

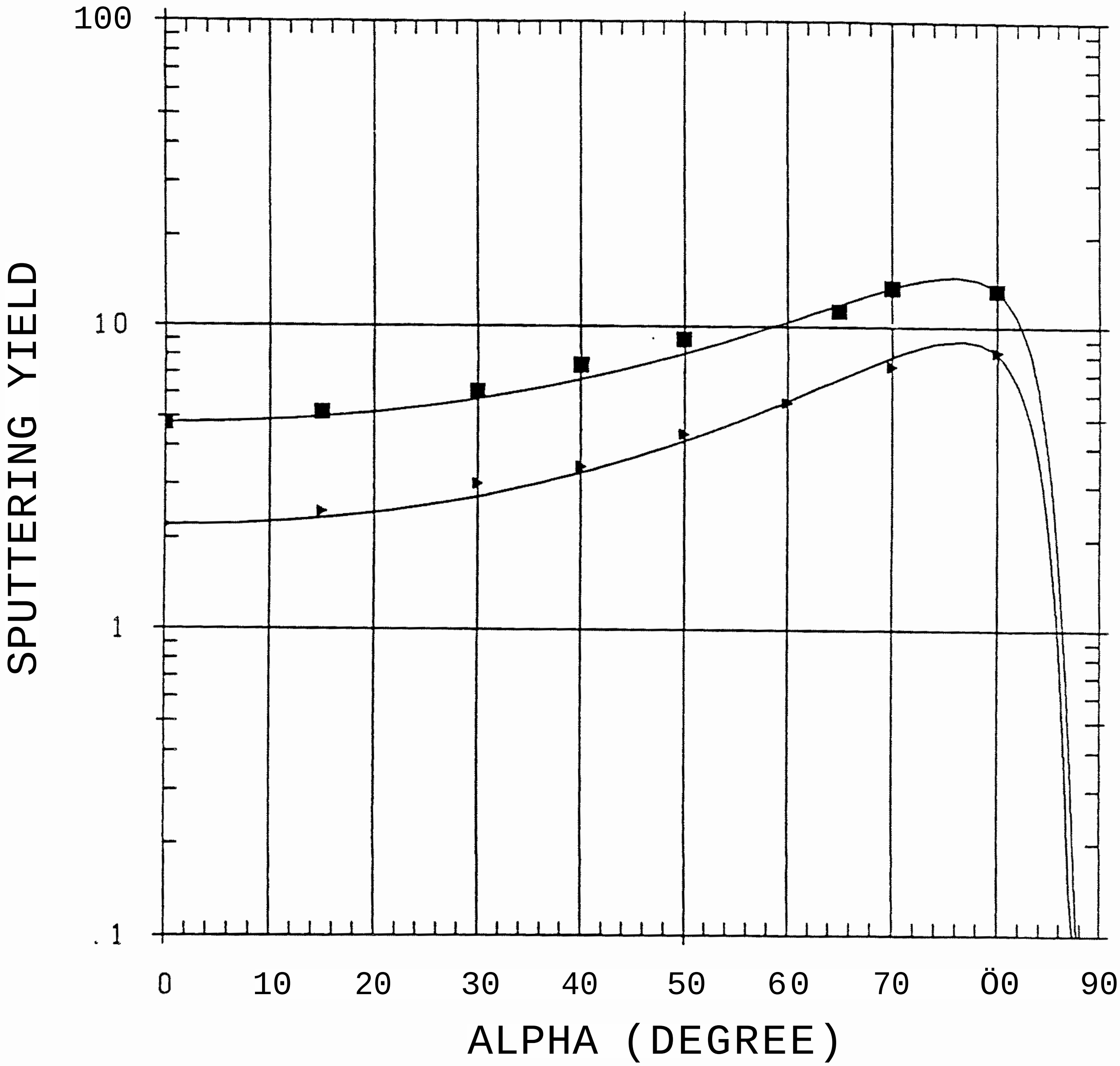


Fig. 73: Angular dependence of the sputtering yield of Au with 30 keV Na and K ions. The data are unpublished.

Calculated Data

Target	Proj.	Energy	Angle	Yield	Temp.	p	SEE
Au	Na	30.000	0	2.2000	20	19.300	3.800
Au	Na	30.000	15	2.4500	20	19.300	3.800
Au	Na	30.000	30	3.0300	20	19.300	3.800
Au	Na	30.000	40	3.4500	20	19.300	3.800
Au	Na	30.000	50	4.4200	20	19.300	3.800
Au	Na	30.000	60	5.6200	20	19.300	3.800
Au	Na	30.000	70	7.4200	20	19.300	3.800
Au	Na	30.000	80	8.2700	20	19.300	3.800

Target	Proj.	Energy	Angle	Yield	Temp.	p	SBE
Au	K	30.000	0	4.7200	20	19.300	3.800
Au	K	30.000	15	5.1100	20	19.300	3.800
Au	K	30.000	30	5.9900	20	19.300	3.800
Au	K	30.000	40	7.3100	20	19.300	3.800
Au	K	30.000	50	8.9000	20	19.300	3.800
Au	K	30.000	65	11.0800	20	19.300	3.800
Au	K	30.000	70	13.2600	20	19.300	3.800
Au	K	30.000	80	13.0400	20	19.300	3.800

Calculated Data

Target	Projectile	Energy	Symbol	y(0)	a	f
B	D	0.030	♦	0.00117	55.6	4.86
B	D	0.050	▸	0.00666	66.0	4.05
B	D	0.100	▸	0.01460	70.7	4.41

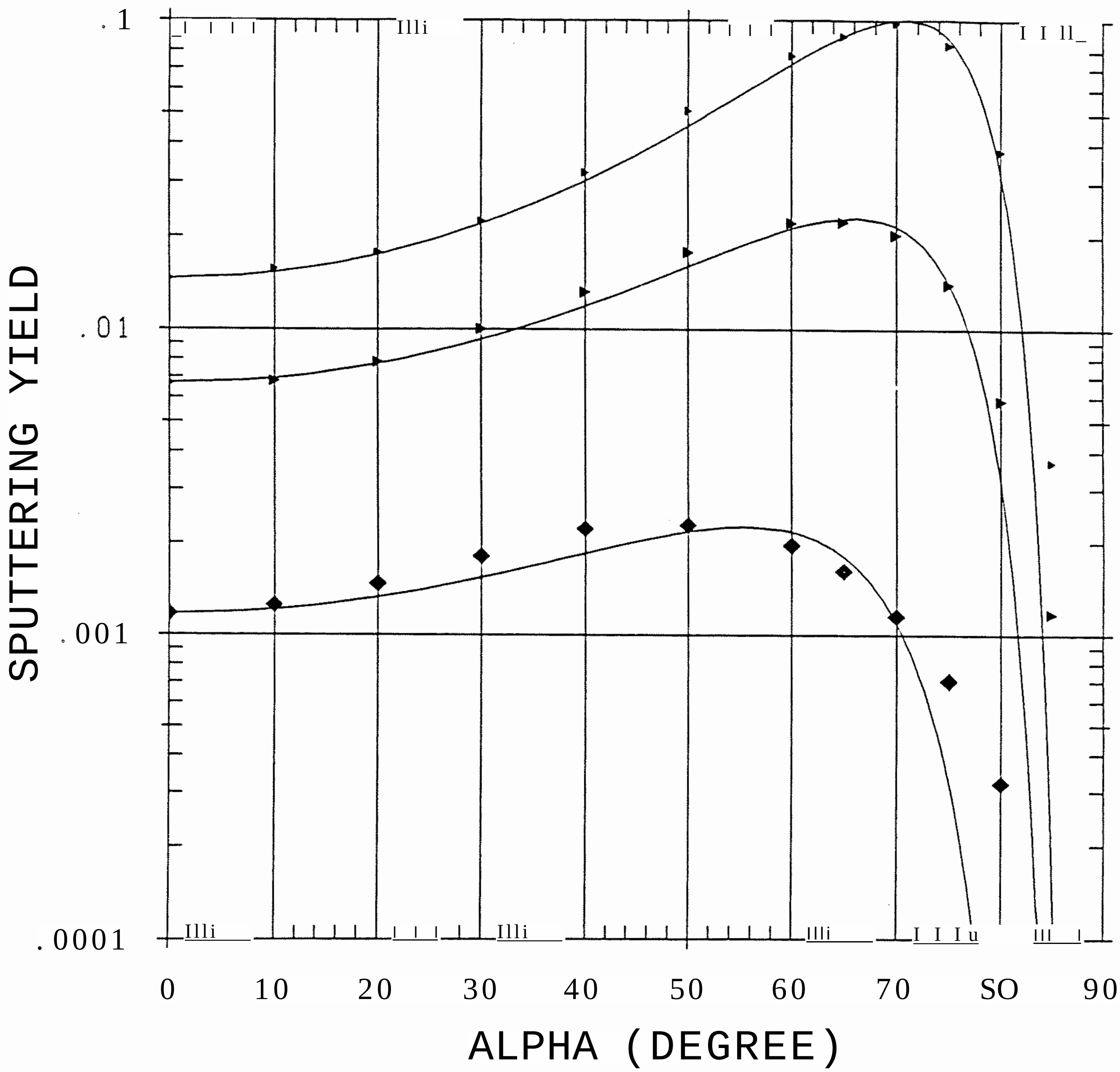


Fig. 74: Angular dependence of the sputtering yield of B with 30 , 50 and 100 eV D ions. The data are unpublished.

Calculated Data

Target	Proj.	Energy	Angle	Yield	Temp.	P	SBE
B	5	0.030	0	0.00117	20	2.350	5.730
B	D	0.030	10	0.00125	20	2.350	5.730
B	D	0.030	20	0.00147	20	2.350	5.730
B	D	0.030	30	0.00181	20	2.350	5.730
B	D	0.030	40	0.00223	20	2.350	5.730
B	D	0.030	50	0.00229	20	2.350	5.730
B	D	0.030	60	0.00197	20	2.350	5.730
B	D	0.030	65	0.00162	20	2.350	5.730
B	D	0.030	70	0.00115	20	2.350	5.730
B	D	0.030	75	0.00071	20	2.350	5.730
B	D	0.030	80	0.00032	20	2.350	5.730

Target	Proj.	Energy	Angle	Yield	Temp.	P	SBE
B	D	0.050	0	0.00666	20	2.350	5.730
B	D	0.050	10	0.00678	20	2.350	5.730
B	D	0.050	20	0.00780	20	2.350	5.730
B	D	0.050	30	0.01000	20	2.350	5.730
B	D	0.050	40	0.01320	20	2.350	5.730
B	D	0.050	50	0.01780	20	2.350	5.730
B	D	0.050	60	0.02220	20	2.350	5.730
B	D	0.050	65	0.02230	20	2.350	5.730
B	D	0.050	70	0.02030	20	2.350	5.730
B	D	0.050	75	0.01400	20	2.350	5.730
B	D	0.050	80	0.00585	20	2.350	5.730
B	D	0.050	85	0.00117	20	2.350	5.730

Target	Proj.	Energy	Angle	Yield	Temp.	p	SBE
[illegible]	D	0.100	0	0.01460	20	2.350	5.730
[illegible]	D	0.100	0	0.01460	20	2.350	5.730
[illegible]	D	0.100	10	0.01570	20	2.350	5.730
[illegible]	D	0.100	20	0.01780	20	2.350	5.730
[illegible]	D	0.100	30	0.02240	20	2.350	5.730
[illegible]	D	0.100	40	0.03230	20	2.350	5.730
[illegible]	D	0.100	50	0.05100	20	2.350	5.730
[illegible]	D	0.100	60	0.07690	20	2.350	5.730
[illegible]	D	0.100	65	0.08900	20	2.350	5.730
[illegible]	D	0.100	70	0.09820	20	2.350	5.730
[illegible]	D	0.100	75	0.08320	20	2.350	5.730
[illegible]	D	0.100	80	0.03790	20	2.350	5.730
[illegible]	D	0.100	85	0.00369	20	2.350	5.730

Experimental Data

Target	Projectile	Energy	Symbol	y(o)	α	f
B	D	0.400	□	0.02840		
B	D	8.000	o	0.00510		

Calculated Data

Target	Projectile	Energy	Symbol	y(0)	α	f
B	D	0.400	■	0.02040	77.1	3.59
B	D	0.500	◆	0.01870	78.2	3.46
B	D	8.000	•	0.00571	86.4	2.12

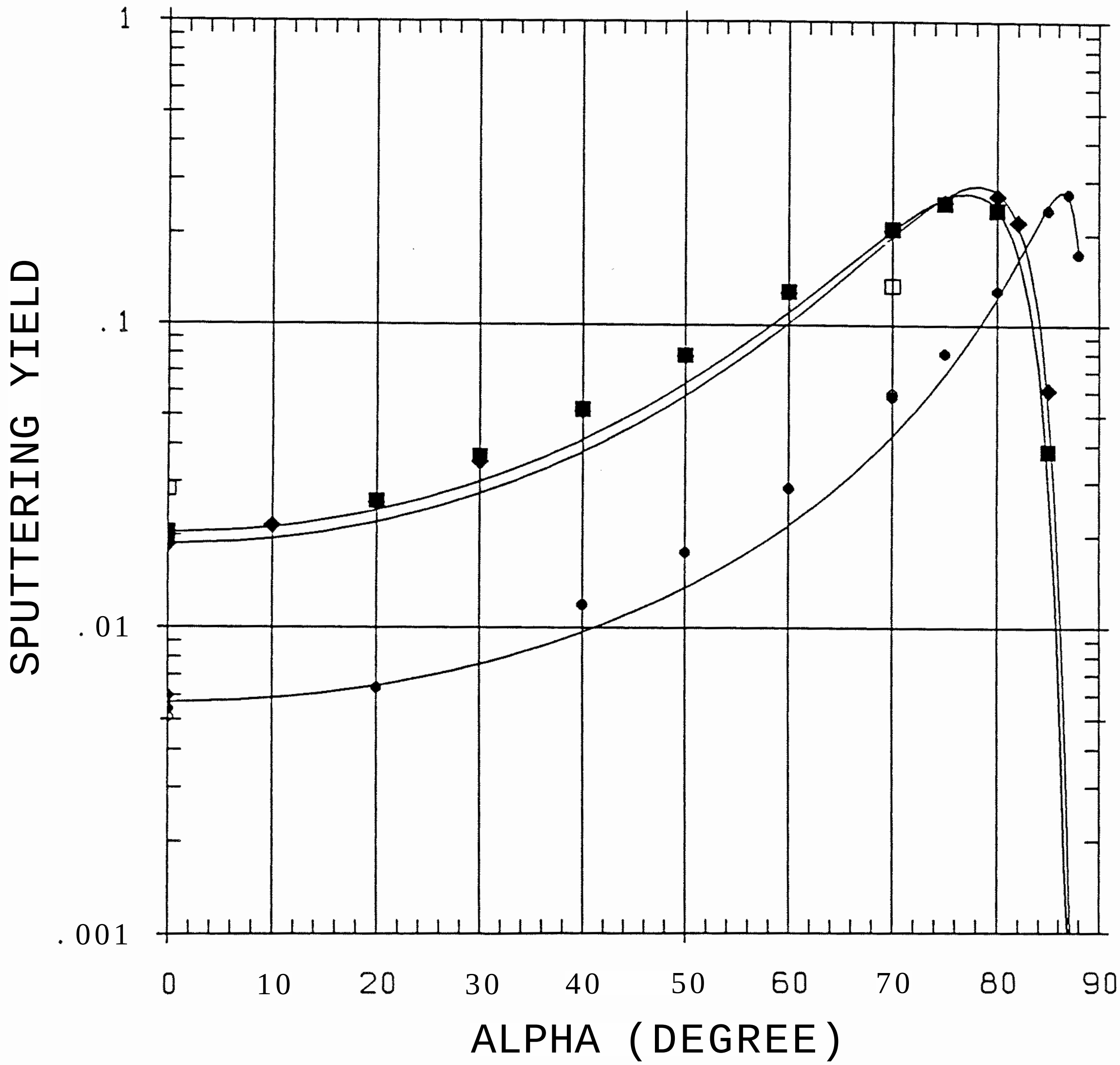


Fig. 75: Angular dependence of the sputtering yield of **B** with 0.4 , 0.5 and 8 keV D ions. The data axe partly published in [30].

Experimental Data

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
B	D	0.400	0	0.02840	20	3	V	132	17.03.1982
B	D	0.400	70	0.13500	20	3	V	47	25.09.1980

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
B	D	8.000	0	0.00510	20	1	V	132	16.03.1982
B	D	8.000	70	0.05920	20	1	V	47	26.09.1980

Calculated Data

Target	Proj.	Energy	Angle	Yield	Temp.	P	SBE
B	D	0.400	0	0.02030	20	2.350	5.730
B	D	0.400	0	0.02050	20	2.350	5.730
B	D	0.400	20	0.02600	20	2.350	5.730
B	D	0.400	30	0.03670	20	2.350	5.730
B	D	0.400	40	0.05240	20	2.350	5.730
B	D	0.400	50	0.07930	20	2.350	5.730
B	D	0.400	60	0.12900	20	2.350	5.730
B	D	0.400	70	0.20800	20	2.350	5.730
B	D	0.400	75	0.25300	20	2.350	5.730
B	D	0.400	80	0.24100	20	2.350	5.730
B	D	0.400	85	0.03820	20	2.350	5.730

Target	Proj.	Energy	Angle	Yield	Temp.	P	SBE
B	D	0.500	0	0.01870	20	2.350	5.730
B	D	0.500	10	0.02160	20	2.350	5.730
B	D	0.500	20	0.02570	20	2.350	5.730
B	D	0.500	30	0.03520	20	2.350	5.730
B	D	0.500	40	0.05180	20	2.350	5.730
B	D	0.500	50	0.07860	20	2.350	5.730
B	D	0.500	60	0.12800	20	2.350	5.730
B	D	0.500	70	0.20600	20	2.350	5.730
B	D	0.500	75	0.25500	20	2.350	5.730
B	D	0.500	80	0.26800	20	2.350	5.730
B	D	0.500	82	0.22000	20	2.350	5.730
B	D	0.500	85	0.06090	20	2.350	5.730

Target	Proj.	Energy	Angle	Yield	Temp.	P	SBE
B	D	8.000	0	0.00599	20	2.350	5.730
B	D	8.000	0	0.00543	20	2.350	5.730
B	D	8.000	20	0.00636	20	2.350	5.730
B	D	8.000	40	0.01190	20	2.350	5.730
B	D	8.000	50	0.01770	20	2.350	5.730
B	D	8.000	60	0.02880	20	2.350	5.730
B	D	8.000	70	0.05790	20	2.350	5.730
B	D	8.000	75	0.08040	20	2.350	5.730
B	D	8.000	80	0.13000	20	2.350	5.730
B	D	8.000	85	0.24100	20	2.350	5.730
B	D	8.000	87	0.27300	20	2.350	5.730
B	D	8.000	88	0.17300	20	2.350	5.730

Projectile: B

Experimented Data

Target	Projectile	Energy	Symbol	y(0)	*a*	f
~B	B	2.000	Ö	0.65000		

Calculated Data

Target	Projectile	Energy	Symbol	y(0)	*a*	f
~ B	B	1.000	■	0.21467	741	41?
B	B	2.000	♦	0.25250	77.4	3.33

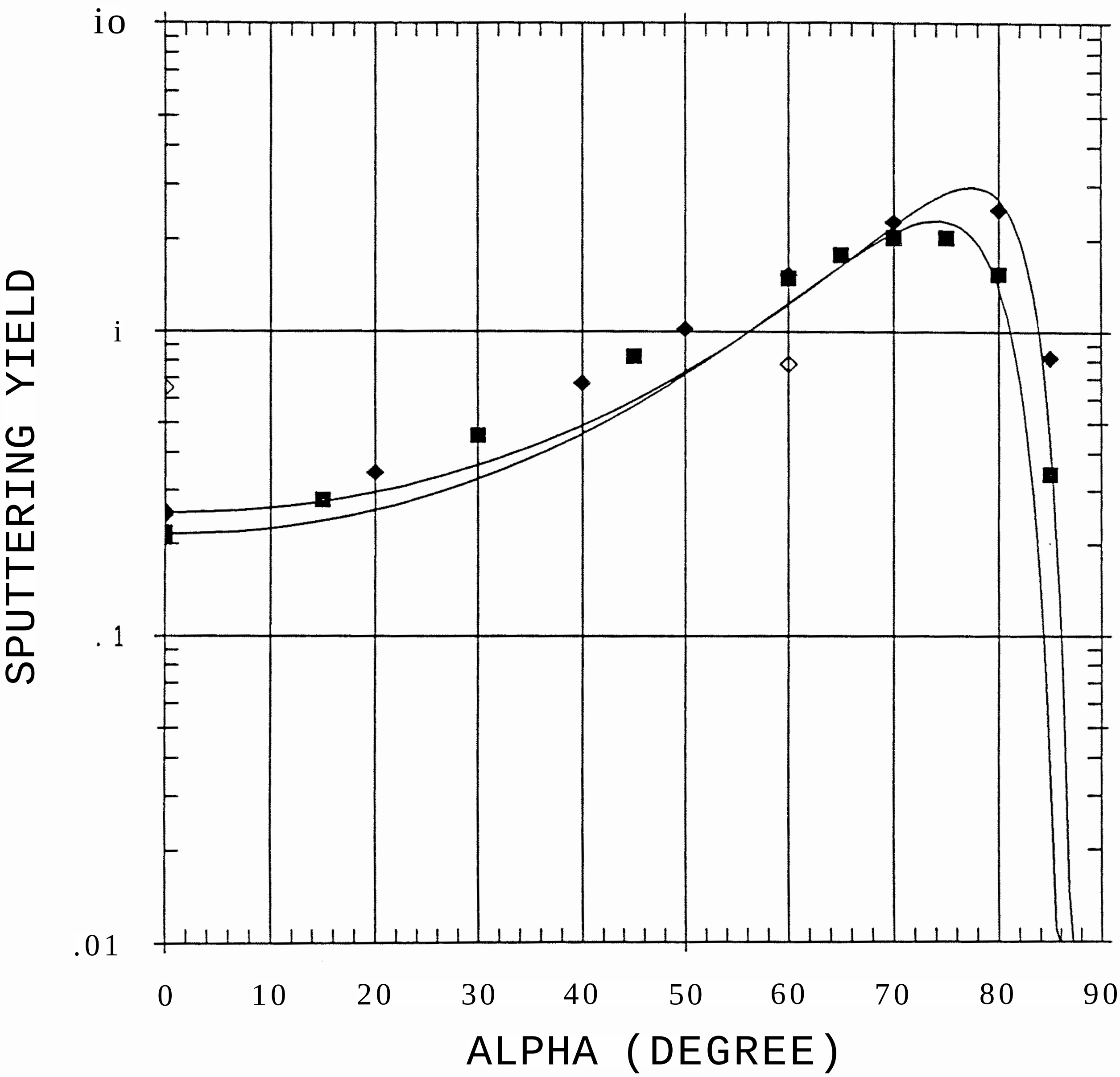


Fig. 76: Angular dependence of the sputtering yield of B with 1 and 2 keV B ions. The data are partly published in [30,36].

Experimental Data

Target	.Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
B	B	2-000	0	0.65000	20	1			HECHTL1991
B	B	2.000	60	0.78000	20	1			HECHTL1991

Calculated Data

Target	Proj.	Energy	Angle	Yield	Temp.	ρ	SBE
B	B	1.000	0	0.21800	20	2.350	5.730
B	B	1.000	0	0.21000	20	2.350	5.730
B	B	1.000	0	0.21600	20	2.350	5.730
B	B	1.000	15	0.28000	20	2.350	5.730
B	B	1.000	30	0.45600	20	2.350	5.730
B	B	1.000	45	0.82700	20	2.350	5.730
B	B	1.000	60	1.50000	20	2.350	5.730
B	B	1.000	65	1.79000	20	2.350	5.730
B	B	1.000	70	2.04000	20	2.350	5.730
B	B	1.000	75	2.04000	20	2.350	5.730
B	B	1.000	80	1.55000	20	2.350	5.730
B	B	1.000	85	0.34100	20	2.350	5.730

Target	Proj.	Energy	Angle	Yield	Temp.	p	SBE
B	B	2.000	0	0.25600	20	2.350	5.730
B	B	2.000	0	0.24900	20	2.350	5.730
B	B	2.000	20	0.34400	20	2.350	5.730
B	B	2.000	40	0.67500	20	2.350	5.730
B	B	2.000	50	1.02000	20	2.350	5.730
B	B	2.000	60	1.54000	20	2.350	5.730
B	B	2.000	70	2.29000	20	2.350	5.730
B	B	2.000	80	2.51000	20	2.350	5.730
B	B	2.000	85	0.81900	20	2.350	5.730

Projectile: D

Experimental Data

Target	Projectile	Energy	Symbol	y(0)	*a*	f
Be/JET	D	0.300	□	0.04987		
Be/JET	D	' 3.000	0	0.01977		

Calculated Data

Target	Projectile	Energy	Symbol	y(0)	*a*	f
Be	D	0.300	■	0.03060	76.6	3.75
Be	D	3.000	♦	0.01250	85.0	2.36

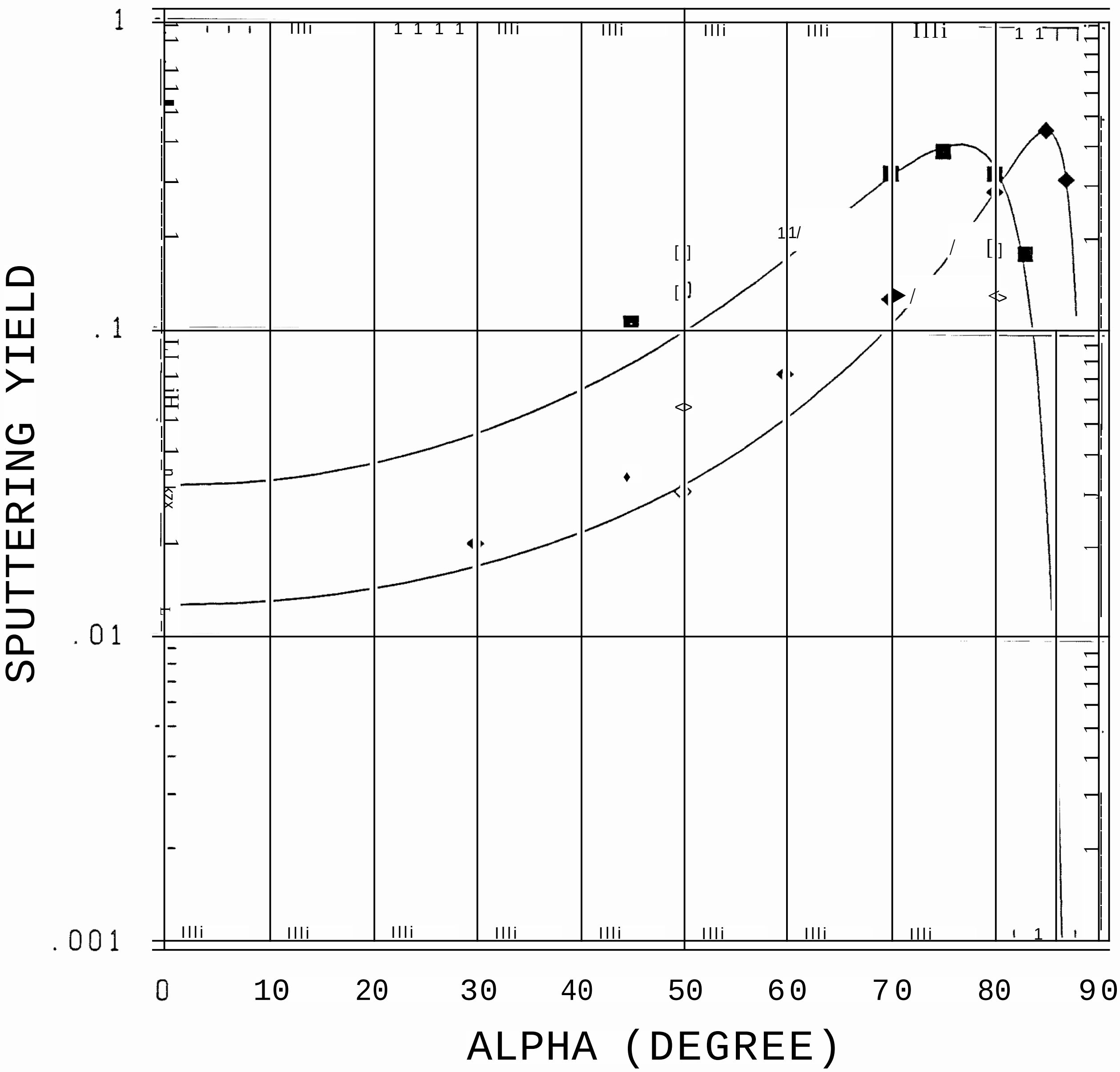


Fig. 77: Angular dependence of the sputtering yield of Be with 0.3 and 3 keV D ions. The experimental data were measured at 650°C to avoid surface oxidation. The data are published in [331.

Experimental Data

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
Be/JET	D	0.300	0	0.05900	650	3	VII	54	07.02.84
Be/JET	D	0.300	0	0.03210	650	2	VII	64	5.03.84
Be/JET	D	0.300	0	0.05850	650	3	VII	82	12.04.84
Be/JET	D	0.300	50	0.18400	650	3	VII	68	20.03.84
Be/JET	D	0.300	50	0.13700	650	3	VII	75	3.04.84
Be/JET	D	0.300	80	0.19100	650	3	VII	75	2.04.84

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
Be/JET	D	3.000	0	0.01530	650	2	VII	55	09.02.84
Be/JET	D	3.000	0	0.01740	650	2	VII	64	2.03.84
Be/JET	D	3.000	0	0.02660	650	2	VII	79	10.04.84
Be/JET	D	3.000	50	0.03020	650	2	VII	58	16.02.84
Be/JET	D	3.000	50	0.05710	650	2	VII	73	29.03.84
Be/JET	D	3.000	80	0.13200	650	2	VII	73	29.03.84

Calculated Data

Target	Proj.	Energy	Angle	Yield	Temp.	P	SBE
Be	D	0.300	0	0.03060	20	1.800	3.380
Be	D	0.300	45	0.10600	20	1.800	3.380
Be	D	0.300	60	0.21200	20	1.800	3.380
Be	D	0.300	70	0.32900	20	1.800	3.380
Be	D	0.300	75	0.38900	20	1.800	3.380
Be	D	0.300	80	0.33100	20	1.800	3.380
Be	D	0.300	83	0.18300	20	1.800	3.380

Target	Proj.	Energy	Angle	Yield	Temp.	P	SBE
Be	D	3.000	0	0.01250	20	1.800	3.380
Be	D	3.000	30	0.02020	20	1.800	3.380
Be	D	3.000	45	0.03430	20	1.800	3.380
Be	D	3.000	60	0.07290	20	1.800	3.380
Be	D	3.000	70	0.12900	20	1.800	3.380
Be	D	3.000	80	0.28900	20	1.800	3.380
Be	D	3.000	85	0.45900	20	1.800	3.380
Be	D	3.000	87	0.31800	20	1.800	3.380

Calculated Data

Target	Projectile	Energy	Symbol	y(0)	a	f
Be	T	0.020	■	0.00402	66.2	5.26
Be	T	0.030	♦	0.01230	66.4	5.60
Be	T	0.050	•	0.02310	67.8	5.85
Be	T	0.100	A	0.03350	71.0	5.32

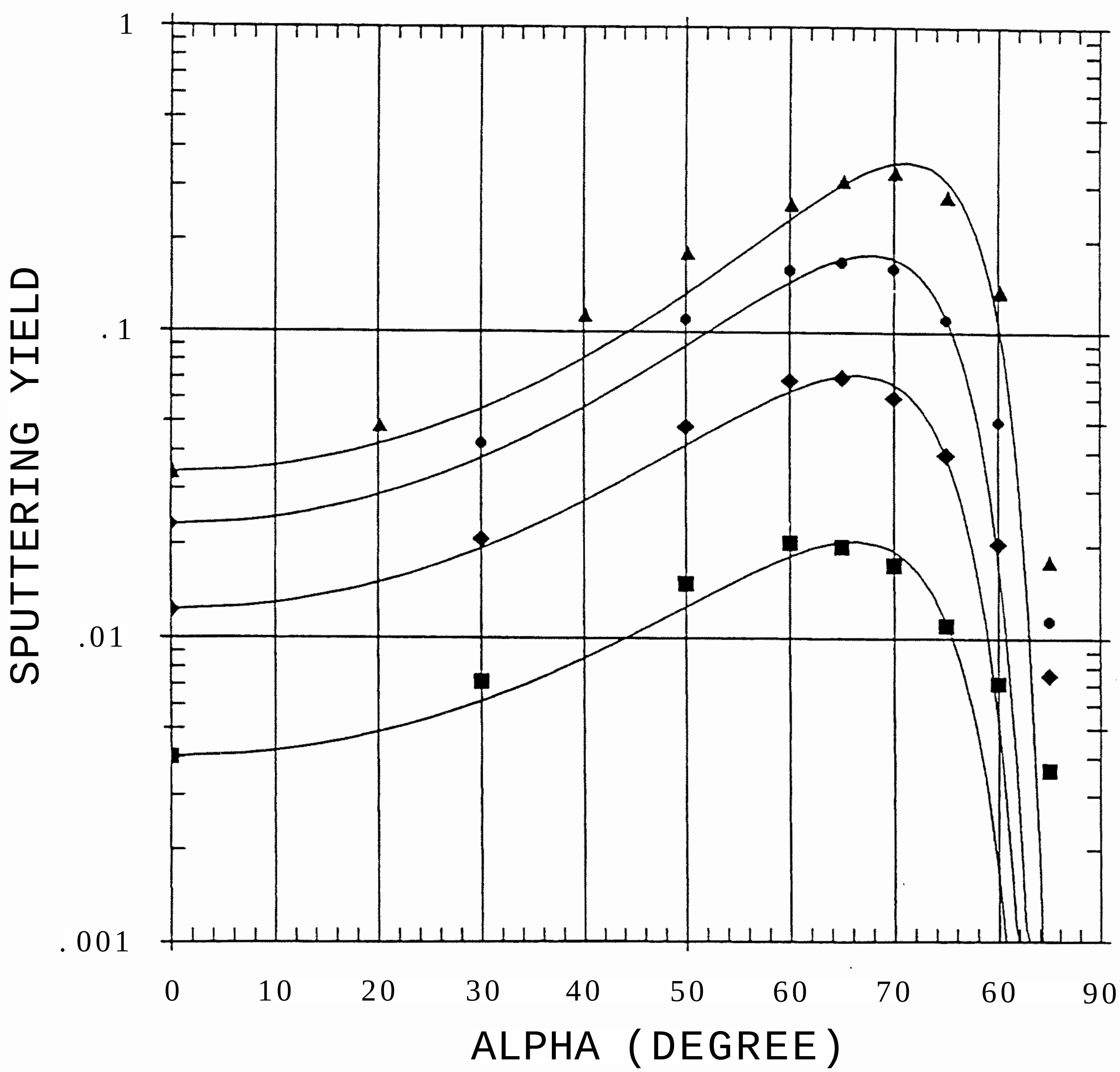


Fig. 78: Angular dependence of the sputtering yield of Be with 20 , 30 , 50 and 100 keV T ions. The data are published in [36].

Calculated Data

Target	Proj.	Energy	Angle	Yield	Temp.	P	SBE
Be	T	0.020	0	0.00402	20	1.800	3.380
Be	T	0.020	30	0.00716	20	1.800	3.380
Be	T	0.020	50	0.01499	20	1.800	3.380
Be	T	0.020	60	0.02040	20	1.800	3.380
Be	T	0.020	65	0.01980	20	1.800	3.380
Be	T	0.020	70	0.01730	20	1.800	3.380
Be	T	0.020	75	0.01101	20	1.800	3.380
Be	T	0.020	80	0.00709	20	1.800	3.380
Be	T	0.020	85	0.00364	20	1.800	3.380

Target	Proj.	Energy	Angle	Yield	Temp.	P	SBE
Be	T	0.030	0	0.01230	20	1.800	3.380
Be	T	0.030	30	0.02084	20	1.800	3.380
Be	T	0.030	50	0.04829	20	1.800	3.380
Be	T	0.030	60	0.06910	20	1.800	3.380
Be	T	0.030	65	0.07060	20	1.800	3.380
Be	T	0.030	70	0.06050	20	1.800	3.380
Be	T	0.030	75	0.03927	20	1.800	3.380
Be	T	0.030	80	0.02030	20	1.800	3.380
Be	T	0.030	85	0.00756	20	1.800	3.380

Target	Proj.	Energy	Angle	Yield	Temp.	P	SBE
Be	T	0.050	0	0.02310	20	1.800	3.380
Be	T	0.050	30	0.04256	20	1.800	3.380
Be	T	0.050	50	0.11000	20	1.800	3.380
Be	T	0.050	60	0.16000	20	1.800	3.380
Be	T	0.050	65	0.17000	20	1.800	3.380
Be	T	0.050	70	0.16200	20	1.800	3.380
Be	T	0.050	75	0.11020	20	1.800	3.380
Be	T	0.050	80	0.05040	20	1.800	3.380
Be	T	0.050	85	0.01141	20	1.800	3.380

Target	Proj.	Energy	Angle	Yield	Temp.	P	SBE
Be	T	0.100	0	0.03350	20	1.800	3.380
Be	T	0.100	0	0.03350	20	1.800	3.380
Be	T	0.100	20	0.04810	20	1.800	3.380
Be	T	0.100	40	0.11300	20	1.800	3.380
Be	T	0.100	50	0.18200	20	1.800	3.380
Be	T	0.100	50	0.18200	20	1.800	3.380
Be	T	0.100	60	0.26400	20	1.800	3.380
Be	T	0.100	60	0.26400	20	1.800	3.380
Be	T	0.100	65	0.31500	20	1.800	3.380
Be	T	0.100	65	0.31500	20	1.800	3.380
Be	T	0.100	70	0.33700	20	1.800	3.380
Be	T	0.100	70	0.33700	20	1.800	3.380
Be	T	0.100	75	0.28000	20	1.800	3.380
Be	T	0.100	80	0.13600	20	1.800	3.380
Be	T	0.100	80	0.13800	20	1.800	3.380
Be	T	0.100	85	0.01740	20	1.800	3.380

Calculated Data

Target	Projectile	Energy	Symbol	y(0)	Q	f
Be	T	0.200	■	0.04040	73.9	4.53
Be	T	0.500	♦	0.03760	78.3	3.55
Be	T	1.000	•	0.03540	81.4	2.85

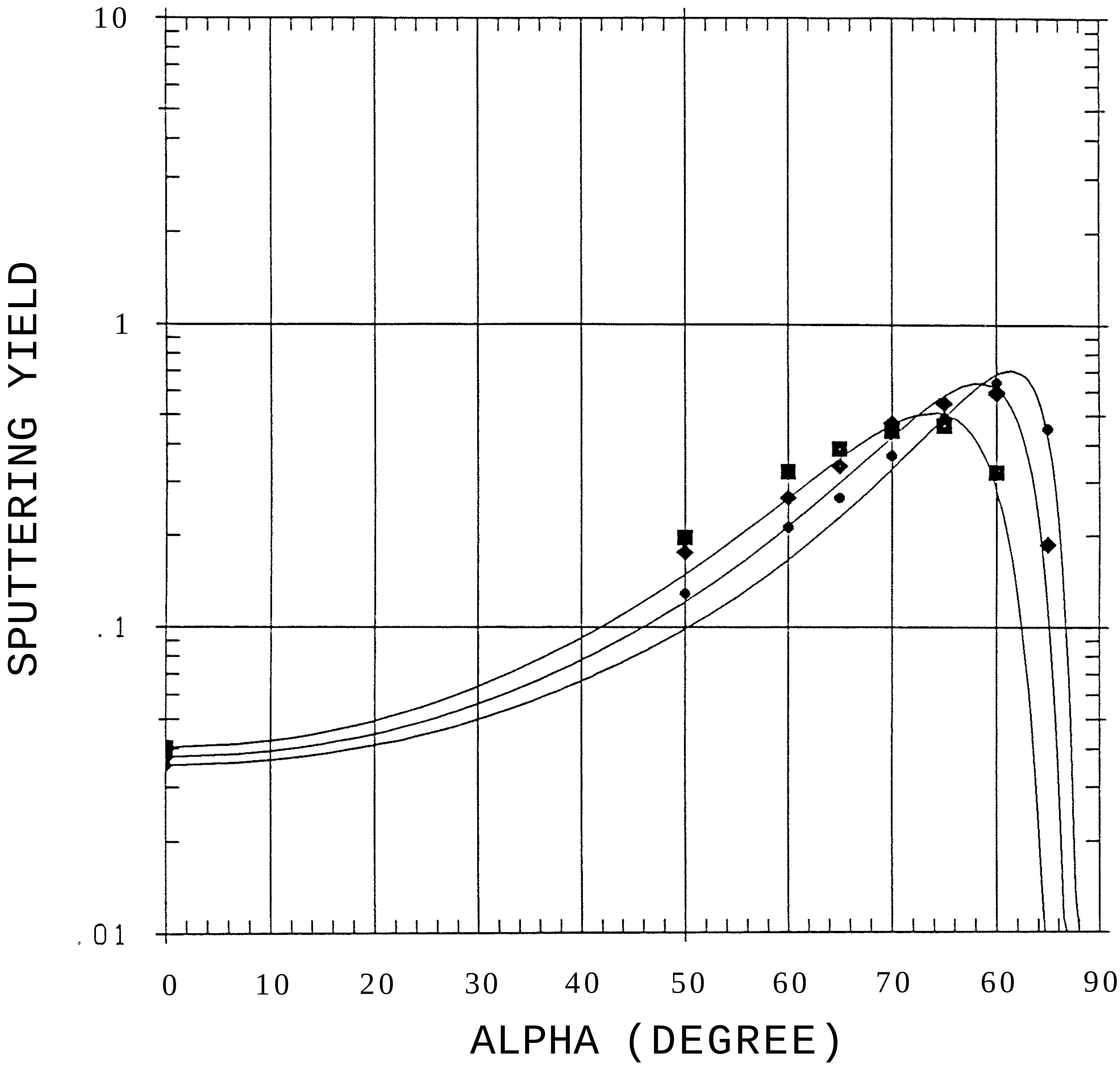


Fig.79: Angular dependence of the sputtering yield of Be with 0.2 , 0.5 and 1 keV T ions. The data are published in [36].

Calculated Data

Target	Proj.	Energy	Angle	Yield	Temp.	P	SBE
Be	T	0.200	0	0.04040	20	1.800	3.380
Be	T	0.200	50	0.19700	20	1.800	3.380
Be	T	0.200	60	0.32500	20	1.800	3.380
Be	T	0.200	65	0.38700	20	1.800	3.380
Be	T	0.200	70	0.44300	20	1.800	3.380
Be	T	0.200	75	0.46200	20	1.800	3.380
Be	T	0.200	80	0.32400	20	1.800	3.380

Target	Proj.	Energy	Angle	Yield	Temp.	P	SBE
Be	T	0.500	0	0.03760	20	1.800	3.380
Be	T	0.500	50	0.17600	20	1.800	3.380
Be	T	0.500	60	0.26600	20	1.800	3.380
Be	T	0.500	65	0.33900	20	1.800	3.380
Be	T	0.500	70	0.47100	20	1.800	3.380
Be	T	0.500	75	0.54600	20	1.800	3.380
Be	T	0.500	80	0.59800	20	1.800	3.380
Be	T	0.500	80	0.58900	20	1.800	3.380
Be	T	0.500	85	0.18700	20	1.800	3.380

Target	Proj.	Energy	Angle	Yield	Temp.	P	SBE
Be	T	1.000	0	0.03540	20	1.800	3.380
Be	T	1.000	50	0.12900	20	1.800	3.380
Be	T	1.000	60	0.21300	20	1.800	3.380
Be	T	1.000	65	0.26700	20	1.800	3.380
Be	T	1.000	70	0.36800	20	1.800	3.380
Be	T	1.000	75	0.49100	20	1.800	3.380
Be	T	1.000	80	0.64200	20	1.800	3.380
Be	T	1.000	85	0.45200	20	1.800	3.380

Projectile: He

Experimental Data

Target	Projectile	Energy	Symbol	y(0)	a	f
Be/JET	Ik	3.000	Ö	0.11000		

Calculated Data

Target	Projectile	Energy	Symbol	y(0)	a	f
Be	He	3.000	♦	0.06800	815	162

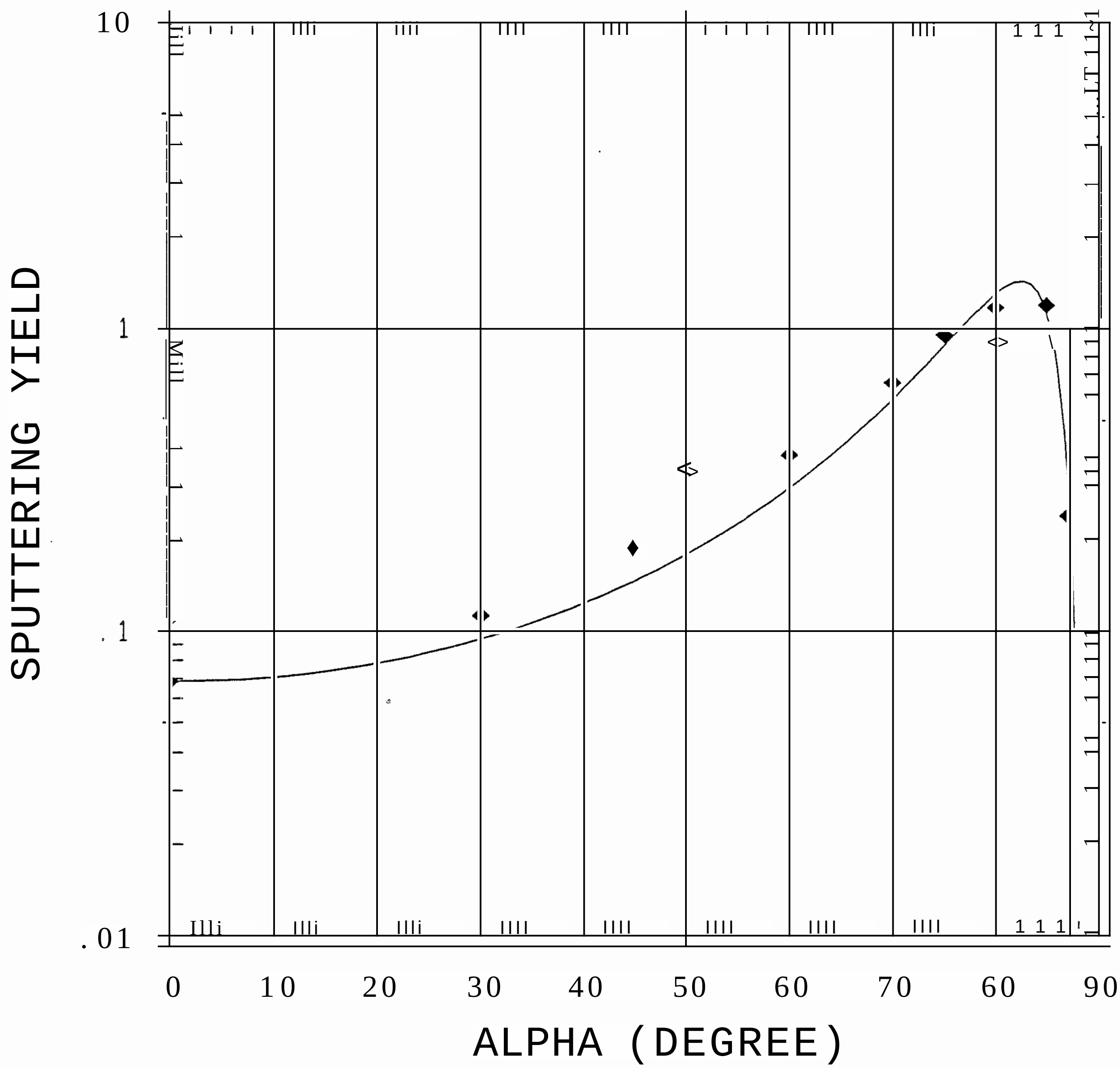


Fig. 80: Angular dependence of the sputtering yield of Be with 3 keV He ions. The experimental data were measured at 650°C to avoid surface oxidation. The data are published in [331.

Experimental Data

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
Be/JET	He	3.000	0	0.11000	650	1	VII	58	17.02.84
Be/JET	He	3.000	50	0.33600	650	1	VII	61	24.02.84
Be/JET	He	3.000	80	0.91000	650	1			1989

Calculated Data

Target	Proj.	Energy	Angle	Yield	Temp.	P	SBE
Be	He	3.000	0	0.06800	20	1.800	3.380
Be	He	3.000	30	0.11200	20	1.800	3.380
Be	He	3.000	45	0.18800	20	1.800	3.380
Be	He	3.000	60	0.38100	20	1.800	3.380
Be	He	3.000	70	0.66200	20	1.800	3.380
Be	He	3.000	75	0.95500	20	1.800	3.380
Be	He	3.000	80	1.18000	20	1.800	3.380
Be	He	3.000	85	1.20400	20	1.800	3.380
Be	He	3.000	87	0.24100	20	1.800	3.380

Projectile: Be

Calculated Data

Target	Projectile	Energy	Symbol	y(0)	a	f
Be	Be	0.050	■	0.01820	67.5	9.47
Be	Be	0.100	♦	0.07800	66.9	7.59
Be	Be	0.200	•	0.16000	68.2	5.87

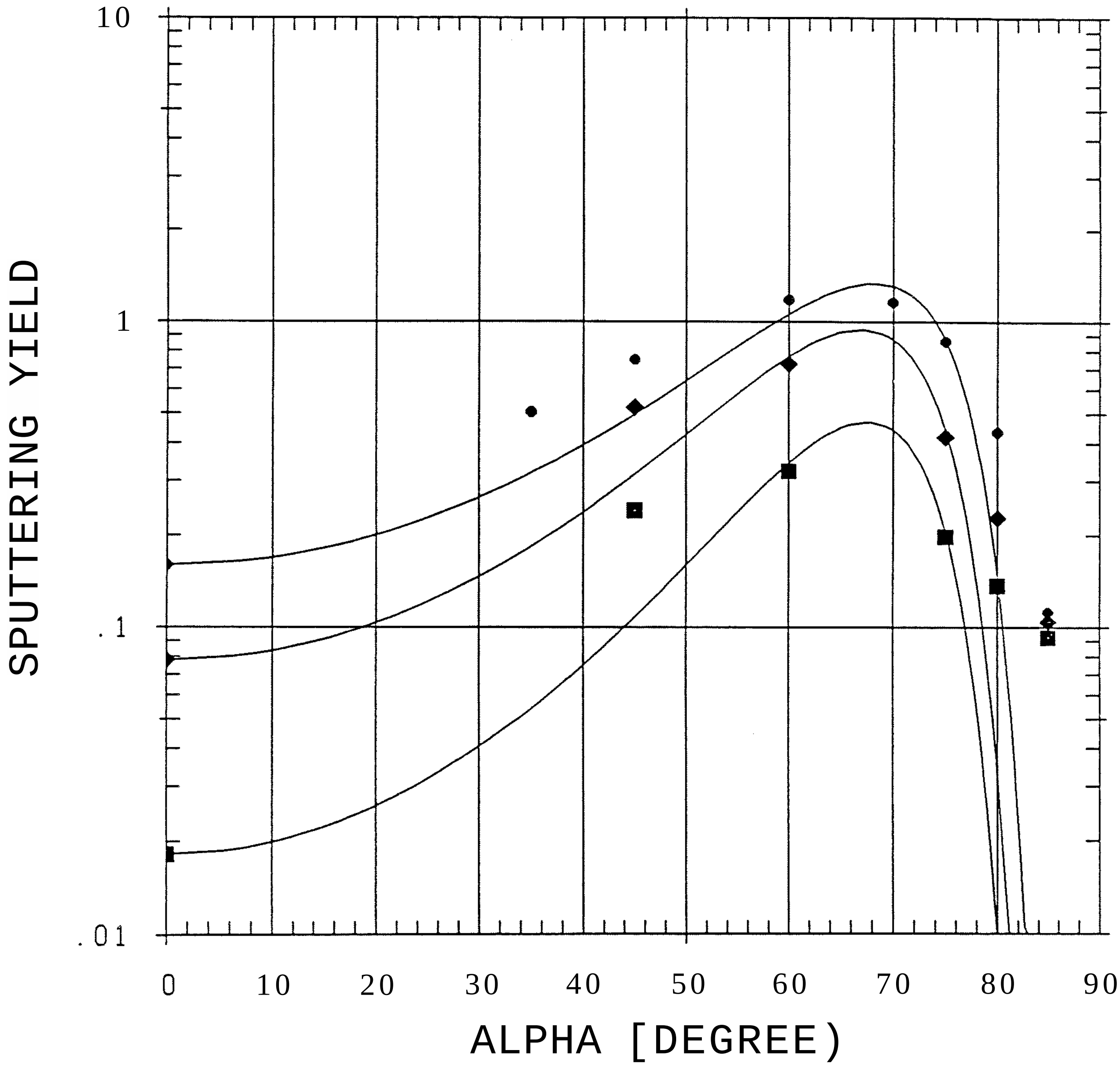


Fig. 81: Angular dependence of the sputtering yield of Be with 0.05 , 0.1 and 0.2 keV Be ions. The data are partly published in [33].

Calculated Data

Target	Proj.	Energy	Angle	Yield	Temp.	P	SBE
Be	Be	0.050	0	0.01820	20	1.800	3.380
Be	Be	0.050	45	0.24100	20	1.800	3.380
Be	Be	0.050	60	0.32300	20	1.800	3.380
Be	Be	0.050	75	0.19800	20	1.800	3.380
Be	Be	0.050	80	0.13700	20	1.800	3.380
Be	Be	0.050	85	0.09250	20	1.800	3.380

Target	Proj.	Energy	Angle	Yield	Temp.	P	SBE
Be	Be	0.100	0	0.07800	20	1.800	3.380
Be	Be	0.100	45	0.52300	20	1.800	3.380
Be	Be	0.100	60	0.72500	20	1.800	3.380
Be	Be	0.100	75	0.41900	20	1.800	3.380
Be	Be	0.100	80	0.22800	20	1.800	3.380
Be	Be	0.100	85	0.10400	20	1.800	3.380

Target	Proj.	Energy	Angle	Yield	Temp.	P	SBE
Be	Be	0.200	0	0.16000	20	1.800	3.380
Be	Be	0.200	35	0.50500	20	1.800	3.380
Be	Be	0.200	45	0.74800	20	1.800	3.380
Be	Be	0.200	60	1.18000	20	1.800	3.380
Be	Be	0.200	70	1.16000	20	1.800	3.380
Be	Be	0.200	75	0.86200	20	1.800	3.380
Be	Be	0.200	80	0.43500	20	1.800	3.380
Be	Be	0.200	85	0.11200	20	1.800	3.380

Calculated Data

Target	Projectile	Energy	Symbol	y(0)	α	f
Be	Be	1.000	■	0.26050	75.9	3.63
Be	Be	3'.000	◆	0.26300	80.7	2.67
Be	Be	5.000	•	0.22700	82.3	2.46

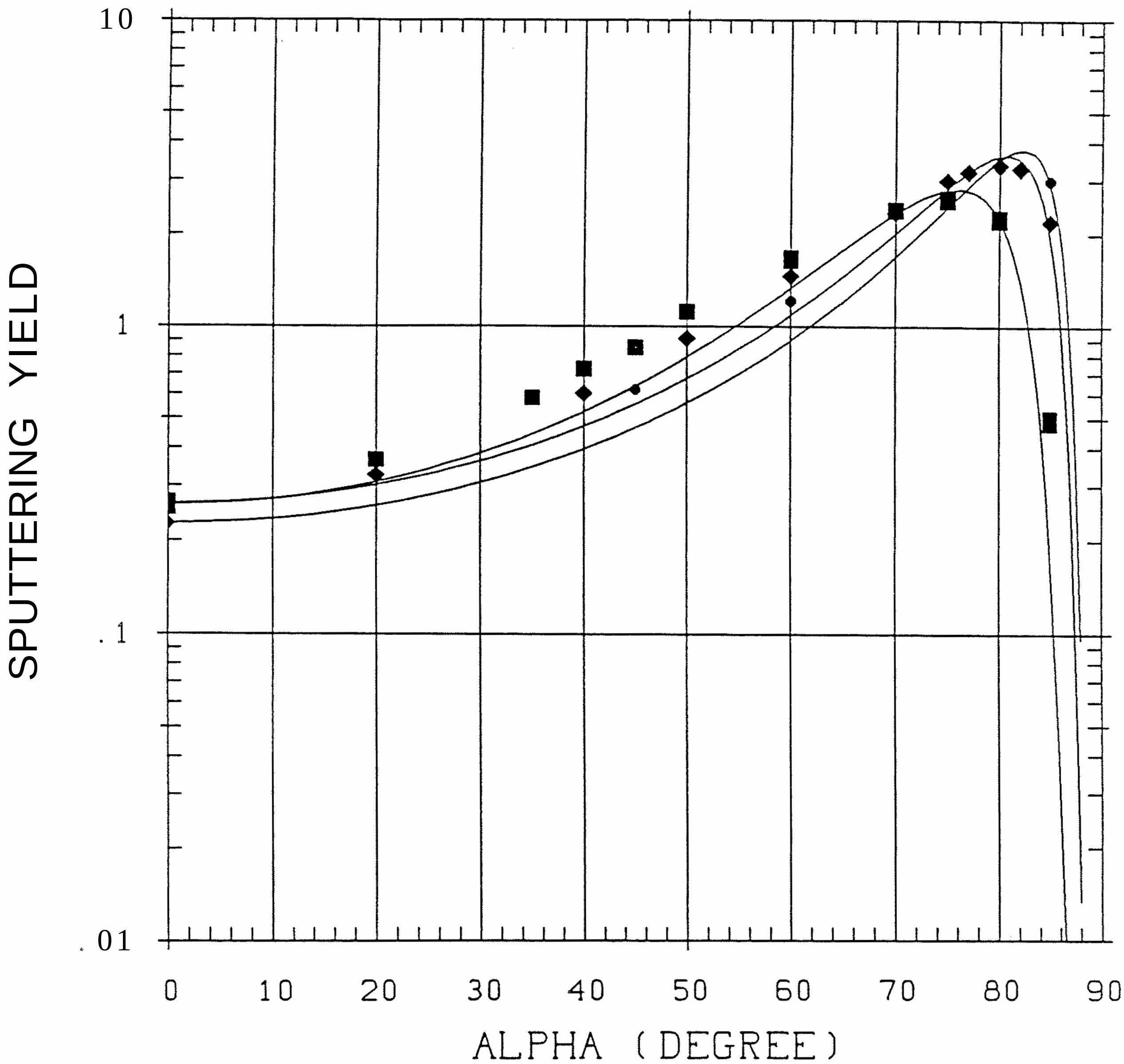


Fig. 82: Angular dependence of the sputtering yield of Be with 1 , 3 and 5 keV Be ions. The data are partly published in [33, 36].

Calculated Data

Target	Proj.	Energy	Angle	Yield	Temp.	P	SBE
Be	Be	1.000	0	0.25500	20	1.800	3.380
Be	Be	1.000	0	0.26600	20	1.800	3.380
Be	Be	1.000	20	0.36400	20	1.800	3.380
Be	Be	1.000	35	0.58200	20	1.800	3.380
Be	Be	1.000	40	0.72500	20	1.800	3.380
Be	Be	1.000	45	0.85200	20	1.800	3.380
Be	Be	1.000	50	1.11400	20	1.800	3.380
Be	Be	1.000	60	1.67300	20	1.800	3.380
Be	Be	1.000	60	1.64000	20	1.800	3.380
Be	Be	1.000	70	2.41200	20	1.800	3.380
Be	Be	1.000	70	2.39000	20	1.800	3.380
Be	Be	1.000	75	2.62800	20	1.800	3.380
Be	Be	1.000	75	2.57000	20	1.800	3.380
Be	Be	1.000	80	2.26900	20	1.800	3.380
Be	Be	1.000	80	2.21000	20	1.800	3.380
Be	Be	1.000	85	0.50230	20	1.800	3.380
Be	Be	1.000	85	0.48200	20	1.800	3.380

Target	Proj.	Energy	Angle	Yield	Temp.	P	SBE
Be	Be	3.000	0	0.26300	20	1.800	3.380
Be	Be	3.000	20	0.32500	20	1.800	3.380
Be	Be	3.000	40	0.60200	20	1.800	3.380
Be	Be	3.000	50	0.91200	20	1.800	3.380
Be	Be	3.000	60	1.46000	20	1.800	3.380
Be	Be	3.000	70	2.35000	20	1.800	3.380
Be	Be	3.000	75	2.99000	20	1.800	3.380
Be	Be	3.000	77	3.20000	20	1.800	3.380
Be	Be	3.000	80	3.38000	20	1.800	3.380
Be	Be	3.000	82	3.29000	20	1.800	3.380
Be	Be	3.000	85	2.20000	20	1.800	3.380

Target	Proj.	Energy	Angle	Yield	Temp.	P	SBE
Be	Be	5.000	0	0.22700	20	1.800	3.380
Be	Be	5.000	45	0.61900	20	1.800	3.380
Be	Be	5.000	60	1.21000	20	1.800	3.380
Be	Be	5.000	75	2.64000	20	1.800	3.380
Be	Be	5.000	80	3.31000	20	1.800	3.380
Be	Be	5.000	85	3.00000	20	1.800	3.380

Calculated Data

Target	Projectile	Energy	Symbol	y(0)	a	f
Tte	C	0.300	i	0.22800	69?5	T34
Be	C	1.000	♦	0.38500	74.1	3.96

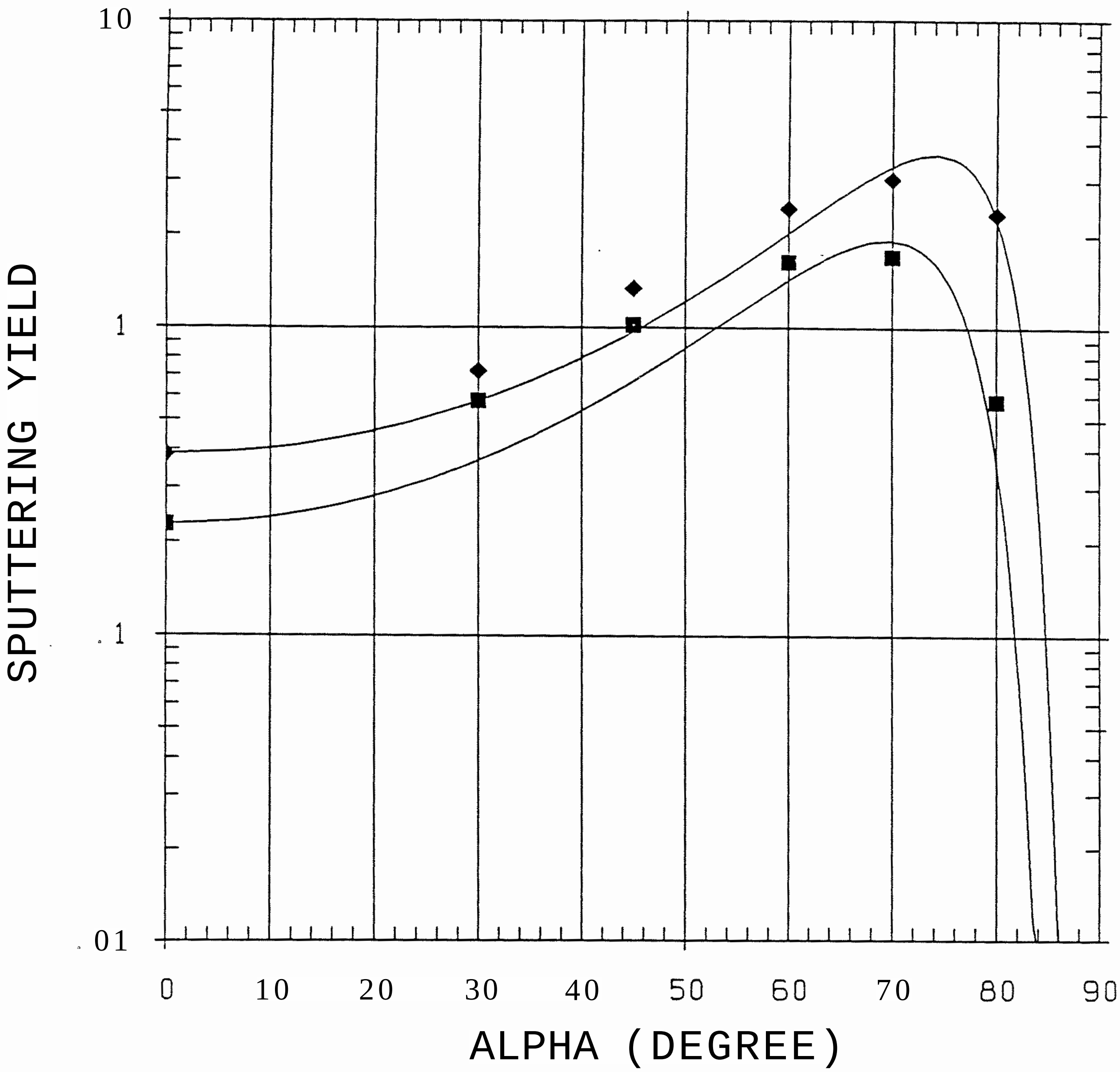


Fig. 83: Angular dependence of the sputtering yield of Be with 0.3 and 1 keV C ions. The built-up of carbon layers by C irradiation was not taken into account for calculation. The data are unpublished.

Calculated Data

Target	Proj.	Energy	Angle	Yield	Temp.	P	SBE
Be	c	0.300	0	0.22800	20	1.800	3.400
Be	C	0.300	30	0.57600	20	1.800	3.400
Be	C	0.300	45	1.01800	20	1.800	3.400
Be	C	0.300	60	1.63200	20	1.800	3.400
Be	C	0.300	70	1.70600	20	1.800	3.400
Be	C	0.300	80	0.57800	20	1.800	3.400

Target	Proj.	Energy	Angle	Yield	Temp.	P	SBE
Be	C	1.000	0	0.38500	20	1.800	3.400
Be	C	1.000	30	0.71900	20	1.800	3.400
Be	C	1.000	45	1.33900	20	1.800	3.400
Be	C	1.000	60	2.43700	20	1.800	3.400
Be	C	1.000	70	3.04300	20	1.800	3.400
Be	C	1.000	80	2.34300	20	1.800	3.400

Projectile: H

Experimental Data

Target	Projectile	Energy	Symbol	y(0)	Q	f
C/UCHOPG	H	1.000	t>	0.00712	71.2	4.71

Calculated Data

Target	Projectile	Energy	Symbol	y(0)	a	f
C	H	0.100	■	0.00318	70.6	2.95
C	H	1.000	▶	0.00472		

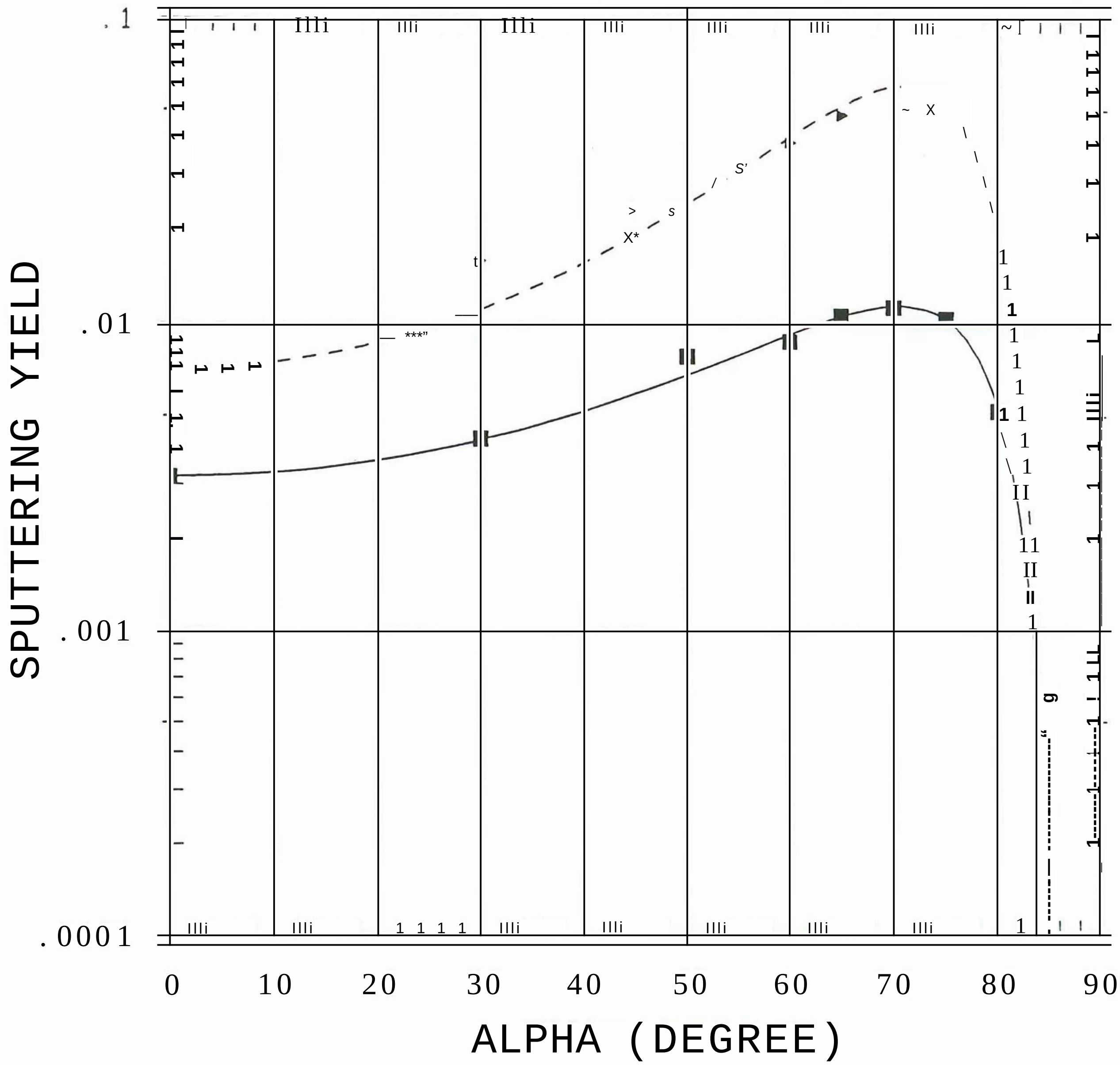


Fig. 84: Angular dependence of the sputtering yield of C with 0.1 and 1 keV H ions. The data are unpublished.

Experimental Data

Target.	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
C/UCHOPG	H	1.000	0	0.00712	80	3	IX	167	20.06.1988
C/UCHOPG	H	1.000	30	0.01600	20	3	IX	187	19.09.1988
C/UCHOPG	H	1.000	45	0.02380	20	3	IX	188	20.09.1988
C/UCHOPG	H	1.000	60	0.03900	20	3	IX	168	22.06.1988
C/UCHOPG	H	1.000	75	0.05400	20	3	IX	168	21.06.1988

Calculated Data

Target	Proj.	Energy	Angle	Yield	Temp.	*P*	SBE
C	H	0.100	0	0.00318	20	1.850	7.400
C	H	0.100	0	0.00318	20	1.850	7.400
C	H	0.100	30	0.00422	20	1.850	7.400
C	H	0.100	50	0.00782	20	1.850	7.400
C	H	0.100	60	0.00874	20	1.850	7.400
C	II	0.100	65	0.01060	20	1.850	7.400
C	H	0.100	70	0.01130	20	1.850	7.400
C	H	0.100	75	0.01040	20	1.850	7.400
C	H	0.100	80	0.00520	20	1.850	7.400
C	H	0.100	85	0.00062	20	1.850	7.400

Target	Proj.	Energy	Angle	Yield	Temp.	*p*	SBE
C	H	1.000	0	0.00472	20	1.850	7.400
C	H	1.000	65	0.04800	20	1.850	7.400

Experimental Data

Target	Projectile	Energy	Symbol	y(0)	a	f
C/UC1 pol.	H	2.000	□	0.00482	79.9	3.08
C/POCO	H '	2.000	t>	0.00912	77.4	2.23

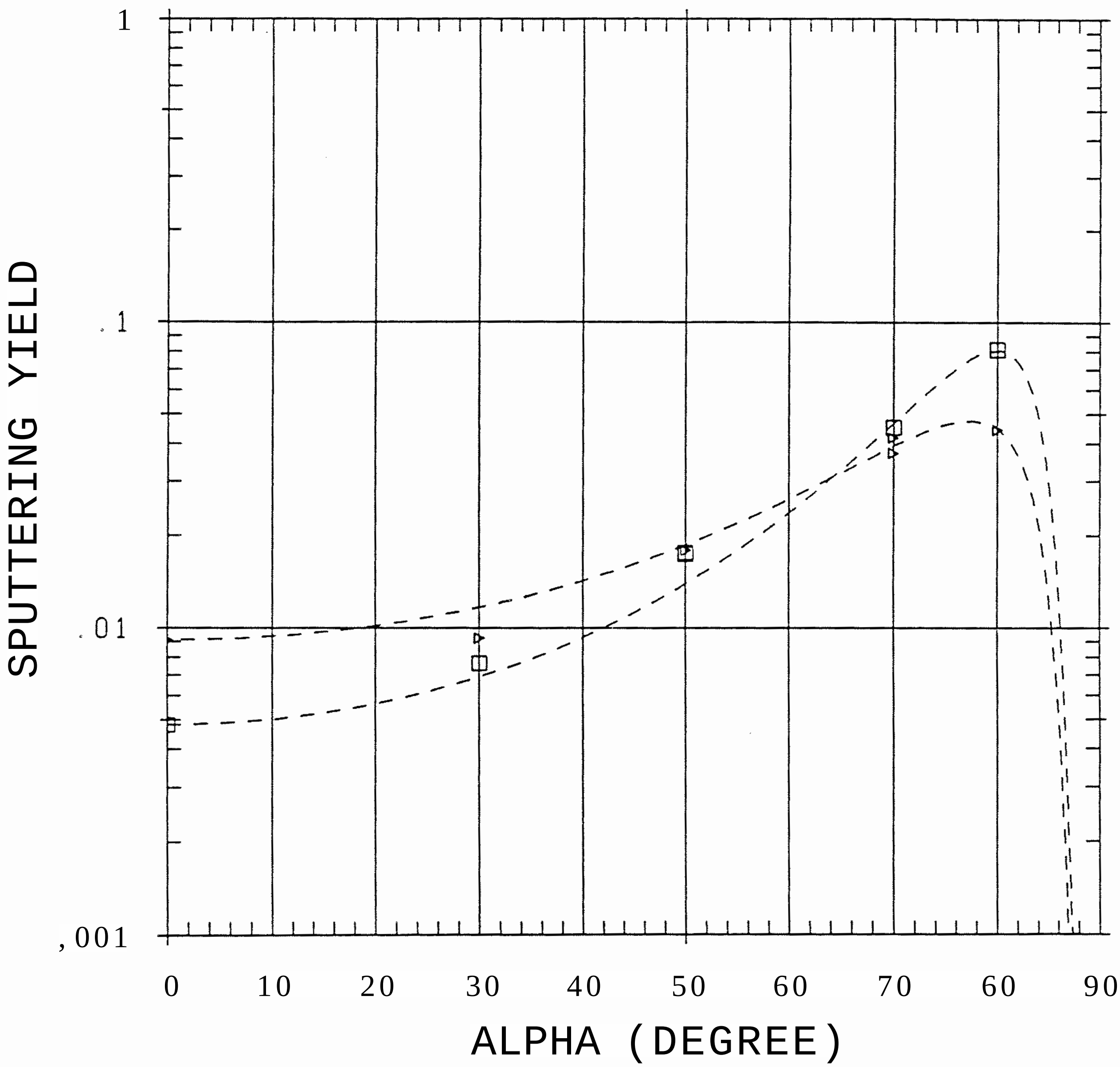


Fig. 85: Angular dependence of the sputtering yield of graphite with different degrees of surface roughness for 2 keV H ions. The roughness increases from polished pyrolytic graphite to POCO graphite. The data are partly published in [69].

Experimental Data

Target-	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
C/UCI pol.	IX	2.000	0	0.00482	190	3	VI	7	1.07.1982
C/UCI pol.	ffi	2.000	30	0.00764	160	3	VI	11	6.07.1982
C/UCI pol.	K	2.000	50	0.01760	190	3	VI	10	5.07.1982
C/UCI pol.	M	2.000	50	0.01740	190	3	VI	11	7.07.1982
C/UCI pol.	ffi	2.000	70	0.04510	160	3	VI	9	5.07.1982
C/UCI pol.	M	2.000	80	0.08130	130	3	VI	10	5.07.1982

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
C/POCO	K	2.000	0	0.00912	150	3	VI	1	24.06.1982
C/POCO	W	2.000	30	0.00925	170	3	VI	6	30.06.1982
C/POCO		2.000	50	0.01790	170	3	VI	5	29.06.1982
C/POCO	MM	2.000	70	0.03710	140	3	VI	5	29.06.1982
C/POCO	K	2.000	70	0.04170	170	3	VI	6	30.06.1982
C/POCO	IX	2.000	80	0.04440	110	3	VI	5	29.06.1982

Experimental Data

Target	Projectile	Energy	Symbol	y(0)	*a*	f
C/*	D	0.050	.	0.04015	59.5	0.58

Calculated Data

Target	Projectile	Energy	Symbol	y(0)	*a*	f
~ C	D	0.050	♦	0.00188	66T	T3?
C	D	0.100	►	0.00968	72.1	3.62

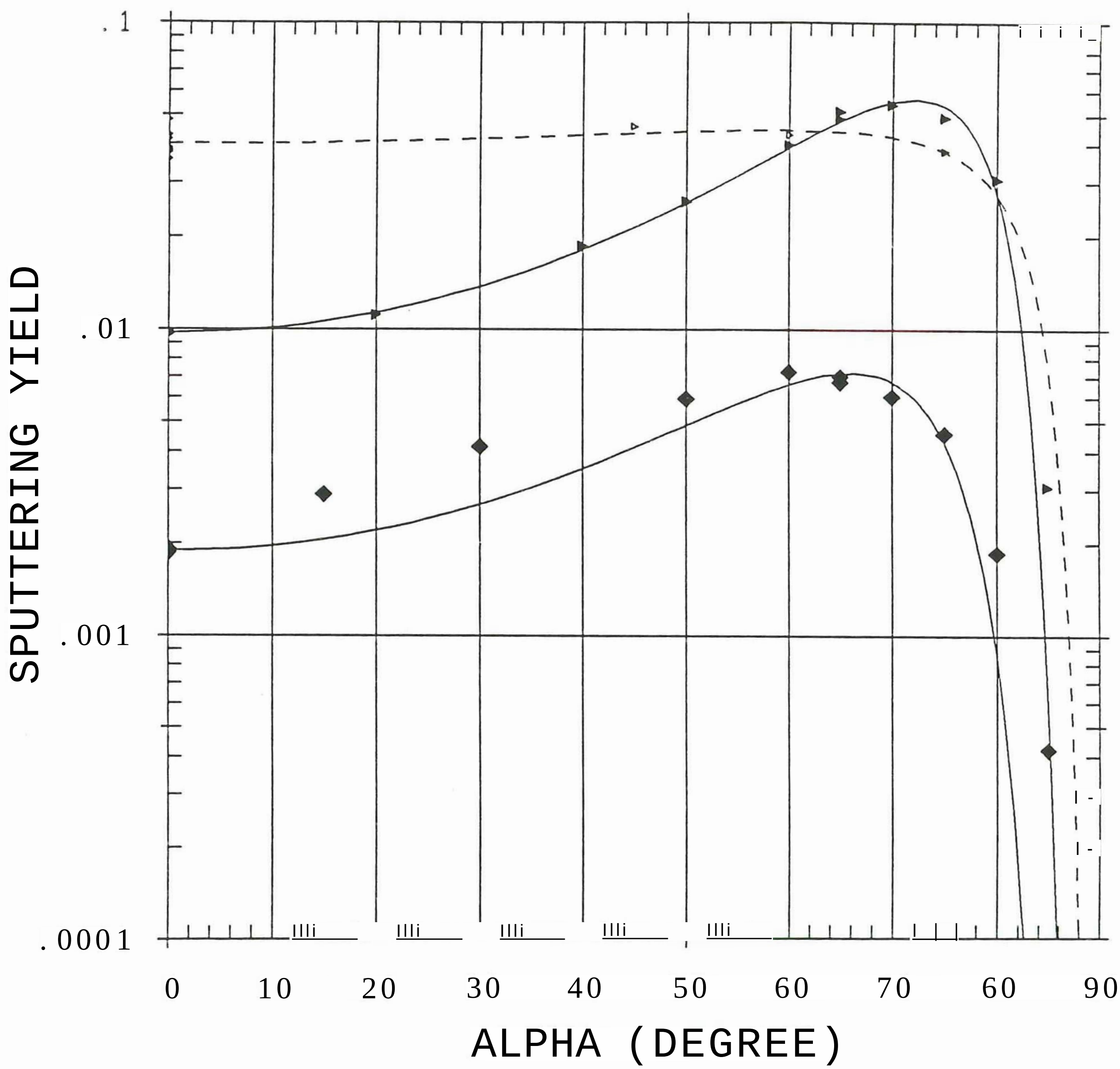


Fig. 86: Angular dependence of the sputtering yield of C with 50 and 100 eV D ions. The experimental values at 50 eV show enhanced yields due to chemical erosion, which is found at room temperature for ion energies below 100 eV. The data are unpublished.

Experimental Data

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
C/UC	D	0.050	0	0.03770	20	3	III	77	08.05.1978
C/UC	D	0.050	0	0.03570	20	3	III	115	25.07.1978
C/UC-	D	0.050	0	0.04810	20	3	VI	114	19.02.1983
C/UC-	D	0.050	0	0.03820	20	3	VIII	95	2.12.1985
C/EK98	D	0.050	0	0.03880	20	3	VIII	99	7.01.1986
C/UC	D	0.050	0	0.04150	20	3	VIII	185	28.08.1986
C/EK76	D	0.050	0	0.03830	20	3	IX	4	10.09.1986
C/TI	D	0.050	0	0.04290	20	3	X	156	01.03.1990
C/UC-	D	0.050	45	0.04570	20	3	VIII	187	4.09.1986
C/UC-	D	0.050	60	0.04320	20	3	VIII	186	2.09.1986
C/UC-	D	0.050	75	0.03810	20	3	VIII	187	2.09.1986

Calculated Data

Target	Proj.	Energy	Angle	Yield	Temp.	P	SBE
C	D	0.050	0	0.00191	20	1.850	7.400
C	D	0.050	0	0.00186	20	1.850	7.400
C	D	0.050	15	0.00290	20	1.850	7.400
C	D	0.050	30	0.00414	20	1.850	7.400
C	D	0.050	50	0.00594	20	1.850	7.400
C	D	0.050	60	0.00728	20	1.850	7.400
C	D	0.050	65	0.00675	20	1.850	7.400
C	D	0.050	65	0.00702	20	1.850	7.400
C	D	0.050	70	0.00604	20	1.850	7.400
C	D	0.050	75	0.00457	20	1.850	7.400
C	D	0.050	80	0.00186	20	1.850	7.400
C	D	0.050	85	0.00042	20	1.850	7.400

Target	Proj.	Energy	Angle	Yield	Temp.	P	SBE
C	D	0.100	0	0.00957	20	1.850	7.400
C	D	0.100	0	0.00980	20	1.850	7.400
C	D	0.100	20	0.01110	20	1.850	7.400
C	D	0.100	40	0.01860	20	1.850	7.400
C	D	0.100	50	0.02600	20	1.850	7.400
C	D	0.100	60	0.03990	20	1.850	7.400
C	D	0.100	65	0.04860	20	1.850	7.400
C	D	0.100	65	0.05150	20	1.850	7.400
C	D	0.100	70	0.05420	20	1.850	7.400
C	D	0.100	75	0.04910	20	1.850	7.400
C	D	0.100	80	0.03080	20	1.850	7.400
C	D	0.100	85	0.00308	20	1.850	7.400

Projectile: D

Experimental Data

Target	Projectile	Energy	Symbol	y(0)	Q	f
C/UC pol.	D	0.350	□	0.02120	75.0	3.21
C/UC pol.	D '	1.000	0	0.01735	80.8	2.80

Calculated Data

Target	Projectile	Energy	Symbol	y(o)	a	f
C	D	1.000	♦	0.01276	81.0	3.02

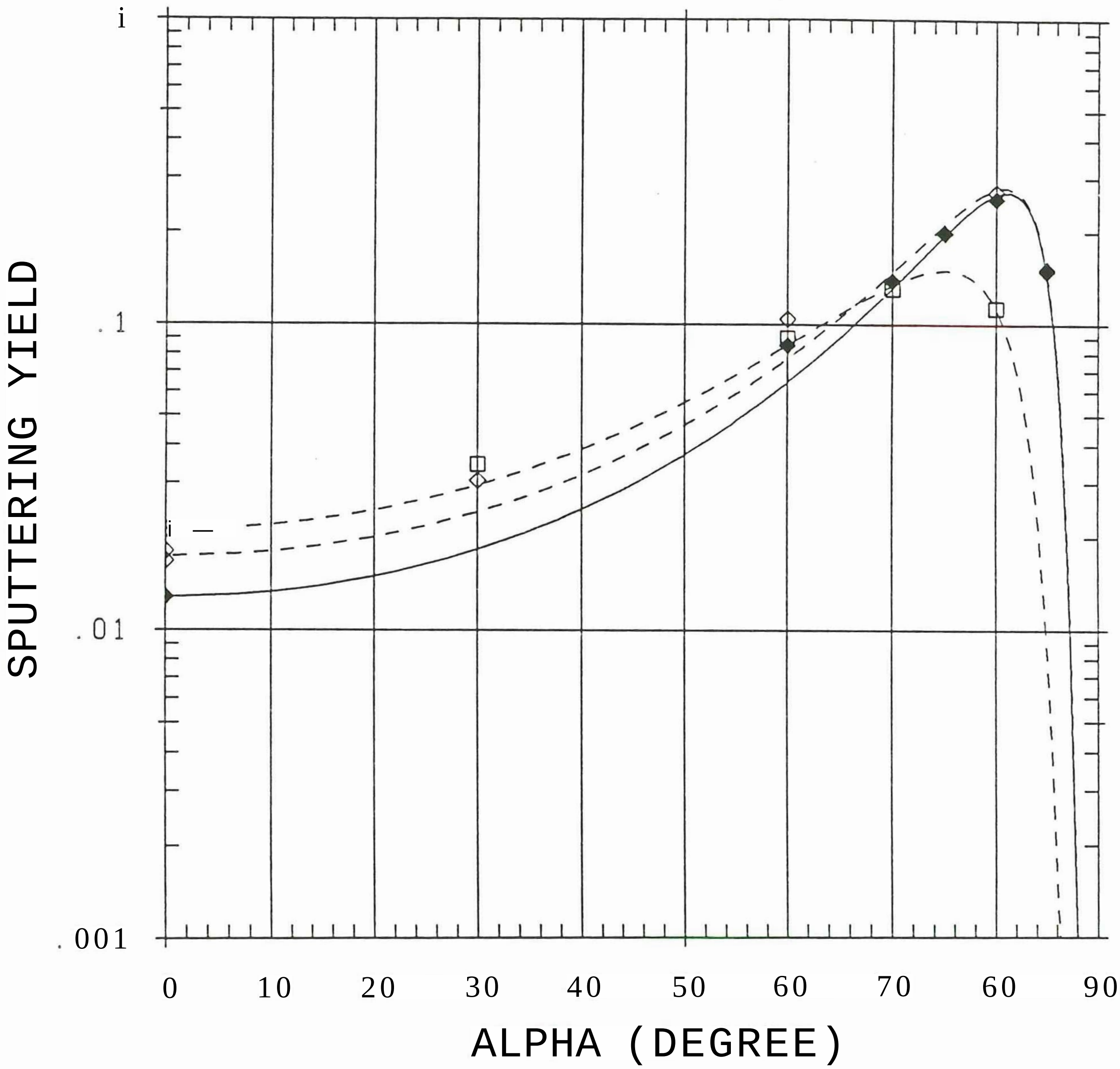


Fig. 87: Angular dependence of the sputtering yield of polished pyrolytic graphite with 0.35 and 1 keV D ions. The data are published in [691.

Experimental Data

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
C/UC pol.	D	0.350	0	0.02120	20	3	V	96	12.10.1981
C/UC pol.	D	0.350	30	0.03460	20	3	V	96	07.10.1981
C/UC pol.	D	0.350	60	0.09000	20	3	V	97	13.10.1981
C/UC pol.	D	0.350	70	0.13100	20	3	V	135	24.03.1982
C/UC pol.	D	0.350	80	0.11300	20	3	V	96	09.10.1981

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
C/UC pol.	D	1.000	0	0.01800	20	3	11	179	18.08.1977
C/UC pol.	D	1.000	0	0.01670	20	3	V	97	16.10.1981
C/UC pol.	D	1.000	30	0.03060	60	3	V	98	20.10.1981
C/UC pol.	D	1.000	60	0.10400	20	3	V	97	15.10.1981
C/UC pol.	D	1.000	80	0.27000	20	3	V	98	19.10.1981
C/UC pol.	D	1.000	85	0.15200	30	3	V	101	3.11.1981

Calculated Data

Target	Proj.	Energy	Angle	Yield	Temp.	P	SBE
C	D	1.000	0	0.01276	20	2.200	7.400
C	D	1.000	60	0.08529	20	2.200	7.400
C	D	1.000	70	0.13890	20	2.200	7.400
C	D	1.000	75	0.19910	20	2.200	7.400
C	D	1.000	80	0.25700	20	2.200	7.400
C	D	1.000	85	0.14980	20	2.200	7.400

Projectile: D

Experimental Data

Target	Projectile	Energy	Symbol	y(0)	a	f
C/UC pol.	D	2.000	□	0.01153	82.2	2.96
C/UC-	D	2.000	0	0.01800	77.0	2.83
C/POCO	D	2.000	o	0.02590	75.4	1.50

Calculated Data

Target	Projectile	Energy	Symbol	y(0)	Q	f
C	D	2.000	■	0.00987	83.3	2.64

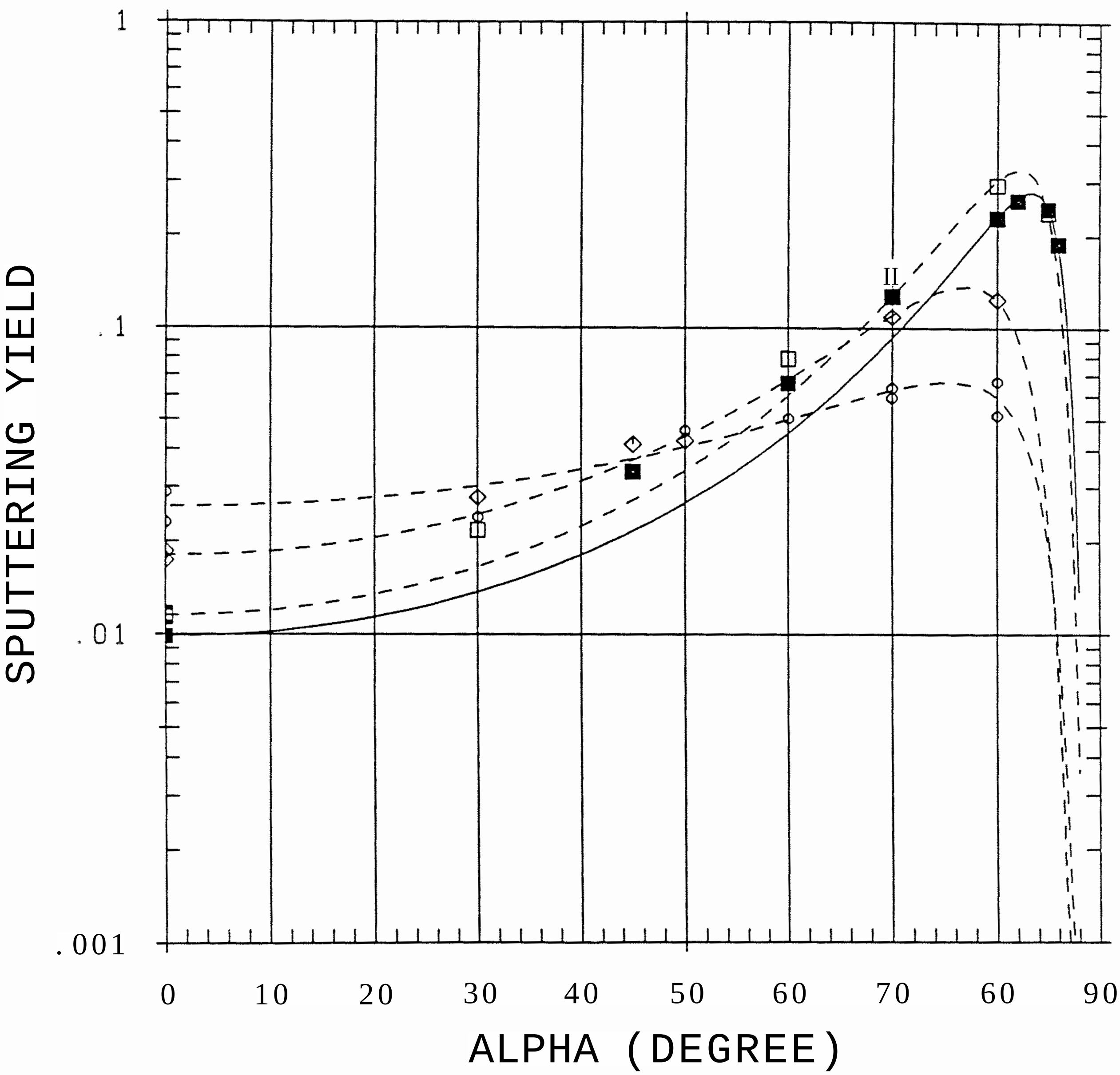


Fig. 88: Angular dependence of the sputtering yield of graphite with different degrees of surface roughness for 2 keV D ions. The roughness increases from polished pyrolytic graphite to pyrolitic graphite (basal plane) to POCO graphite. The data are published in [70].

Experimental Data

Target •	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
C/UC pol.	D	2.000	0	0.01140	20	3	II	179	17.08.1977
C/UC pol.	D	2.000	0	0.01150	110	3	V	98	21.10.1981
C/UC pol.	D	2.000	0	0.01170	20	3	V	102	6.11.1981
C/UC pol.	D	2.000	30	0.02180	110	3	V	99	22.10.1981
C/UC pol.	D	2.000	60	0.07900	45	3	V	99	26.10.1981
C/UC pol.	D	2.000	70	0.15300	42	3	V	100	27.10.1981
C/UC pol.	D	2.000	80	0.29300	42	3	V	99	23.10.1981
C/UC pol.	D	2.000	85	0.23900	45	3	V	101	30.10.1981

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
C/UC-	D	2.000	0	0.01860	200	3	VI	17	14.07.1982
C/UC-	D	2.000	0	0.01740	200	3	VI	18	15.07.1982
C/UC-	D	2.000	30	0.02780	210	3	VI	22	19.07.1982
C/UC-	D	2.000	45	0.04160	20	3	IX	163	20.05.1988
C/UC-	D	2.000	50	0.04270	200	3	VI	18	15.07.1982
C/UC-	D	2.000	70	0.10900	150	3	VI	18	14.07.1982
C/UC-	D	2.000	80	0.12400	110	3	VI	17	14.07.1982

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
C/POCO	D	2.000	0	0.02880	180	3	V	187	23.06.1982
C/POCO	D	2.000	0	0.02300	160	3	VI	1	24.06.1982
C/POCO	D	2.000	30	0.02400	155	3	V	188	24.06.1982
C/POCO	D	2.000	50	0.04620	155	3	V	188	24.06.1982
C/POCO	D	2.000	60	0.05060	155	3	V	189	24.06.1982
C/POCO	D	2.000	70	0.05920	135	3	V	187	23.06.1982
C/POCO	D	2.000	70	0.06370	130	3	V	189	24.06.1982
C/POCO	D	2.000	80	0.05180	110	3	V	186	23.06.1982
C/POCO	D	2.000	80	0.06670	110	3	VI	1	24.06.1982

Calculated Data

Target	Proj.	Energy	Angle	Yield	Temp.	P	SBE
C	D	2.000	0	0.00987	20	2.200	7.400
C	D	2.000	45	0.03380	20	2.200	7.400
C	D	2.000	60	0.06575	20	2.200	7.400
C	D	2.000	70	0.12700	20	2.200	7.400
C	D	2.000	80	0.22870	20	2.200	7.400
C	D	2.000	82	0.26100	20	2.200	7.400
C	D	2.000	85	0.24500	20	2.200	7.400
C	D	2.000	86	0.18900	20	2.200	7.400

Calculated Data

Target	Projectile	Energy	Symbol	y(0)	a	f
C	T	0.035	•	0.00069	63.0	6.99
C	T	0.100	▶	0.01065	72.1	4.66
C	T	0.300	▶	0.01735	76.4	3.96

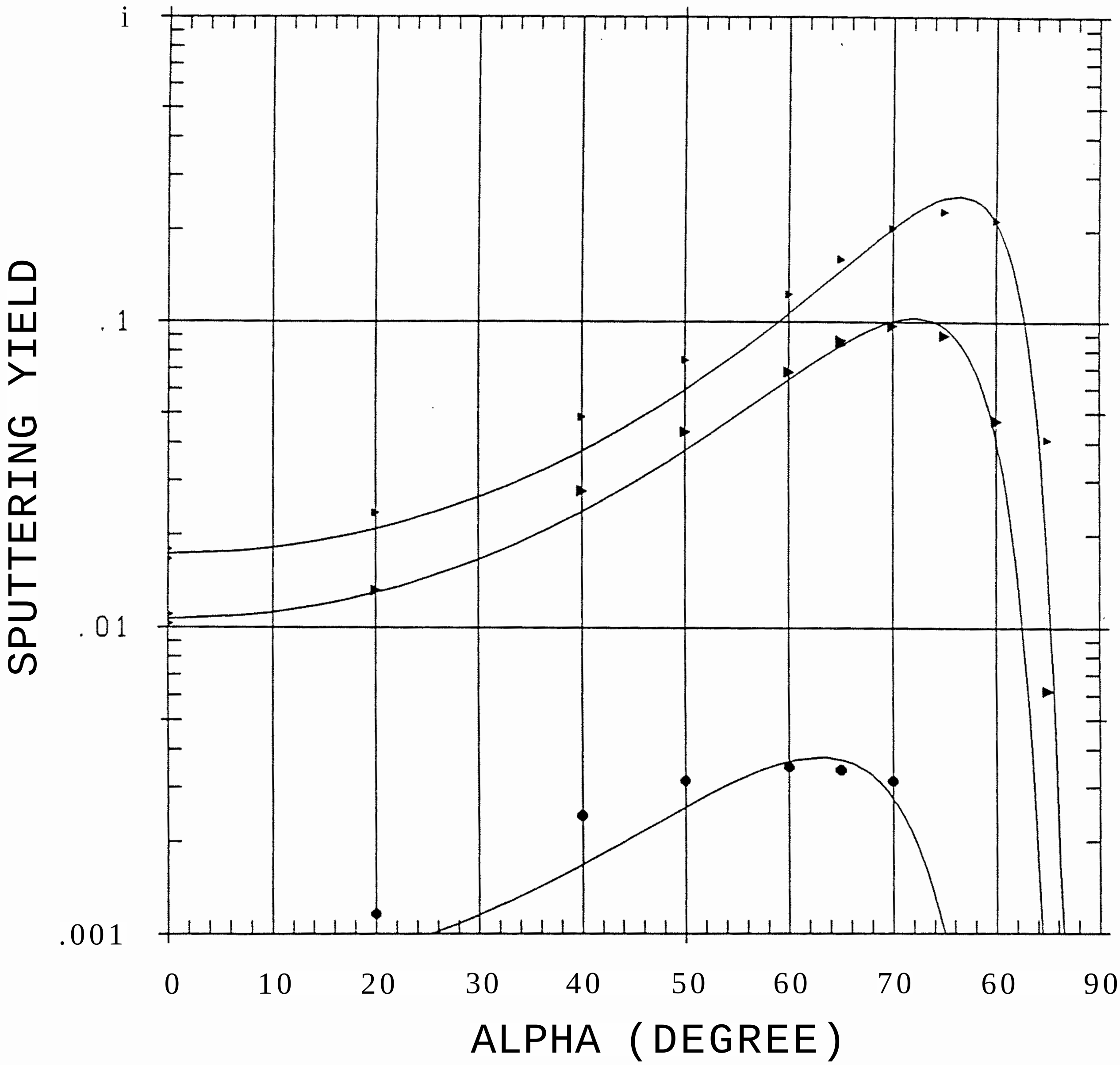


Fig. 89: Angular dependence of the sputtering yield of C with 35 , 100 and 300 eV T ions. For energies below 100 eV experimental data are expected to show enhanced erosion yields due to chemical sputtering. The data are partly published in [37].

Calculated Data

Target	Proj.	Energy	Angle	Yield	Temp.	p	SBE
C	T	0.035	0	0.00069	20	1.850	7.400
C	T	0.035	0	0.00069	20	1.850	7.400
C	T	0.035	10	0.00081	20	1.850	7.400
C	T	0.035	20	0.00116	20	1.850	7.400
C	T	0.035	40	0.00243	20	1.850	7.400
C	T	0.035	50	0.00316	20	1.850	7.400
C	T	0.035	60	0.00351	20	1.850	7.400
C	T	0.035	65	0.00343	20	1.850	7.400
C	T	0.035	65	0.00343	20	1.850	7.400
C	T	0.035	70	0.00315	20	1.850	7.400
C	T	0.035	80	0.00099	20	1.850	7.400

Target	Proj.	Energy	Angle	Yield	Temp.	p	SBE
C	T	0.100	0	0.01100	20	1.850	7.400
C	T	0.100	0	0.01030	20	1.850	7.400
C	T	0.100	20	0.01320	20	1.850	7.400
C	T	0.100	40	0.02780	20	1.850	7.400
C	T	0.100	50	0.04340	20	1.850	7.400
C	T	0.100	60	0.06810	20	1.850	7.400
C	T	0.100	65	0.08680	20	1.850	7.400
C	T	0.100	65	0.08430	20	1.850	7.400
C	T	0.100	70	0.09700	20	1.850	7.400
C	T	0.100	75	0.09020	20	1.850	7.400
C	T	0.100	80	0.04720	20	1.850	7.400
C	T	0.100	85	0.00620	20	1.850	7.400

Target	Proj.	Energy	Angle	Yield	Temp.	p	SBE
C	T	0.300	0	0.01800	20	1.850	7.400
C	T	0.300	0	0.01670	20	1.850	7.400
C	T	0.300	20	0.02360	20	1.850	7.400
C	T	0.300	40	0.04840	20	1.850	7.400
C	T	0.300	50	0.07460	20	1.850	7.400
C	T	0.300	60	0.12300	20	1.850	7.400
C	T	0.300	65	0.16100	20	1.850	7.400
C	T	0.300	65	0.16000	20	1.850	7.400
C	T	0.300	70	0.20300	20	1.850	7.400
C	T	0.300	75	0.23000	20	1.850	7.400
C	T	0.300	80	0.21600	20	1.850	7.400
C	T	0.300	85	0.04090	20	1.850	7.400

Experimental Data

Target	Projectile	Energy	Symbol	y(0)	a	f
C/UCI	T	2.000	Z	0.08505	78T	278
C/POCO	He	2.000	t>	0.12700	81.6	1.29

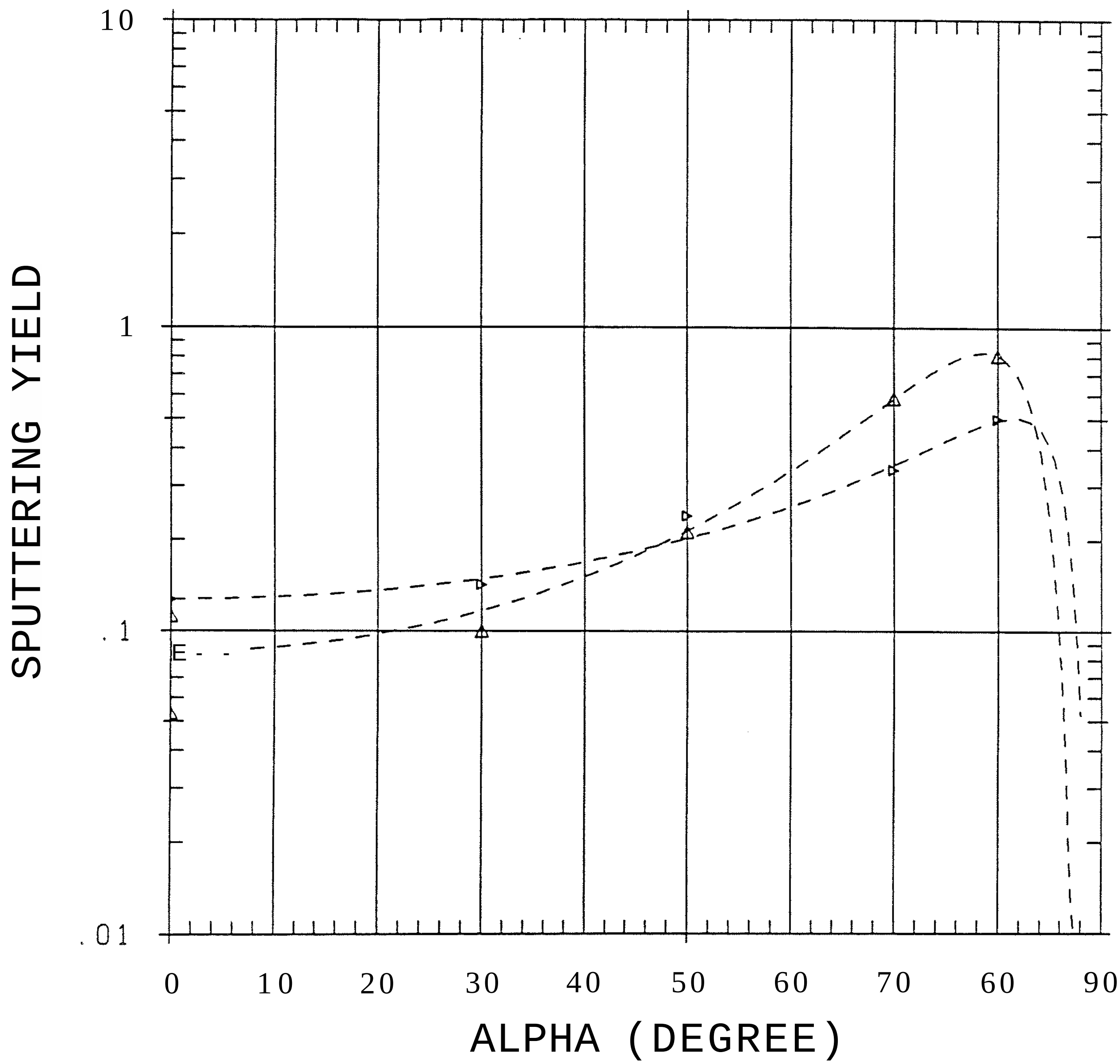


Fig. 90: Angular dependence of the sputtering yield of graphite with different degrees of surface roughness for 2 keV He ions. The roughness increases from pyrolitic graphite (edge plane) to POCO graphite. The data are partly published in [69].

Experimental Data

Target	■ Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
C/UCI	He	2.000	0	0.11200	110	1	VI	11	6.07.1982
C/UCI	He	2.000	0	0.05330	110	1	VI	14	12.07.1982
C/UCI	He	2.000	0	0.08800	130	1	VI	15	13.07.1982
C/UCI	He	2.000	0	0.08690	140	1	VI	15	13.07.1982
C/UCI	He	2.000	30	0.10000	no	1	VI	14	12.07.1982
C/UCI	He	2.000	50	0.21300	no	1	VI	14	12.07.1982
C/UCI	He	2.000	70	0.58600	no	1	VI	13	12.07.1982
C/UCI	He	2.000	80	0.81000	no	1	VI	13	12.07.1982

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
C/POCO	He	2.000	0	0.12700	no	1	VI	2	25.06.1982
C/POCO	He	2.000	30	0.14200	no	1	VI	4	28.06.1982
C/POCO	He	2.000	50	0.24000	no	1	VI	3	28.06.1982
C/POCO	He	2.000	70	0.34000	no	1	VI	3	28.06.1982
C/POCO	He	2.000	80	0.50000	no	1	VI	2	25.06.1982

Experimental Data

Target	Projectile	Energy	Symbol	y(0)	*a*	f
C/UC-	^{12}C	0.100	□	0.12800	71.3	3.46
C/UC-	^{12}C	0.300	0	0.23300		
C/UC-	^{12}C	1.000	o	0.37000	79.2	1.71

Calculated Data

Target	Projectile	Energy	Symbol	y(0)	Q	f
C	^{12}C	0.100	■	0.01200	64.7	12.43
C	^{12}C	0.300	♦	0.08050	72.4	5.13
C	^{12}C	1.000	•	0.19500	73.7	4.32

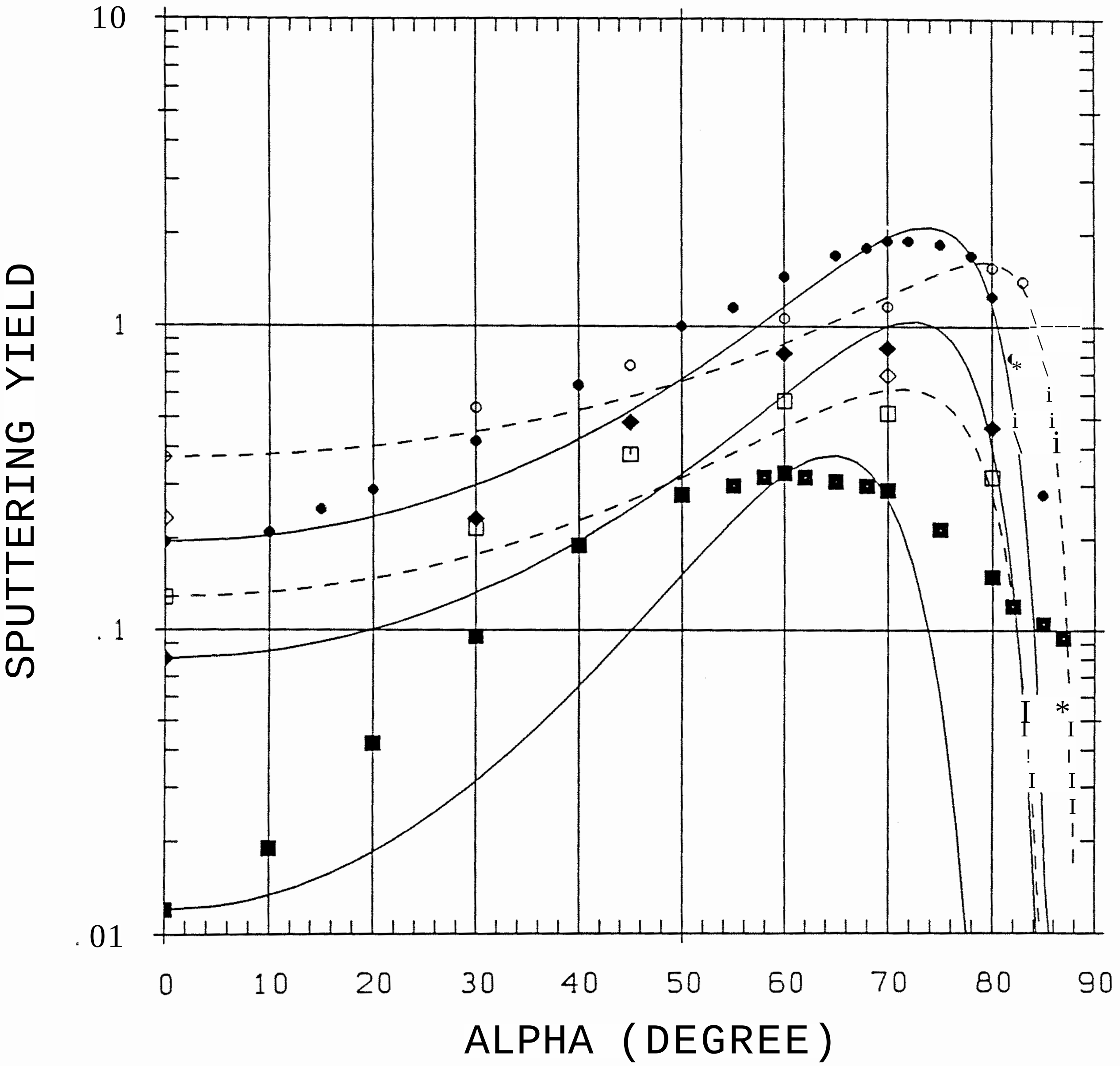


Fig. 91: Angular dependence of the sputtering yield of C with 0.1 , 0.3 and 1 keV C ions. The data are published in [10].

Experimental Data

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
c/uc-	^{12}C	0.100	0	0.12800	20	1	X	5	7.10.1988
c/uc-	^{12}C	0.100	30	0.21600	20	1	X	6	12.10.1988
c/uc-	^{12}c	0.100	45	0.38000	20	1	X	5	10.10.1988
c/uc-	^{12}c	0.100	60	0.57000	20	1	X	6	10.10.1988
c/uc-	^{12}c	0.100	70	0.52000	20	1	X	3	4.10.1988
c/uc-	^{12}c	0.100	80	0.32000	20	1	X	6	11.10.1988

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
c/uc-	^{12}c	0.300	0	0.23300	20	1	X	7	13.10.1988
c/uc-	^{12}c	0.300	70	0.69000	20	1	X	2	3.10.1988

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
c/uc-	^{12}C	1.000	0	0.37000	20	1	X	2	3.10.1988
c/uc-	^{12}C	1.000	30	0.54000	20	1	X	5	7.10.1988
c/uc-	^{12}C	1.000	45	0.74400	20	1	X	3	4.10.1988
C/UC-	^{12}c	1.000	60	1.06000	20	1	X	4	5.10.1988
C/UC-	^{12}c	1.000	70	1.16000	20	1	X	1	29.09.1988
C/UC-	^{12}c	1.000	80	1.55000	20	1	X	4	5.10.1988
C/UC-	^{12}c	1.000	83	1.40000	20	1	X	4	6.10.1988

Calculated Data

Target	Proj.	Energy	Angle	Yield	Temp.	P	SBE
C	^{12}C	0.100	0	0.01200	20	2.260	7.400
C	^{12}C	0.100	10	0.01900	20	2.260	7.400
C	^{12}C	0.100	20	0.04200	20	2.260	7.400
C	^{12}C	0.100	30	0.09500	20	2.260	7.400
C	^{12}C	0.100	40	0.19000	20	2.260	7.400
C	^{12}c	0.100	50	0.28000	20	2.260	7.400
C	^{12}c	0.100	55	0.30000	20	2.260	7.400
C	^{12}c	0.100	58	0.32000	20	2.260	7.400
C	^{12}c	0.100	60	0.33000	20	2.260	7.400
C	^{12}c	0.100	62	0.32000	20	2.260	7.400
C	^{12}c	0.100	65	0.31000	20	2.260	7.400
C	^{12}c	0.100	68	0.30000	20	2.260	7.400
C	^{12}c	0.100	70	0.29000	20	2.260	7.400
C	^{12}C	0.100	75	0.21500	20	2.260	7.400
C	^{12}c	0.100	80	0.15000	20	2.260	7.400
C	^{12}c	0.100	82	0.12000	20	2.260	7.400
C	^{12}c	0.100	85	0.10500	20	2.260	7.400
C	^{12}c	0.100	87	0.09400	20	2.260	7.400

Target	Proj.	Energy	Angle	Yield	Temp.	P	SBE
C	^{12}C	0.300	0	0.08050	20	2.000	7.400
C	^{12}C	0.300	30	0.23300	20	2.000	7.400
C	^{12}C	0.300	45	0.48500	20	2.000	7.400
C	^{12}C	0.300	60	0.81600	20	2.000	7.400
C	^{12}C	0.300	70	0.84900	20	2.000	7.400
C	^{12}C	0.300	80	0.46600	20	2.000	7.400

Target	Proj.	Energy	Angle	Yield	Temp.	P	SBE
C	^{12}C	1.000	0	0.19500	20	2.260	7.400
C	^{12}C	1.000	10	0.21000	20	2.260	7.400
C	^{12}C	1.000	15	0.25000	20	2.260	7.400
C	^{12}C	1.000	20	0.29000	20	2.260	7.400
C	^{12}C	1.000	30	0.42000	20	2.260	7.400
C	^{12}C	1.000	40	0.64000	20	2.260	7.400
C	^{12}C	1.000	50	1.00000	20	2.260	7.400
C	^{12}C	1.000	55	1.15000	20	2.260	7.400
C	^{12}C	1.000	60	1.45000	20	2.260	7.400
C	^{12}C	1.000	65	1.70000	20	2.260	7.400
C	^{12}C	1.000	68	1.80000	20	2.260	7.400
C	^{12}C	1.000	70	1.90000	20	2.260	7.400
C	^{12}C	1.000	72	1.90000	20	2.260	7.400
C	^{12}C	1.000	75	1.85000	20	2.260	7.400
C	^{12}C	1.000	78	1.70000	20	2.260	7.400
C	^{12}C	1.000	80	1.25000	20	2.260	7.400
C	^{12}C	1.000	82	0.79000	20	2.260	7.400
C	^{12}C	1.000	85	0.28000	20	2.260	7.400
C	^{12}C	1.000	87	0.05700	20	2.260	7.400

Experimental Data

Target	Projectile	Energy	Symbol	y(0)	a	f
C/UCI pol.	^{12}C	3.000	A	0.32900	76.9	2.50
C/POCO	^{12}C	3.000	0	0.44300	70.9	2.00

Calculated Data

Target	Projectile	Energy	Symbol	y(0)	a	f
C	^{12}C	3.000	A	0.24900	79.2	2.90

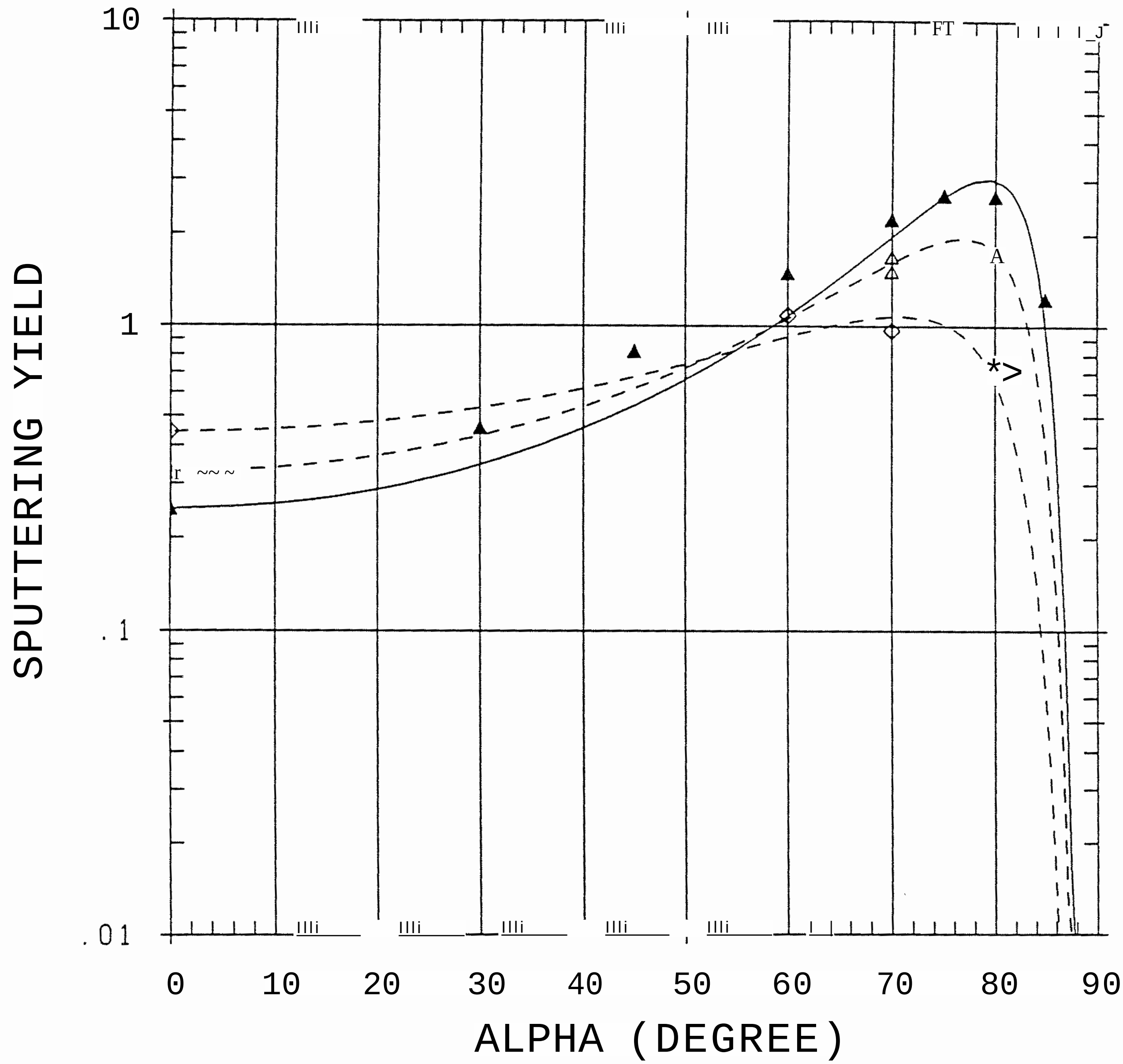


Fig. 92: Angular dependence of the sputtering yield of graphite with different degrees of surface roughness for 3 keV C ions. The roughness increases from polished pyrolytic graphite to POCO graphite. The data are published in [70].

Experimental Data

Target •	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
C/UCI pol.	^{12}C	3.000	0	0.32900	20	1	X	129	27.11.1989
C/UCI pol.	^{12}C	3.000	70	1.70000	20	1	X	130	29.11.1989
C/UCI pol.	^{12}C	3.000	70	1.52000	20	1	X	182	24.04.1990
C/UCI pol.	^{12}C	3.000	80	1.78000	20	1	X	130	28.11.1989

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
C/POCO	^{12}C	3.000	0	0.44300	20	1	X	129	24.11.1989
C/POCO	^{12}C	3.000	60	1.08000	20	1	X	129	24.11.1989
C/POCO	^{12}C	3.000	70	0.96710	20	1	X	128	23.11.1989
C/POCO	^{12}C	3.000	80	0.68000	20	1	X	128	23.11.1989

Calculated Data

Target	Proj.	Energy	Angle	Yield	Temp.	P	SBE
C	^{12}C	3.000	0	0.24900	20	2.000	7.400
C	^{12}C	3.000	30	0.45890	20	2.000	7.400
C	^{12}C	3.000	45	0.82290	20	2.000	7.400
C	^{12}C	3.000	60	1.49800	20	2.000	7.400
C	^{12}C	3.000	70	2.25000	20	2.000	7.400
C	^{12}C	3.000	75	2.68300	20	2.000	7.400
C	^{12}C	3.000	80	2.67800	20	2.000	7.400
C	^{12}C	3.000	85	1.23300	20	2.000	7.400

Projectile: Xe

Calculated Data

Target	Projectile	Energy	Symbol	y(0)	*a*	*f*
C	Xe	0:200	■	0.00041	71.5	14.61
C	Xe	0.500	♦	0.02880	73.0	8.16

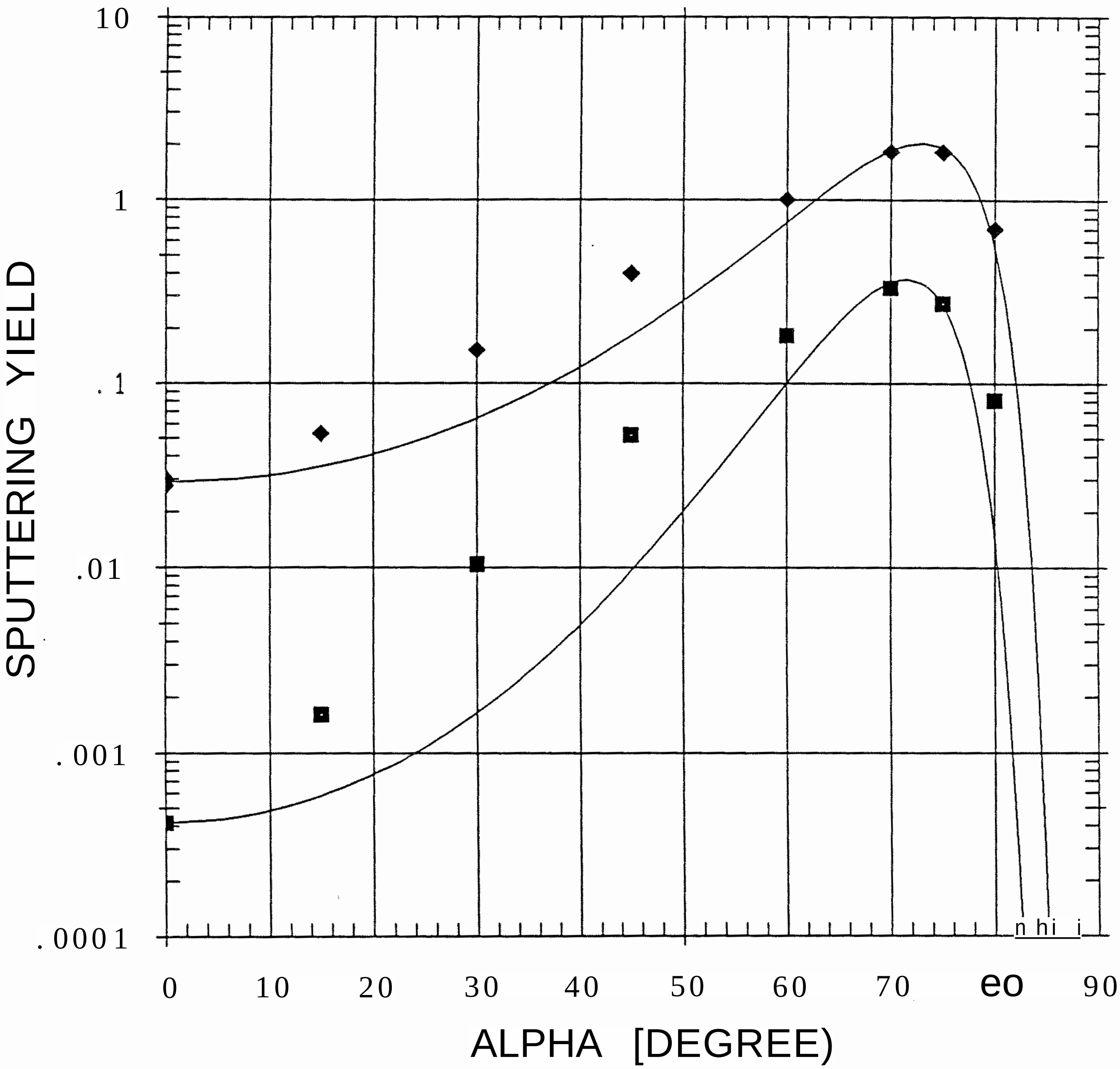


Fig. 93: Angular dependence of the sputtering yield of C with 200 and 500 eV Xe ions. The scale of the y-axis of this plot is different from all other angular dependence plots. The data are unpublished.

Calculated Data

Target	Proj.	Energy	Angle	Yield	Temp.	P	SBE
C	Xe	0.200	0	0.00041	20	2.260	7.420
C	Xe	0.200	15	0.00161	20	2.260	7.420
C	Xe	0.200	30	0.01040	20	2.260	7.420
C	Xe	0.200	45	0.05210	20	2.260	7.420
C	Xe	0.200	60	0.18290	20	2.260	7.420
C	Xe	0.200	70	0.33260	20	2.260	7.420
C	Xe	0.200	75	0.27400	20	2.260	7.420
C	Xe	0.200	80	0.08120	20	2.260	7.420

Target	Proj.	Energy	Angle	Yield	Temp.	P	SBE
C	Xe	0.500	0	0.03000	20	2.260	7.420
C	Xe	0.500	0	0.02760	20	2.260	7.420
C	Xe	0.500	15	0.05310	20	2.260	7.420
C	Xe	0.500	30	0.15200	20	2.260	7.420
C	Xe	0.500	45	0.39900	20	2.260	7.420
C	Xe	0.500	60	1.00300	20	2.260	7.420
C	Xe	0.500	70	1.82500	20	2.260	7.420
C	Xe	0.500	75	1.82000	20	2.260	7.420
C	Xe	0.500	80	0.69720	20	2.260	7.420

Calculated Data

Target	Projectile	Energy	Symbol	y(0)	a	f
C	Xe	1.000	■	0.12750	74.4	5.87
C	Xe	3.000	♦	0.46600	77.2	3.97
C	Xe	10.000	•	1.02000	80.0	2.99

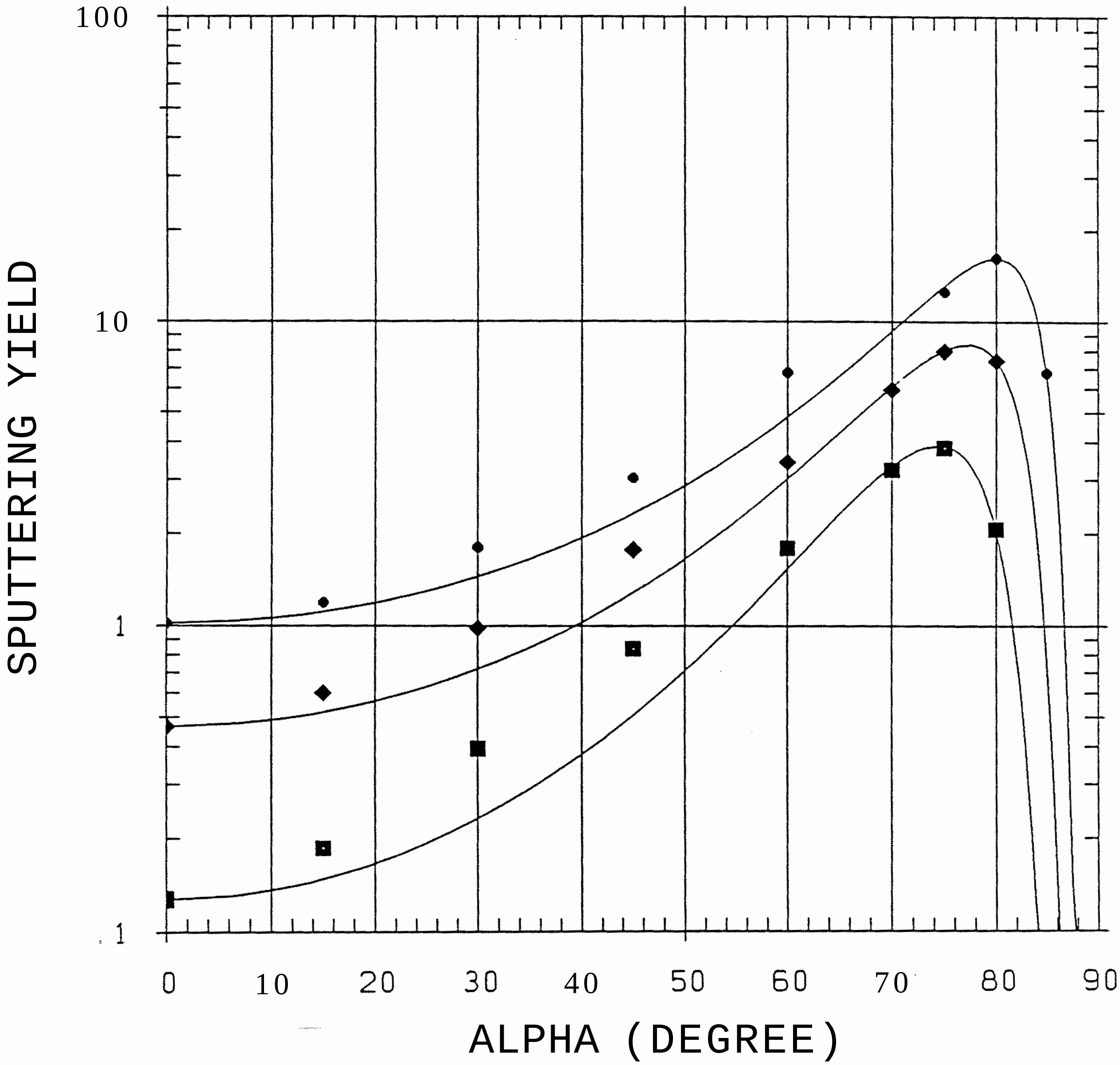


Fig. 94: Angular dependence of the sputtering yield of C with 1, 3 and 10 keV Xe ions. The data are unpublished.

Calculated Data

Target	Proj.	Energy	Angle	Yield	Temp.	P	SBE
C	Xe	1.000	0	0.12800	20	2.260	7.420
C	Xe	1.000	0	0.12700	20	2.260	7.420
C	Xe	1.000	15	0.18600	20	2.260	7.420
C	Xe	1.000	30	0.39300	20	2.260	7.420
C	Xe	1.000	45	0.83900	20	2.260	7.420
C	Xe	1.000	60	1.79400	20	2.260	7.420
C	Xe	1.000	70	3.23400	20	2.260	7.420
C	Xe	1.000	75	3.82000	20	2.260	7.420
C	Xe	1.000	80	2.07000	20	2.260	7.420

Target	Proj.	Energy	Angle	Yield	Temp.	P	SBE
C	Xe	3.000	0	0.46600	20	2.260	7.420
C	Xe	3.000	15	0.60000	20	2.260	7.420
C	Xe	3.000	30	0.98100	20	2.260	7.420
C	Xe	3.000	45	1.77000	20	2.260	7.420
C	Xe	3.000	60	3.42600	20	2.260	7.420
C	Xe	3.000	70	5.92400	20	2.260	7.420
C	Xe	3.000	75	7.98000	20	2.260	7.420
C	Xe	3.000	80	7.42000	20	2.260	7.420

Target	Proj.	Energy	Angle	Yield	Temp.	ρ	SEE
C	Xe	10.000	0	1.02000	20	2.260	7.420
C	Xe	10.000	15	1.19000	20	2.260	7.420
C	Xe	10.000	30	1.80000	20	2.260	7.420
C	Xe	10.000	45	3.04000	20	2.260	7.420
C	Xe	10.000	60	6.77300	20	2.260	7.420
C	Xe	10.000	75	12.50000	20	2.260	7.420
C	Xe	10.000	80	16.20000	20	2.260	7.420
C	Xe	10.000	85	6.77300	20	2.260	7.420

Experimental Data

Target	Projectile	Energy	Symbol	y(0)	a	f
~Cu	*H*	50.000	□	0.00603	8E8	L54

Calculated Data

Target	Projectile	Energy	Symbol	y(0)	a	f
Tu	H	50.000	i	0.00301	8E8	L82

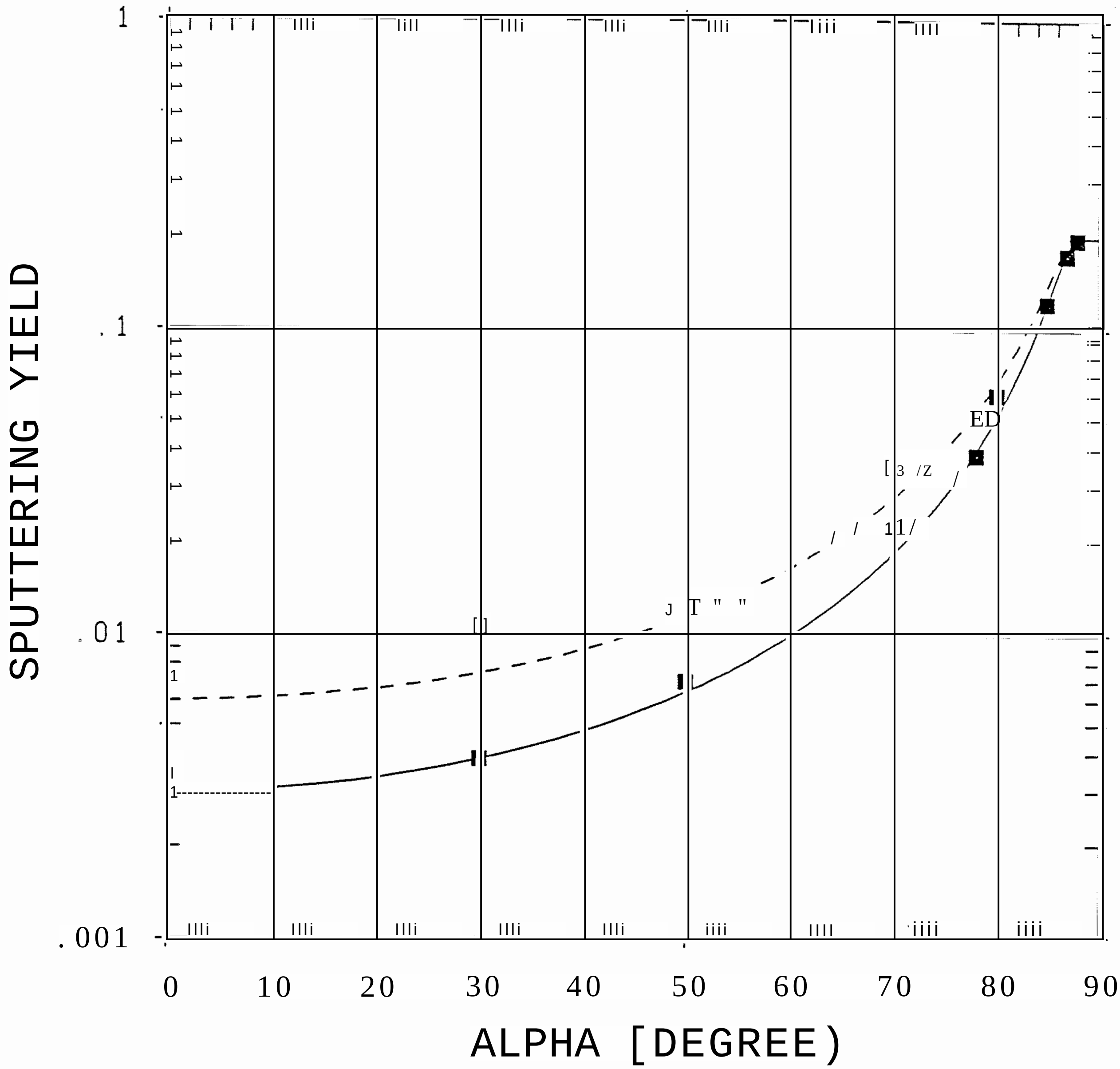


Fig. 95: Angular dependence of the sputtering yield of Cu with 50 keV H ions. The value of a_{opt} for the experimental data was taken from the calculated data for fitting. The data are published in [48].

Experimental Data

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
Cu	H	50.000	0	0.00350	20	1			PHARAO73
Cu	H	50.000	0	0.00730	20	1			PHARAO73
Cu	H	50.000	30	0.01090	20	1			PHARAO82
Cu	H	50.000	50	0.01230	20	1			PHARAO82
Cu	H	50.000	70	0.03610	20	1			PHARAO82
Cu	H	50.000	78	0.05110	20	1			PHARAO82

Calculated Data

Target	Proj.	Energy	Angle	Yield	Temp.	*P*	SBE
Cu	H	50.000	0	0.00301	20	8.950	3.520
Cu	H	50.000	30	0.00387	20	8.950	3.520
Cu	H	50.000	50	0.00702	20	8.950	3.520
Cu	H	50.000	70	0.02270	20	8.950	3.520
Cu	H	50.000	78	0.03870	20	8.950	3.520
Cu	H	50.000	80	0.06120	20	8.950	3.520
Cu	H	50.000	85	0.12200	20	8.950	3.520
Cu	H	50.000	87	0.17500	20	8.950	3.520
Cu	H	50.000	88	0.19700	20	8.950	3.520
Cu	H	50.000	89	0.09740	20	8.950	3.520

Experimental Data

Target	Projectile	Energy	Symbol	y(0)	*Q*	f
Cu	D	0.050	□	0.00187	71.1	1.51
Cu	D	0.100	0	0.01490	76.4	0.95
Cu	D	0.300	o	0.05640	72.2	1.20

Calculated Data

Target	Projectile	Energy	Symbol	y(0)	*a*	f
Cu	D	0.050	■	0.00147	0.0	1.85
Cu	D	0.100	♦	0.01640	47.8	1.08
Cu	D	0.300	•	0.04340	73.0	1.97

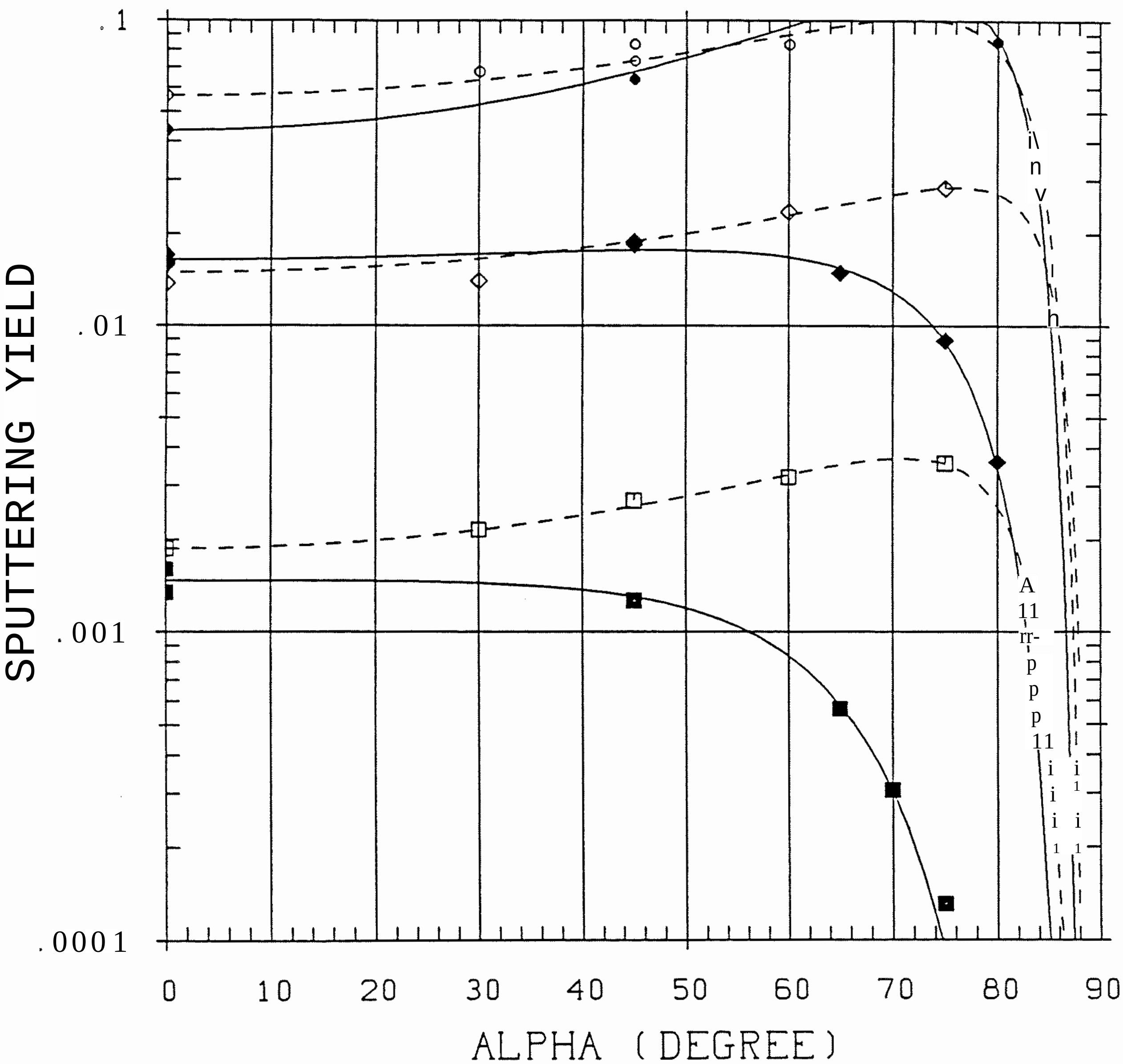


Fig. 9G: Angular dependence of the sputtering yield of Cu with 50 , 100 and 300 eV D ions. The data are partly published in [121.

Experimental Data

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
Cu	D	0.050	0	0.00187	20	3	IX	159	02.05.88
Cu	D	0.050	30	0.00216	20	3	IX	160	10.05.88
Cu	D	0.050	45	0.00269	20	3	IX	159	03.05.88
Cu	D	0.050	60	0.00321	20	3	IX	160	05.05.88
Cu	D	0.050	75	0.00356	20	3	IX	160	09.05.88

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
Cu	D	0.100	0	0.01610	20	3	VIII	127	17.02.86
Cu	D	0.100	0	0.01370	20	3	VIII	183	25.08.86
Cu	D	0.100	30	0.01400	20	3	IX	11	25.09.86
Cu	D	0.100	45	0.01880	20	3	VIII	184	27.08.86
Cu	D	0.100	60	0.02360	20	3	VIII	184	27.08.86
Cu	D	0.100	75	0.02830	20	3	VIII	184	26.08.86

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
Cu	D	0.300	0	0.05640	20	3	IX	134	26.01.88
Cu	D	0.300	30	0.06760	20	3	IX	134	27.01.88
Cu	D	0.300	45	0.08330	20	3	IX	135	01.02.88
Cu	D	0.300	45	0.07330	20	3	IX	135	02.02.88
Cu	D	0.300	60	0.08340	20	3	IX	135	02.02.88
Cu	D	0.300	75	0.10100	20	3	IX	134	26.01.88

Calculated Data

Target	Proj.	Energy	Angle	Yield	Temp.	ρ	SBE
Cu	D	0.050	0	0.00160	20	8.950	3.520
Cu	D	0.050	0	0.00134	20	8.950	3.520
Cu	D	0.050	45	0.00126	20	8.950	3.520
Cu	D	0.050	65	0.00056	20	8.950	3.520
Cu	D	0.050	70	0.00031	20	8.950	3.520
Cu	D	0.050	75	0.00013	20	8.950	3.520
Cu	D	0.050	80	0.00004	20	8.950	3.520

Target	Proj.	Energy	Angle	Yield	Temp.	ρ	SBE
Cu	D	0.100	0	0.01700	20	8.950	3.520
Cu	D	0.100	0	0.01580	20	8.950	3.520
Cu	D	0.100	45	0.01840	20	8.950	3.520
Cu	D	0.100	65	0.01490	20	8.950	3.520
Cu	D	0.100	75	0.00895	20	8.950	3.520
Cu	D	0.100	80	0.00360	20	8.950	3.520

Target	Proj.	Energy	Angle	Yield	Temp.	ρ	SBE
Cu	D	0.300	0	0.04340	20	8.950	3.520
Cu	D	0.300	45	0.06390	20	8.950	3.520
Cu	D	0.300	65	0.10500	20	8.950	3.520
Cu	D	0.300	75	0.12400	20	8.950	3.520
Cu	D	0.300	80	0.08550	20	8.950.	3.520

Experimental Data

Target	Projectile	Energy	Symbol	y(o)	*a*	f
Cu	D	1.000	□	0.08800	78.2	1.15
Cu	D	3.000	0	0.07680	82.3	1.18

Calculated Data

Target	Projectile	Energy	Symbol	y(0)	*a*	f
Cu	D	1.000	■	0.05390	78.2	2.01
Cu	D	3.000	♦	0.03930	82.3	1.96
Cu	D	10.000	•	0.02470	85.3	1.80

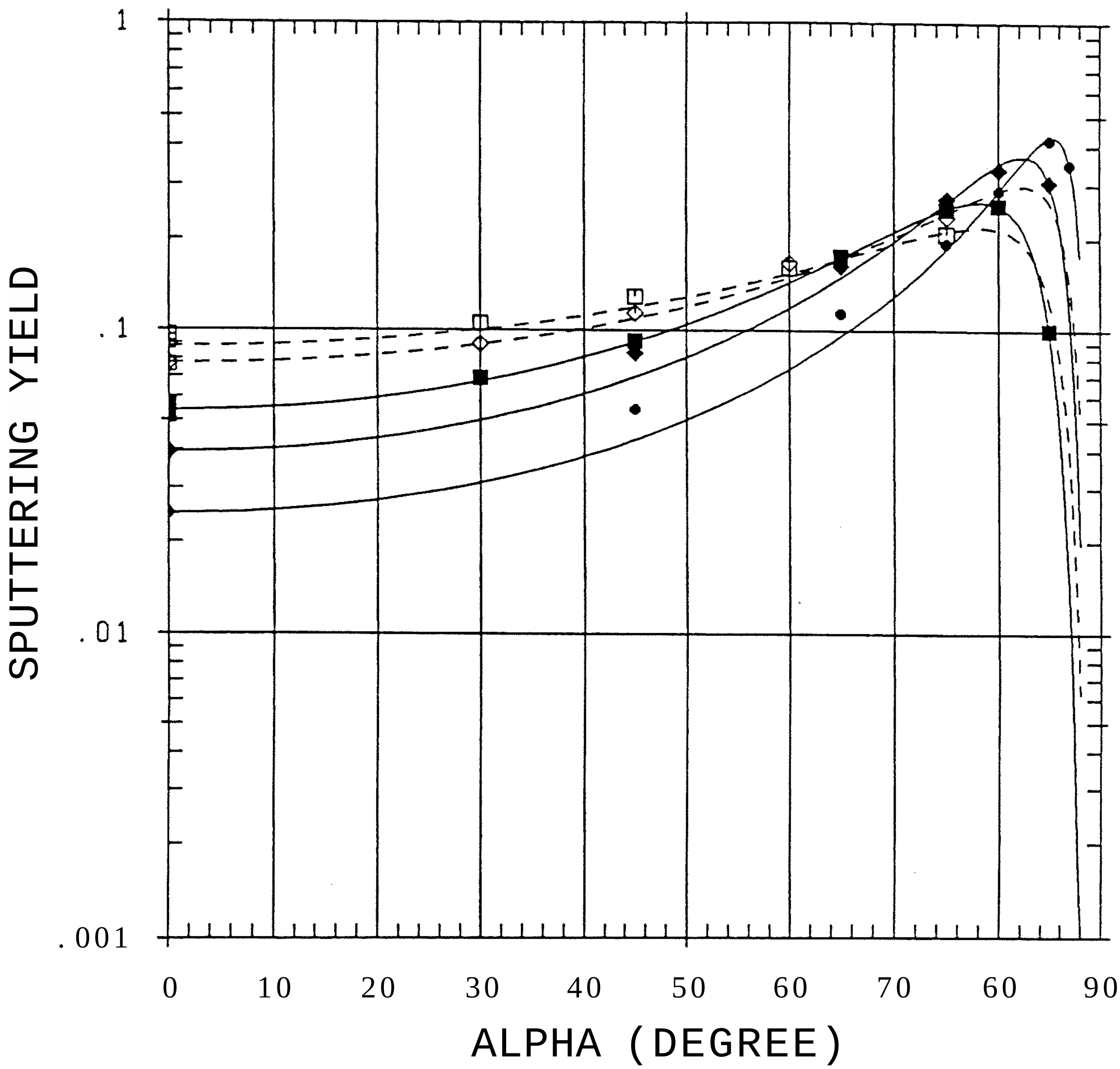


Fig. 97: Angular dependence of the sputtering yield of Cu with 1 , 3 and 10 keV D ions. The value of o_{op}t for the experimental data was taken from the calculated data for fitting. The data are unpublished.

Experimental Data

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
~Cu	D~	1.000	0	0.07640	100	~3	IV	157	18.02.80
Cu	D	1.000	0	0.09660	20	3	VIII	127	17.02.86
Cu	D	1.000	0	0.09100	20	3	VIII	183	26.08.86
Cu	D	1.000	30	0.10500	20	3	IX	132	22.01.88
Cu	D	1.000	45	0.12900	20	3	IX	133	26.01.88
Cu	D	1.000	60	0.16100	20	3	IX	133	26.01.88
Cu	D	1.000	75	0.20800	20	3	IX	133	26.01.88

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
Cu	D	3.000	0	0.07680	20	2	VIII	~183	26.08.80
Cu	D	3.000	30	0.08910	20	2	IX	131	21.01.88
Cu	D	3.000	45	0.11300	20	2	IX	131	21.01.88
Cu	D	3.000	60	0.16600	20	2	IX	132	21.01.88
Cu	D	3.000	75	0.23400	20	2	IX	132	21.01.88

Calculated Data

Target	Proj.	Energy	Angle	Yield	Temp.	P	SBE
Cu	D	1.000	0	0.05600	20	8.950	3.520
Cu	D	1.000	0	0.05180	20	8.950	3.520
Cu	D	1.000	30	0.06930	20	8.950	3.520
Cu	D	1.000	45	0.09190	20	8.950	3.520
Cu	D	1.000	65	0.17500	20	8.950	3.520
Cu	D	1.000	75	0.25000	20	8.950	3.520
Cu	D	1.000	80	0.25800	20	8.950	3.520
Cu	D	1.000	85	0.09995	20	8.950	3.520

Target	Proj.	Energy	Angle	Yield	Temp.	p	SBE
Cu	D	3.000	0	0.03930	20	8.950	3.520
Cu	D	3.000	45	0.08350	20	8.950	3.520
Cu	D	3.000	65	0.16200	20	8.950	3.520
Cu	D	3.000	75	0.26700	20	8.950	3.520
Cu	D	3.000	80	0.33400	20	8.950	3.520
Cu	D	3.000	85	0.30350	20	8.950	3.520

Target	Proj.	Energy	Angle	Yield	Temp.	p	SBE
Cu	D	10.000	0	0.02470	20	8.950	3.520
Cu	D	10.000	45	0.05450	20	8.950	3.520
Cu	D	10.000	65	0.11300	20	8.950	3.520
Cu	D	10.000	75	0.19200	20	8.950	3.520
Cu	D	10.000	80	0.28500	20	8.950	3.520
Cu	D	10.000	85	0.41580	20	8.950	3.520
Cu	D	10.000	87	0.34670	20	8.950	3.520

Calculated Data

Target	Projectile	Energy	Symbol	y(0)	*a*	f
Cu	Ar	0.020	■	0.00018	61.9	17.40
Cu	Ar	0.050	♦	0.03958	57.0	9.90
Cu	Ar	0.300	•	1.04550	55.5	3.30

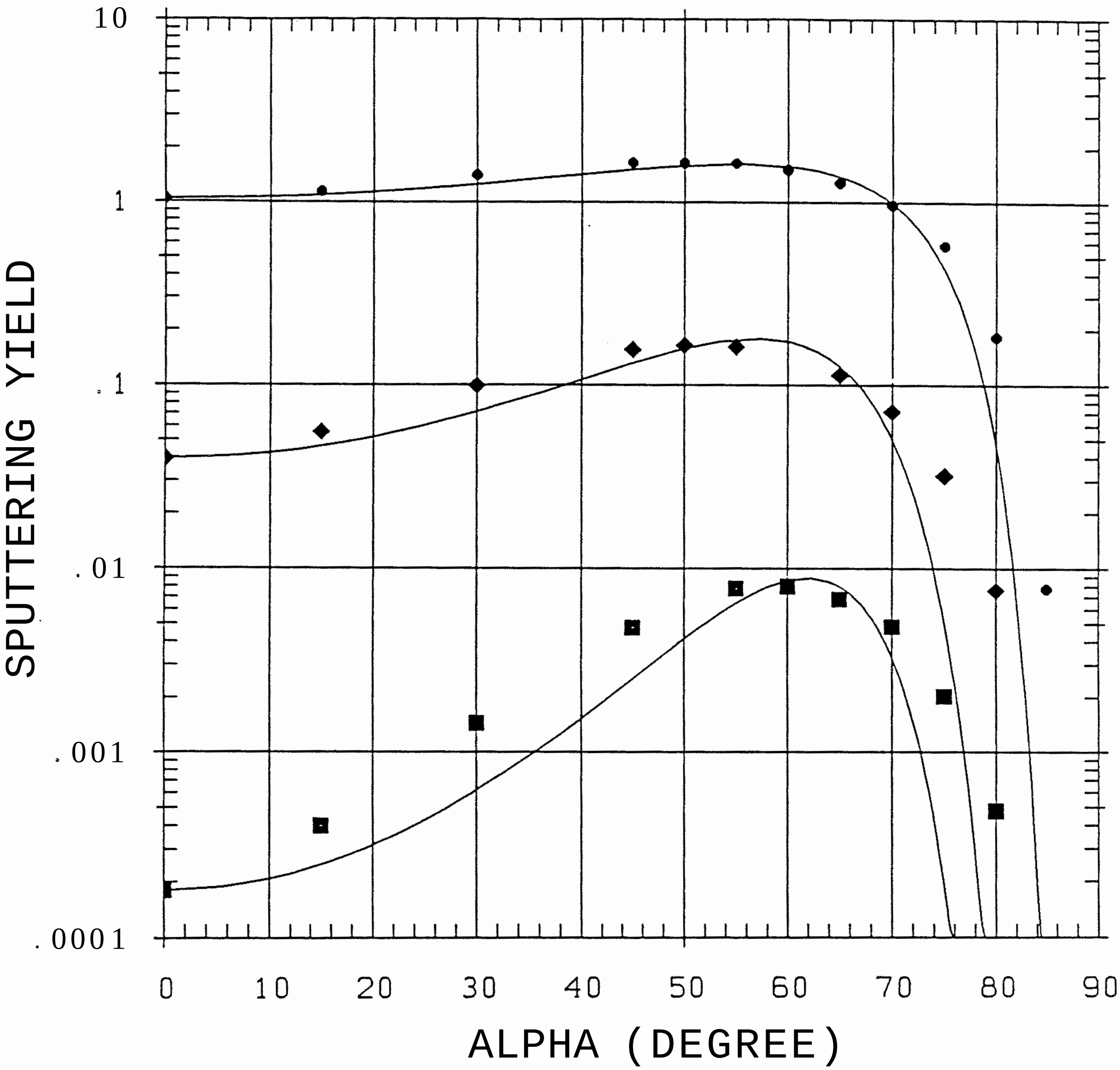


Fig. 98: Angular dependence of the sputtering yield of Cu with 20 , 50 and 300 eV Ar ions. The data are unpublished.

Calculated Data

Target .	Proj.	Energy	Angle	Yield	Temp.	*P*	SEE
Cu	Ar	0.020	0	0.00018	20	8.950	3.520
Cu	Ar	0.020	15	0.00040	20	8.950	3.520
Cu	Ar	0.020	30	0.00144	20	8.950	3.520
Cu	Ar	0.020	45	0.00477	20	8.950	3.520
Cu	Ar	0.020	55	0.00779	20	8.950	3.520
Cu	Ar	0.020	60	0.00798	20	8.950	3.520
Cu	Ar	0.020	65	0.00680	20	8.950	3.520
Cu	Ar	0.020	70	0.00482	20	8.950	3.520
Cu	Ar	0.020	75	0.00203	20	8.950	3.520
Cu	Ar	0.020	80	0.00048	20	8.950	3.520

Target	Proj.	Energy	Angle	Yield	Temp.	*P*	SBE
Cu	Ar	0.050	0	0.03980	20	8.950	3.520
Cu	Ar	0.050	0	0.03937	20	8.950	3.520
Cu	Ar	0.050	15	0.05544	20	8.950	3.520
Cu	Ar	0.050	30	0.09908	20	8.950	3.520
Cu	Ar	0.050	45	0.15540	20	8.950	3.520
Cu	Ar	0.050	50	0.16450	20	8.950	3.520
Cu	Ar	0.050	55	0.16120	20	8.950	3.520
Cu	Ar	0.050	65	0.11340	20	8.950	3.520
Cu	Ar	0.050	70	0.07143	20	8.950	3.520
Cu	Ar	0.050	75	0.03207	20	8.950	3.520
Cu	Ar	0.050	80	0.00762	20	8.950	3.520

Target	Proj.	Energy	Angle	Yield	Temp.	*P*	SBE
Cu	Ar	0.300	0	1.05000	20	8.950	3.520
Cu	Ar	0.300	0	1.04100	20	8.950	3.520
Cu	Ar	0.300	15	1.14800	20	8.950	3.520
Cu	Ar	0.300	30	1.41400	20	8.950	3.520
Cu	Ar	0.300	45	1.65600	20	8.950	3.520
Cu	Ar	0.300	50	1.65000	20	8.950	3.520
Cu	Ar	0.300	55	1.64200	20	8.950	3.520
Cu	Ar	0.300	60	1.51500	20	8.950	3.520
Cu	Ar	0.300	65	1.28400	20	8.950	3.520
Cu	Ar	0.300	70	0.96740	20	8.950	3.520
Cu	Ar	0.300	75	0.57620	20	8.950	3.520
Cu	Ar	0.300	80	0.18310	20	8.950	3.520
Cu	Ar	0.300	85	0.00776	20	8.950	3.520

Projectile: Cu

Calculated Data

Target	Projectile	Energy	Symbol	y(o)	a	f
Cu	Cu	0.020	■	0.00019	75.0	8.10
Cu	Cu	0'.050	♦	0.02452	65.8	7.50
Cu	Cu	0.100	•	0.19250	61.0	5.40
Cu	Cu	0.300	A	0.94720	59.9	3.10

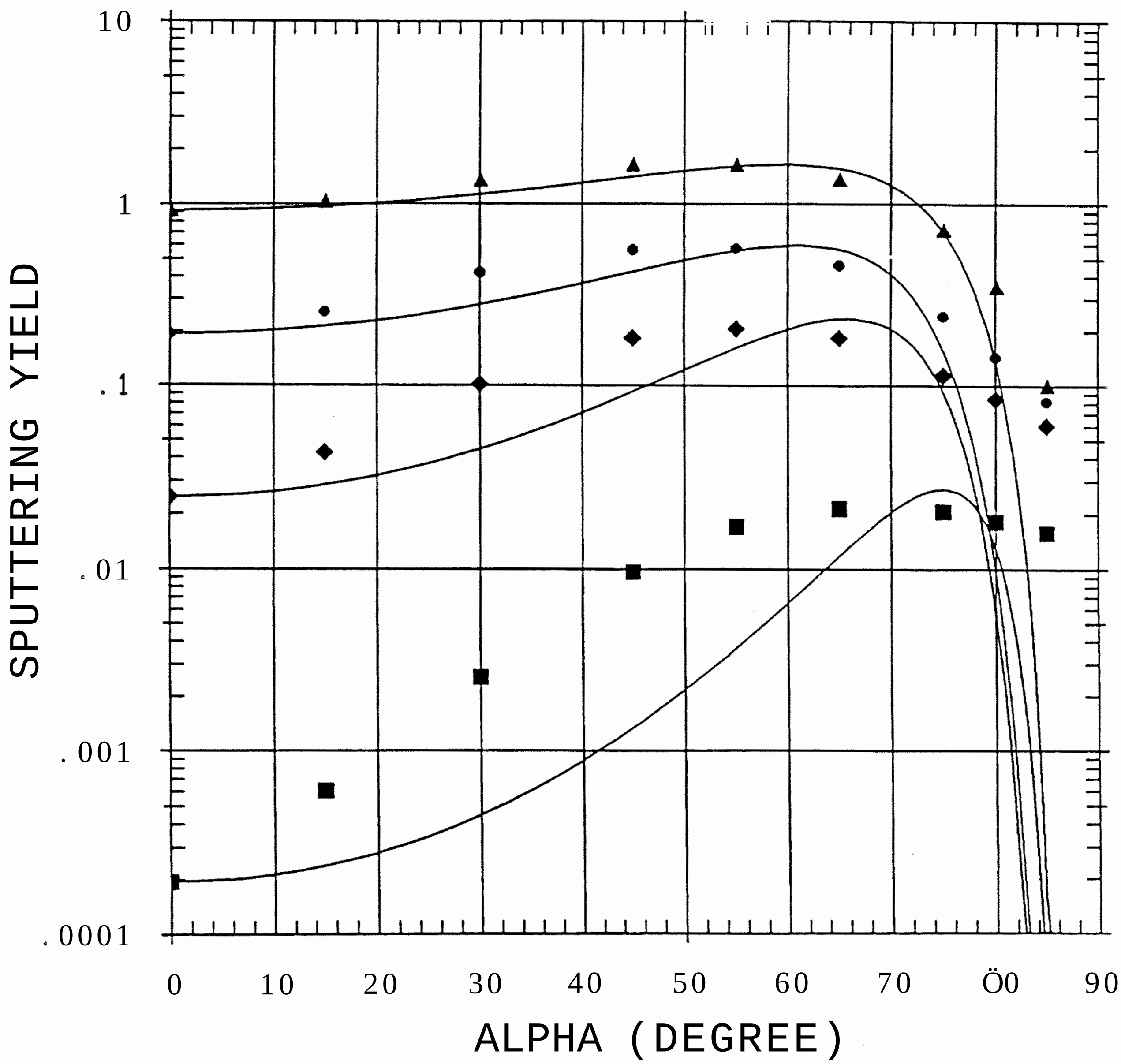


Fig. 99: Angular dependence of the sputtering yield of Cu with 20 , 50 , 100 and 300 eV Cu ions. The data are unpublished.

Calculated Data

Target	Proj.	Energy	Angle	Yield	Temp.	*P*	SBE
Cu	Cu	0.020	0	0.00019	20	8.950	3.520
Cu	Cu	0.020	15	0.00061	20	8.950	3.520
Cu	Cu	0.020	30	0.00254	20	8.950	3.520
Cu	Cu	0.020	45	0.00963	20	8.950	3.520
Cu	Cu	0.020	55	0.01706	20	8.950	3.520
Cu	Cu	0.020	65	0.02130	20	8.950	3.520
Cu	Cu	0.020	75	0.02060	20	8.950	3.520
Cu	Cu	0.020	80	0.01820	20	8.950	3.520
Cu	Cu	0.020	85	0.01580	20	8.950	3.520

Target	Proj.	Energy	Angle	Yield	Temp.	*P*	SBE
Cu	Cu	0.050	0	0.02452	20	8.950	3.520
Cu	Cu	0.050	15	0.04280	20	8.950	3.520
Cu	Cu	0.050	30	0.10200	20	8.950	3.520
Cu	Cu	0.050	45	0.18300	20	8.950	3.520
Cu	Cu	0.050	55	0.20600	20	8.950	3.520
Cu	Cu	0.050	65	0.18300	20	8.950	3.520
Cu	Cu	0.050	75	0.11410	20	8.950	3.520
Cu	Cu	0.050	80	0.08450	20	8.950	3.520
Cu	Cu	0.050	85	0.06040	20	8.950	3.520

Target	Proj.	Energy	Angle	Yield	Temp.	*P*	SBE
Cu	Cu	0.100	0	0.19250	20	8.950	3.520
Cu	Cu	0.100	15	0.25500	20	8.950	3.520
Cu	Cu	0.100	30	0.41900	20	8.950	3.520
Cu	Cu	0.100	45	0.56000	20	8.950	3.520
Cu	Cu	0.100	55	0.56880	20	8.950	3.520
Cu	Cu	0.100	65	0.46000	20	8.950	3.520
Cu	Cu	0.100	75	0.24160	20	8.950	3.520
Cu	Cu	0.100	80	0.14400	20	8.950	3.520
Cu	Cu	0.100	85	0.08220	20	8.950	3.520

Target	Proj.	Energy	Angle	Yield	Temp.	*P*	SBE
Cu	Cu	0.300	0	0.94720	20	8.950	3.520
Cu	Cu	0.300	15	1.07000	20	8.950	3.520
Cu	Cu	0.300	30	1.40000	20	8.950	3.520
Cu	Cu	0.300	45	1.70600	20	8.950	3.520
Cu	Cu	0.300	55	1.70500	20	8.950	3.520
Cu	Cu	0.300	65	1.43000	20	8.950	3.520
Cu	Cu	0.300	75	0.76390	20	8.950	3.520
Cu	Cu	0.300	80	0.37200	20	8.950	3.520
Cu	Cu	0.300	85	0.10700	20	8.950	3.520
Cu	Cu	0.300	85	0.10700	20	8.950	3.520

Calculated Data

Target	Projectile	Energy	Symbol	y(0)	a	f
Cu	Cu	1.000	■	2.40000	63.0	2.46
Cu	Cu	3.000	♦	3.80000	69.0	2.24
Cu	Cu	10.000	•	5.14000	74.0	2.10
Cu	Cu	100.000	A	4.66000	82.2	1.75

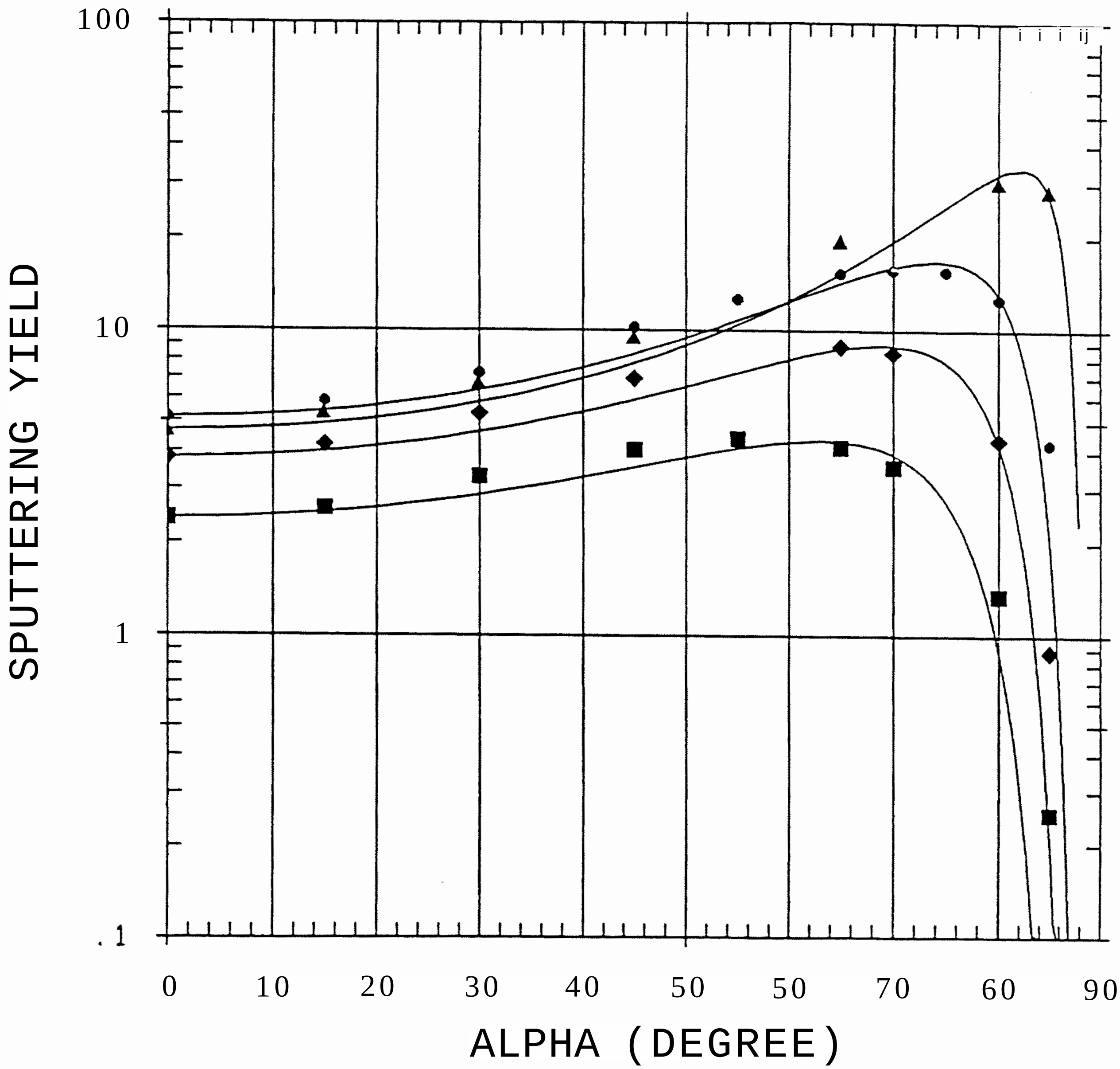


Fig. 100: Angular dependence of the sputtering yield of Cu with 1 ,3 , 10 and 100 keV Cu ions. The data are unpublished.

Calculated Data

Target	Proj.	Energy	Angle	Yield	Temp.	P	SEE
Cu	Cu	1.000	0	2.40000	20	8.950	3.520
Cu	Cu	1.000	15	2.59000	20	8.950	3.520
Cu	Cu	1.000	30	3.30000	20	8.950	3.520
Cu	Cu	1.000	45	4.06000	20	8.950	3.520
Cu	Cu	1.000	55	4.42400	20	8.950	3.520
Cu	Cu	1.000	65	4.14000	20	8.950	3.520
Cu	Cu	1.000	70	3.56400	20	8.950	3.520
Cu	Cu	1.000	80	1.35000	20	8.950	3.520
Cu	Cu	1.000	85	0.25400	20	8.950	3.520
Cu	Cu	1.000	85	0.25400	20	8.950	3.520

Target	Proj.	Energy	Angle	Yield	Temp.	P	SEE
Cu	Cu	3.000	0	3.80000	20	8.950	3.520
Cu	Cu	3.000	15	4.21000	20	8.950	3.520
Cu	Cu	3.000	30	5.33000	20	8.950	3.520
Cu	Cu	3.000	45	6.96000	20	8.950	3.520
Cu	Cu	3.000	65	8.86000	20	8.950	3.520
Cu	Cu	3.000	70	8.46400	20	8.950	3.520
Cu	Cu	3.000	80	4.38000	20	8.950	3.520
Cu	Cu	3.000	85	0.88400	20	8.950	3.520

Target	Proj.	Energy	Angle	Yield	Temp.	P	SBE
Cu	Cu	10.000	0	5.14000	20	8.950	3.520
Cu	Cu	10.000	15	5.84000	20	8.950	3.520
Cu	Cu	10.000	30	7.24000	20	8.950	3.520
Cu	Cu	10.000	45	10.20000	20	8.950	3.520
Cu	Cu	10.000	55	12.59000	20	8.950	3.520
Cu	Cu	10.000	65	15.30000	20	8.950	3.520
Cu	Cu	10.000	70	15.72000	20	8.950	3.520
Cu	Cu	10.000	75	15.56000	20	8.950	3.520
Cu	Cu	10.000	80	12.60000	20	8.950	3.520
Cu	Cu	10.000	85	4.25000	20	8.950	3.520

Target	Proj.	Energy	Angle	Yield	Temp.	P	SBE
Cu	Cu	100.000	0	4.66000	20	8.950	3.520
Cu	Cu	100.000	15	5.35000	20	8.950	3.520
Cu	Cu	100.000	30	6.71000	20	8.950	3.520
Cu	Cu	100.000	45	9.45000	20	8.950	3.520
Cu	Cu	100.000	65	19.50000	20	8.950	3.520
Cu	Cu	100.000	80	30.30000	20	8.950	3.520
Cu	Cu	100.000	85	28.50000	20	8.950	3.520

Experimental Data

Target	Projectile	Energy	Symbol	y(0)	a	f
~~Fe	H	4.000	□	0.01377	EG	L82
Fe	H	8.000	0	0.00734	83.0	2.00

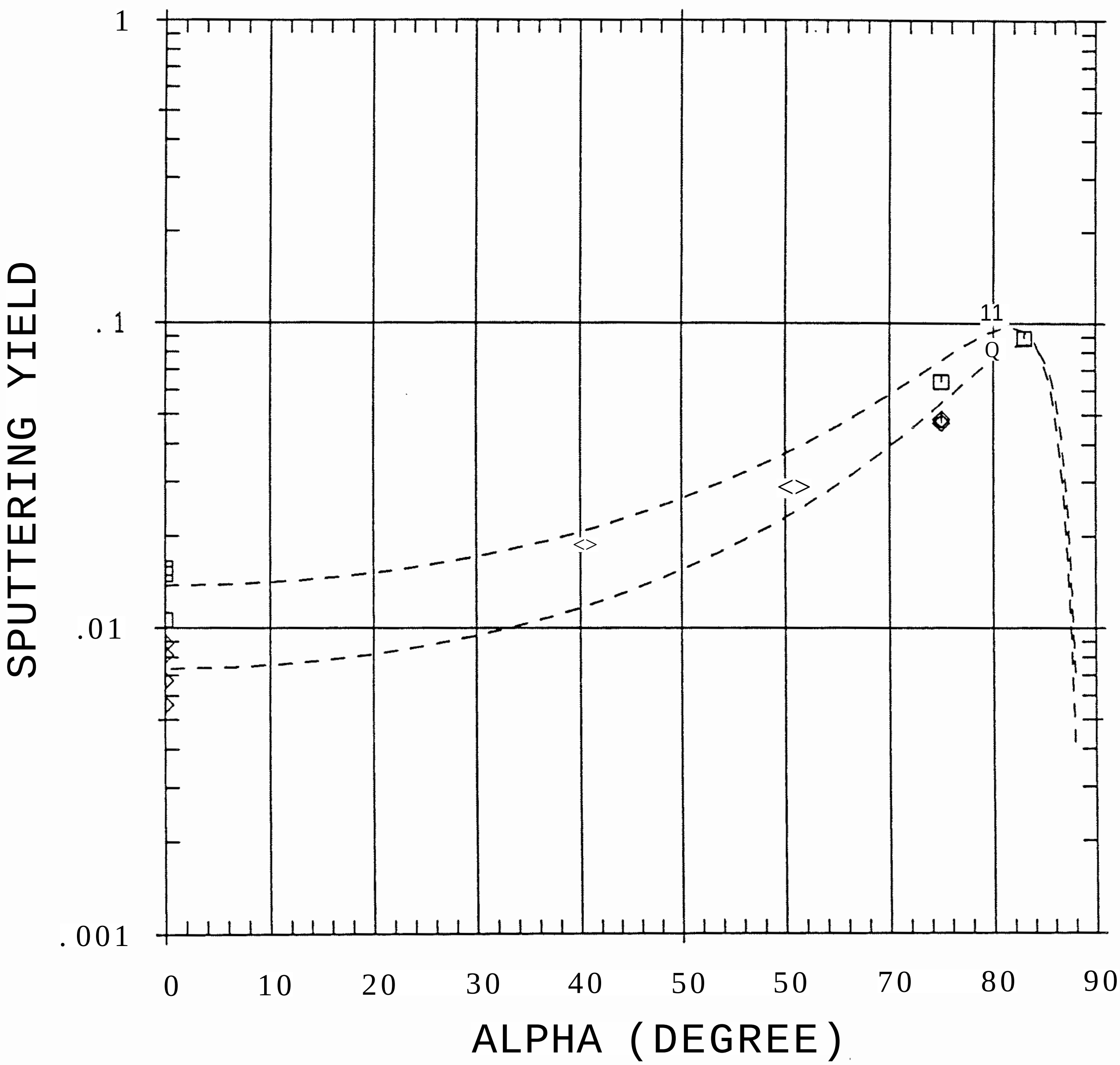


Fig. 101: Angular dependence of the sputtering yield of Fe with 4 and 8 keV H ions. The data are unpublished.

Experimental Data

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
£	a	4.000	0	0.01060	20	2			LIF1979
2	a	4.000	0	0.01500	20	2			LIF1979
Fe	a	4.000	0	0.01570	20	2			LIF1979
Fe	a	4.000	75	0.06400	155	2	IV	5	11.04.79
Fe	a	4.000	80	0.10650	120	2	IV	10	27.04.79
2	a	4.000	83	0.08900	120	2	IV	10	27.04.79

Ha:gS	a2j.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
££££££££	M	8.000	0	0.00672	280	1	III	184	14.03.79
	W	8.000	0	0.00560	20	1			LIF1979
	K	8.000	0	0.00890	20	1			LIF1979
	K	8.000	0	0.00815	20	1			LIF1979
	W	8.000	40	0.01860	20	1	IV	81	16.07.79
	K	8.000	60	0.02820	20	1	IV	97	19.07.79
	K	8.000	75	0.04700	120	1	IV	5	10.04.79
	K	8.000	75	0.04830	20	1	IV	100	26.07.79
	W	8.000	80	0.08370	130	1	IV	10	27.04.79

Calculated Data

Target	Projectile	Energy	Symbol	y(0)	*a*	f
Ga	Ga	0.100	■	0.23700	61.1	6.37
Ga	Ga	0.150	♦	0.44300	60.4	5.44
Ga	Ga	0.200	•	0.63300	61.6	4.39

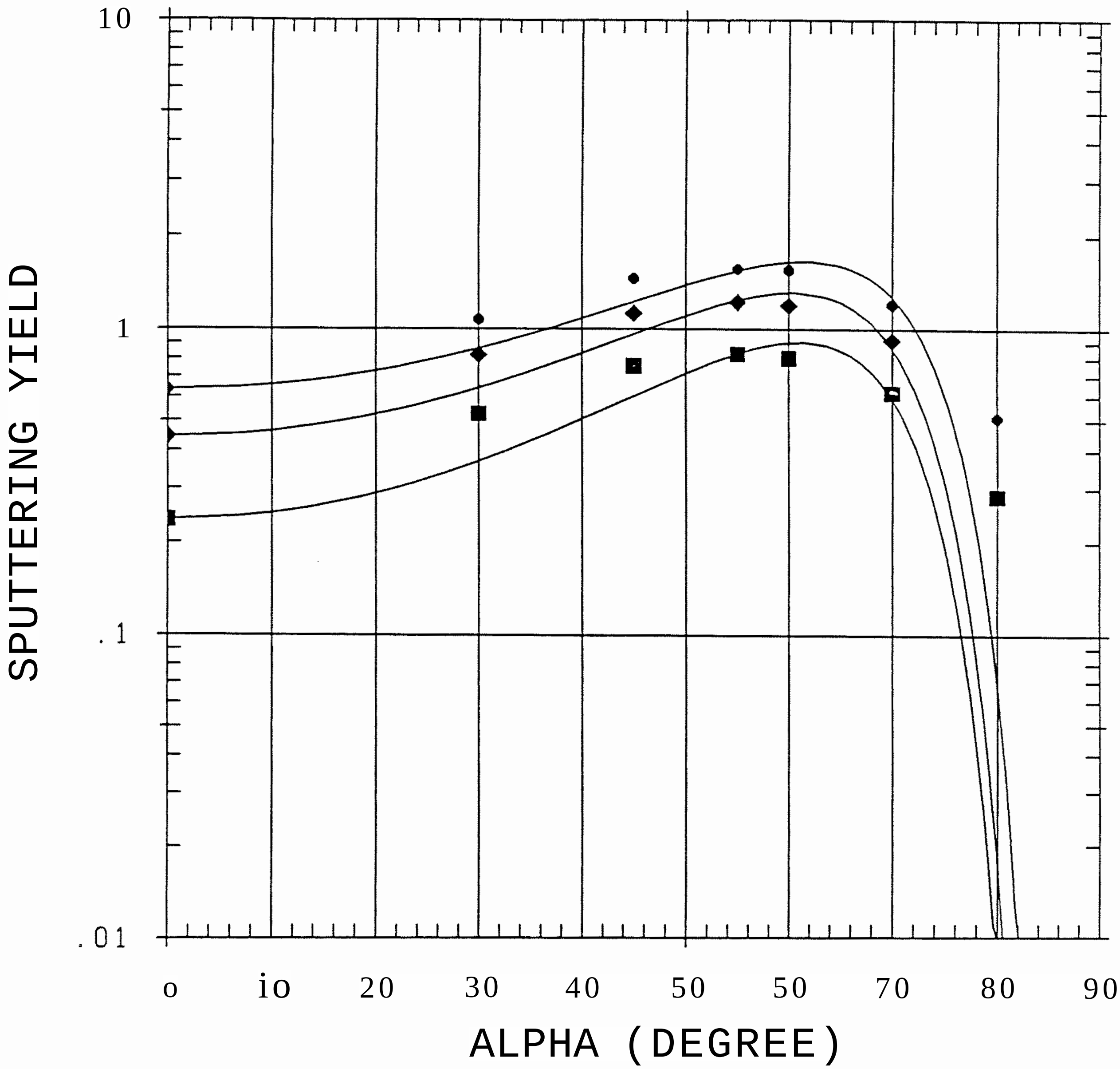


Fig. 102: Angular dependence of the sputtering yield of Ga with 100 , 150 and 200 eV Ga ions. The data are partly published in [52].

Calculated Data

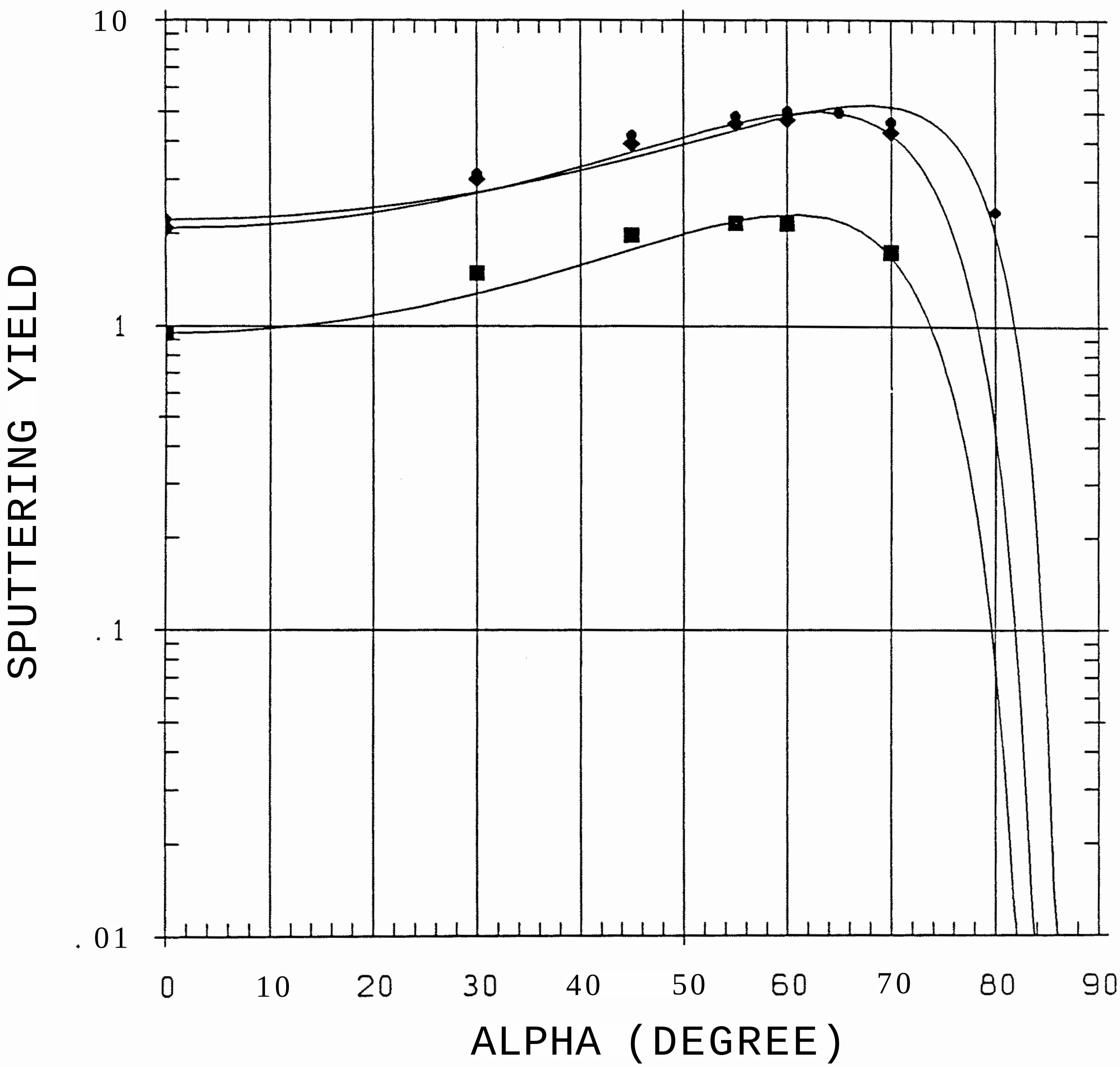
Target	Proj.	Energy	Angle	Yield	Temp.	P	SEE
Ga	Ga	0.100	0	0.23700	20	5.910	2.970
Ga	Ga	0.100	30	0.52500	20	5.910	2.970
Ga	Ga	0.100	45	0.75700	20	5.910	2.970
Ga	Ga	0.100	55	0.82800	20	5.910	2.970
Ga	Ga	0.100	60	0.80300	20	5.910	2.970
Ga	Ga	0.100	70	0.61800	20	5.910	2.970
Ga	Ga	0.100	80	0.28400	20	5.910	2.970

Target	Proj.	Energy	Angle	Yield	Temp.	P	SBE
Ga	Ga	0.150	0	0.44300	20	5.910	2.970
Ga	Ga	0.150	30	0.82200	20	5.910	2.970
Ga	Ga	0.150	45	1.12000	20	5.910	2.970
Ga	Ga	0.150	55	1.22000	20	5.910	2.970
Ga	Ga	0.150	60	1.19000	20	5.910	2.970
Ga	Ga	0.150	70	0.91800	20	5.910	2.970

Target	Proj.	Energy	Angle	Yield	Temp.	P	SBE
Ga	Ga	0.200	0	0.63300	20	5.910	2.970
Ga	Ga	0.200	30	1.07000	20	5.910	2.970
Ga	Ga	0.200	45	1.45000	20	5.910	2.970
Ga	Ga	0.200	55	1.56000	20	5.910	2.970
Ga	Ga	0.200	60	1.55000	20	5.910	2.970
Ga	Ga	0.200	70	1.20000	20	5.910	2.970
Ga	Ga	0.200	80	0.51100	20	5.910	2.970

Calculated Data

Target	Projectile	Energy	Symbol	y(0)	*a*	f
Ga	Ga	0.300	■	0.94600	60.7	4.39
Ga	Ga	0.900	♦	2.08000	62.8	3.65
Ga	Ga	1.000	•	2.22000	67.9	2.44



Fig, 103: Angular dependence of the sputtering yield of Ga with 0.3 , 0.9 and 1 keV Ga ions. The data are partly published in [52],

Calculated Data

Target	Proj.	Energy	Angle	Yield	Temp.	p	SBE
Ga	Ga	0.300	0	0.94600	20	5.910	2.970
Ga	Ga	0.300	30	1.49000	20	5.910	2.970
Ga	Ga	0.300	45	1.98000	20	5.910	2.970
Ga	Ga	0.300	55	2.17000	20	5.910	2.970
Ga	Ga	0.300	60	2.16000	20	5.910	2.970
Ga	Ga	0.300	70	1.75000	20	5.910	2.970

Target	Proj.	Energy	Angle	Yield	Temp.	P	SBE
Ga	Ga	0.900	0	2.08000	20	5.910	2.970
Ga	Ga	0.900	30	3.02000	20	5.910	2.970
Ga	Ga	0.900	45	3.94000	20	5.910	2.970
Ga	Ga	0.900	55	4.57000	20	5.910	2.970
Ga	Ga	0.900	60	4.71000	20	5.910	2.970
Ga	Ga	0.900	70	4.28000	20	5.910	2.970

Target	Proj.	Energy	Angle	Yield	Temp.	P	SBE
Ga	Ga	1.000	0	2.22000	20	5.910	2.970
Ga	Ga	1.000	30	3.14000	20	5.910	2.970
Ga	Ga	1.000	45	4.20000	20	5.910	2.970
Ga	Ga	1.000	55	4.84000	20	5.910	2.970
Ga	Ga	1.000	60	5.02000	20	5.910	2.970
Ga	Ga	1.000	65	4.97000	20	5.910	2.970
Ga	Ga	1.000	70	4.63000	20	5.910	2.970
Ga	Ga	1.000	80	2.37000	20	5.910	2.970

Calculated Data

Target	Projectile	Energy	Symbol	y(0)	q	f
		2.000		0.01650	837	L71

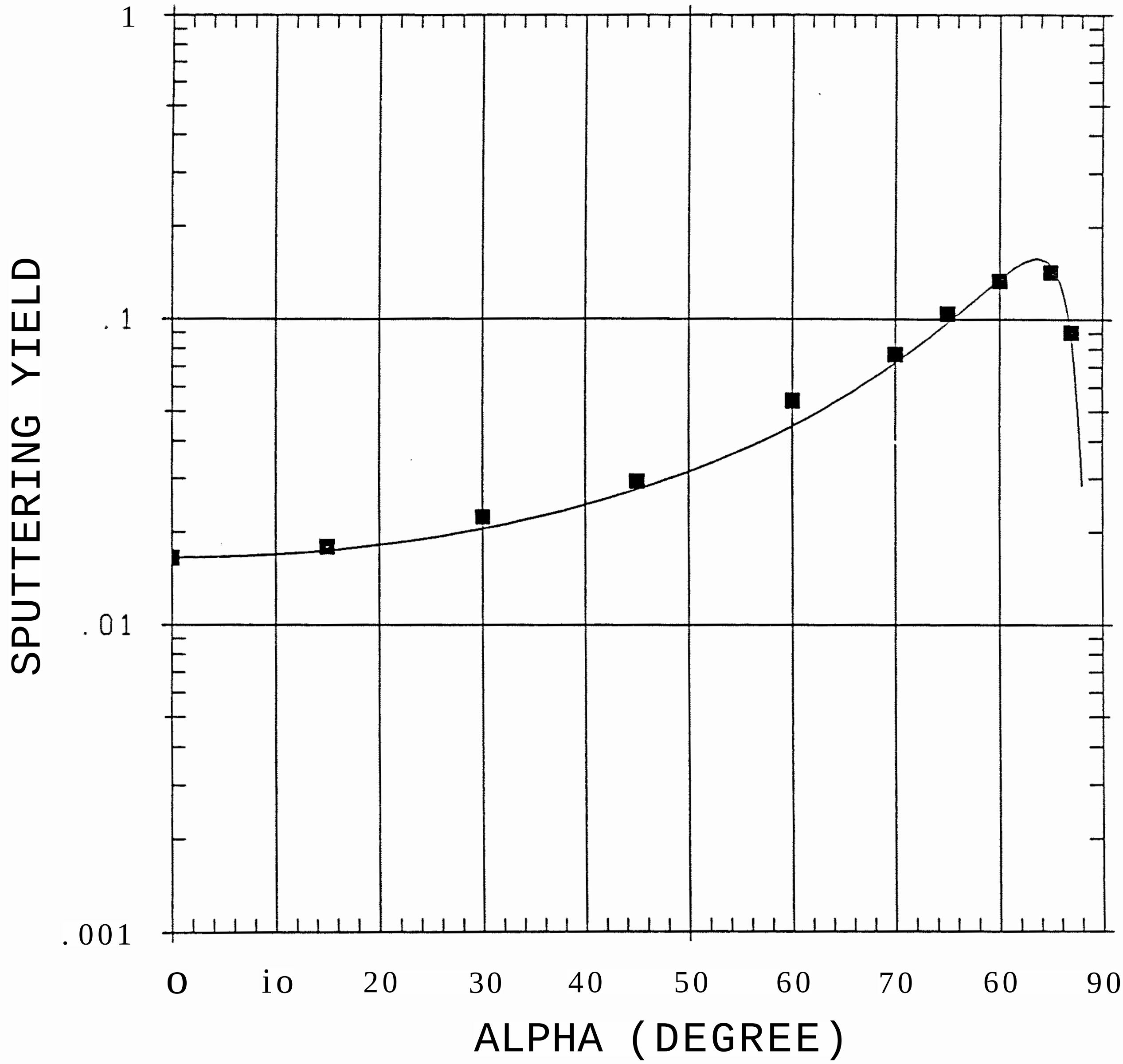


Fig. 104: Angular dependence of the sputtering yield of In with 2 keV II ions. The data are unpublished.

Calculated Data

Target	Proj,	Energy	Angle	Yield	Temp.	p	SEE
In	H	2.000	0	0.01650	20	7.310	2.490
In	H	2.000	15	0.01790	20	7.310	2.490
In	H	2.000	30	0.02240	20	7.310	2.490
In	H	2.000	45	0.02940	20	7.310	2.490
In	H	2.000	60	0.05410	20	7.310	2.490
In	H	2.000	70	0.07680	20	7.310	2.490
In	H	2.000	75	0.10400	20	7.310	2.490
In	H	2.000	80	0.13300	20	7.310	2.490
In	H	2.000	85	0.14200	20	7.310	2.490
In	H	2.000	87	0.09060	20	7.310	2.490

Calculated Data

Target	Projectile	Energy	Symbol	y(o)	Q	f
In	In	0.100	■	0.29700	62.7	5.38
In	In	0.200	◆	0.74900	66.5	2.82
In	In	1.000	•	2.76000	68.3	2.10

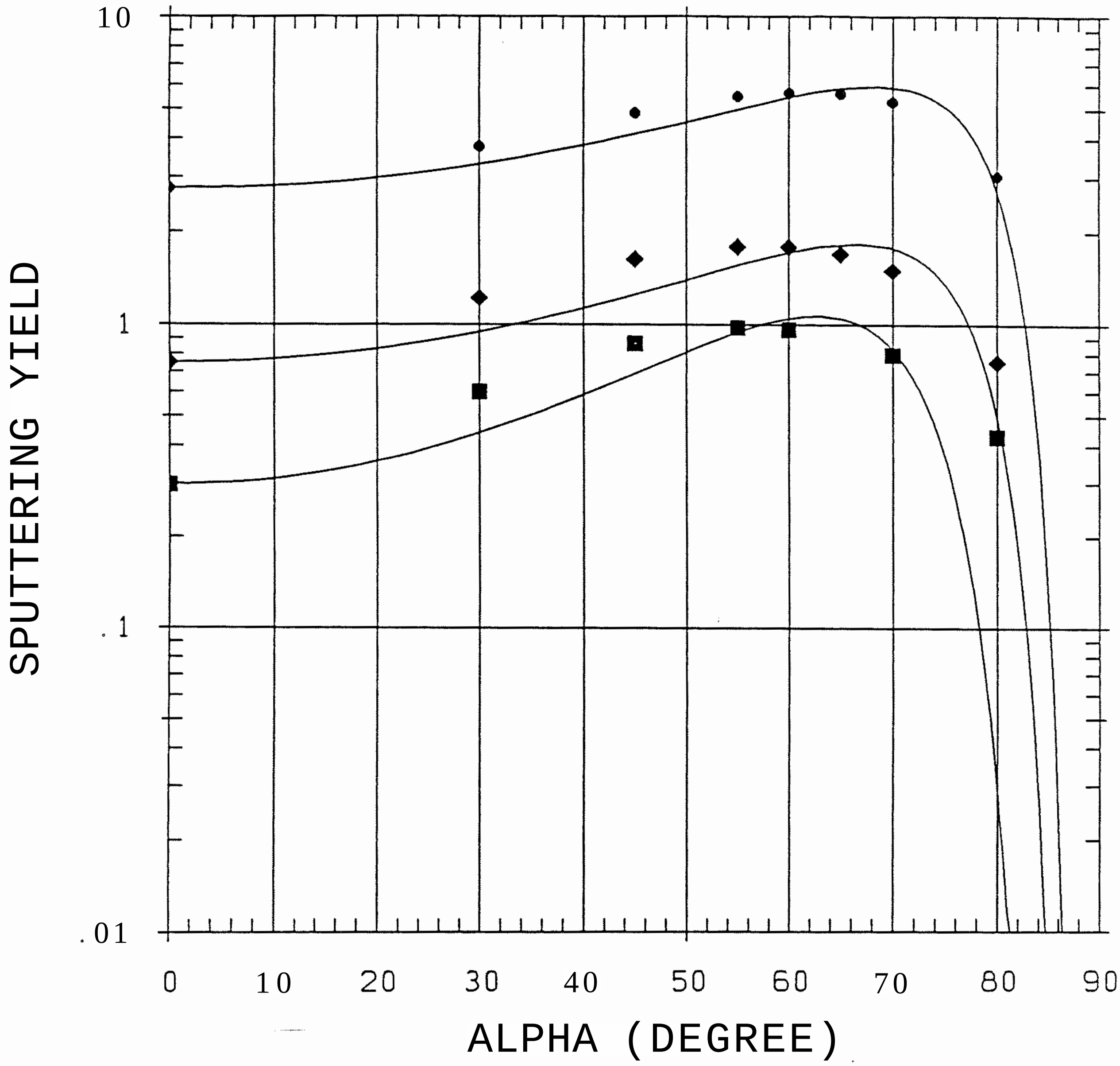


Fig. 105: Angular dependence of the sputtering yield of In with 0.1 , 0.2 and 1 keV In ions. The data are published in [52].

Calculated Data

Target ■	Proj.	Energy	Angle	Yield	Temp.	P	SEE
In	In	0.100	0	0.29700	20	7.310	2.520
In	In	0.100	30	0.60000	20	7.310	2.520
In	In	0.100	45	0.86600	20	7.310	2.520
In	In	0.100	55	0.97600	20	7.310	2.520
In	In	0.100	60	0.96400	20	7.310	2.520
In	In	0.100	70	0.79600	20	7.310	2.520
In	In	0.100	80	0.42900	20	7.310	2.520

Target	Proj.	Energy	Angle	Yield	Temp.	P	SBE
In	In	0.200	0	0.74900	20	7.310	2.520
In	In	0.200	30	1.22000	20	7.310	2.520
In	In	0.200	45	1.63000	20	7.310	2.520
In	In	0.200	55	1.79000	20	7.310	2.520
In	In	0.200	60	1.79000	20	7.310	2.520
In	In	0.200	65	1.70000	20	7.310	2.520
In	In	0.200	70	1.50000	20	7.310	2.520
In	In	0.200	80	0.75400	20	7.310	2.520

Target	Proj.	Energy	Angle	Yield	Temp.	P	SBE
In	In	1.000	0	2.76000	20	7.310	2.520
In	In	1.000	30	3.78000	20	7.310	2.520
In	In	1.000	45	4.85000	20	7.310	2.520
In	In	1.000	55	5.48000	20	7.310	2.520
In	In	1.000	60	5.63000	20	7.310	2.520
In	In	1.000	65	5.61000	20	7.310	2.520
In	In	1.000	70	5.29000	20	7.310	2.520
In	In	1.000	80	3.04000	20	7.310	2.520

Calculated Data

Target	Projectile	Energy	Symbol	y(0)	Q	f
Li	T	0.100	•	0.03930	77.0	3.95
Li	T	0-300	▶	0.04520	81.6	2.76

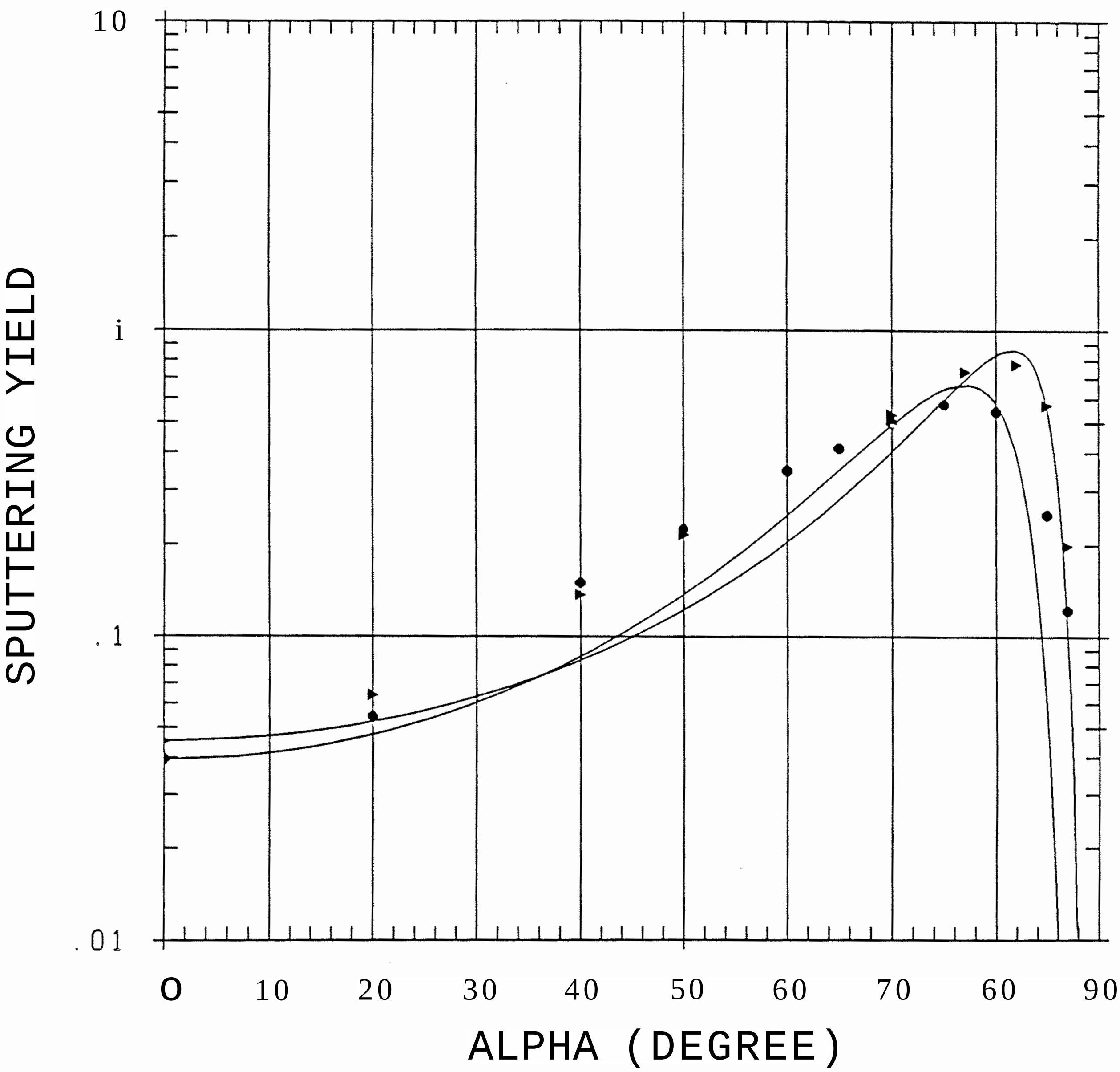


Fig. 10G: Angular dependence of the sputtering yield of Li with 100 and 300 eV T ions. The data are unpublished.

Calculated Data

Target	Proj.	Energy	Angle	Yield	Temp.	*P*	SBE
Li	T	0.100	0	0.0393	20	0.530	1.670
Li	T	0.100	0	0.0393	20	0.530	1.670
Li	T	0.100	20	0.0544	20	0.530	1.670
Li	T.	0.100	40	0.1500	20	0.530	1.670
Li	T	0.100	50	0.2250	20	0.530	1.670
Li	T	0.100	60	0.3480	20	0.530	1.670
Li	T	0.100	65	0.4120	20	0.530	1.670
Li	T	0.100	65	0.4120	20	0.530	1.670
Li	T	0.100	70	0.5000	20	0.530	1.670
Li	T	0.100	75	0.5740	20	0.530	1.670
Li	T	0.100	80	0.5450	20	0.530	1.670
Li	T	0.100	85	0.2510	20	0.530	1.670
Li	T	0.100	87	0.1220	20	0.530	1.670

Target	Proj.	Energy	Angle	Yield	Temp.	*P*	SBE
Li	T	0.300	0	0.0452	20	0.530	1.670
Li	T	0.300	20	0.0640	20	0.530	1.670
Li	T	0.300	40	0.1370	20	0.530	1.670
Li	T	0.300	50	0.2160	20	0.530	1.670
Li	T	0.300	70	0.5310	20	0.530	1.670
Li	T	0.300	7/	0.7330	20	0.530	1.670
Li	T	0.300	82	0.7740	20	0.530	1.670
Li	T	0.300	85	0.5710	20	0.530	1.670
Li	T	0.300	87	0.1990	20	0.530	1.670

Calculated Data

Target	Projectile	Energy	Symbol	y(0)	a	f
Li	Li	0.100	■	0.09480	70.7	5.89
Li	Li	0.200	♦	0.15000	75.0	4.12
Li	Li	1.000	•	0.20700	81.2	2.69

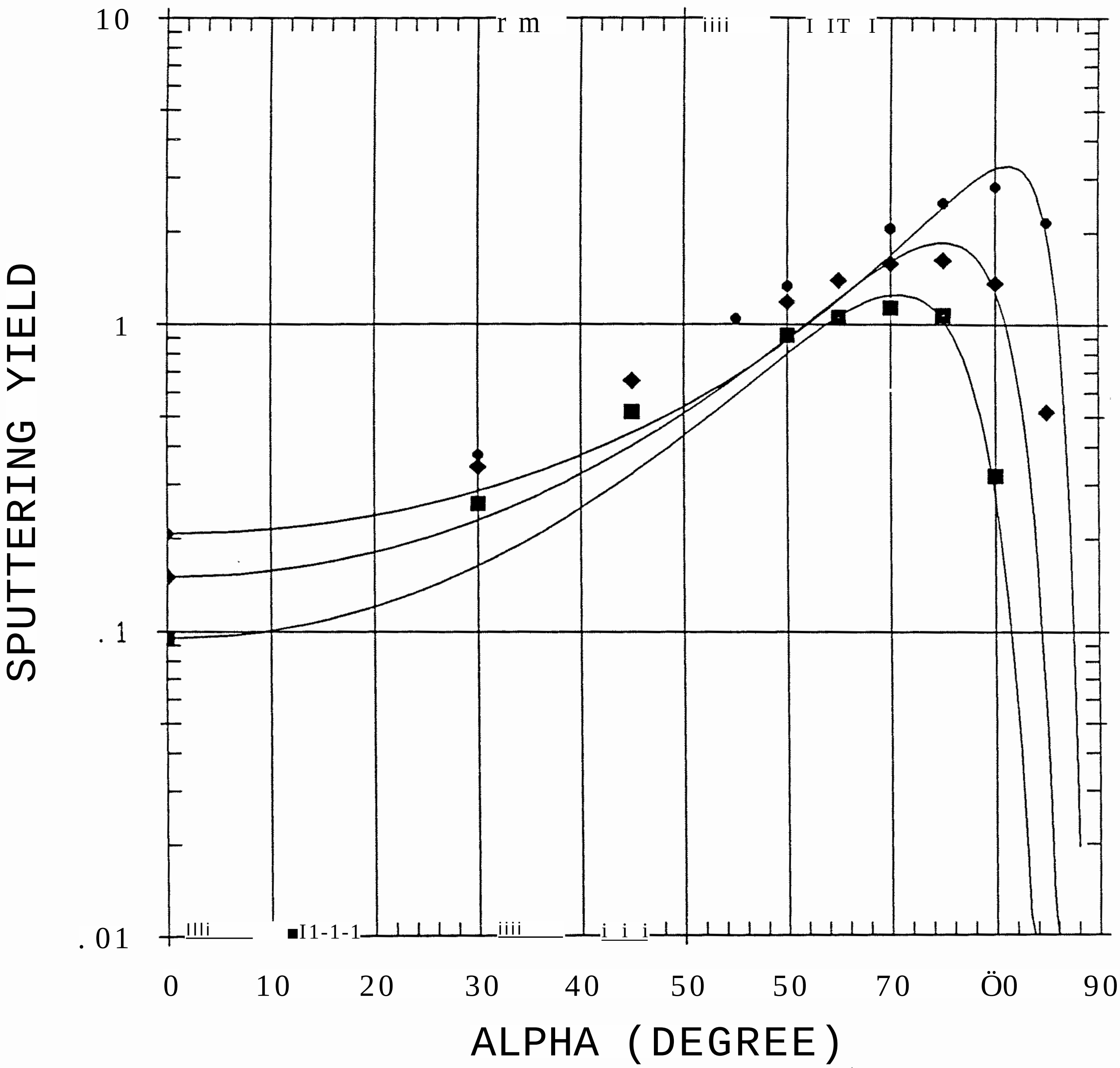


Fig. 107: Angular dependence of the sputtering yield of Li with 0.1 , 0.2 and 1 keV Li ions. The data are published in [52],

Calculated Data

Target .	Proj.	Energy	Angle	Yield	Temp.	P	SEE
Li	Li	0.100	0	0.09480	20	0.530	1.680
Li	Li	0.100	30	0.26000	20	0.530	1.680
Li	Li	0.100	45	0.51900	20	0.530	1.680
Li	Li	0.100	60	0.92100	20	0.530	1.680
Li	Li	0.100	65	1.05000	20	0.530	1.680
Li	Li	0.100	70	1.13000	20	0.530	1.680
Li	Li	0.100	75	1.07000	20	0.530	1.680
Li	Li	0.100	80	0.32100	20	0.530	1.680

Target	Proj.	Energy	Angle	Yield	Temp.	P	SBE
Li	Li	0.200	0	0.15000	20	0.530	1.680
Li	Li	0.200	30	0.34300	20	0.530	1.680
Li	Li	0.200	45	0.65600	20	0.530	1.680
Li	Li	0.200	60	1.18000	20	0.530	1.680
Li	Li	0.200	65	1.39000	20	0.530	1.680
Li	Li	0.200	70	1.58000	20	0.530	1.680
Li	Li	0.200	75	1.62000	20	0.530	1.680
Li	Li	0.200	80	1.36000	20	0.530	1.680
Li	Li	0.200	85	0.51900	20	0.530	1.680

Target	Proj.	Energy	Angle	Yield	Temp.	P	SEE
Li	Li	1.000	0	0.20700	20	0.530	1.680
Li	Li	1.000	30	0.37500	20	0.530	1.680
Li	Li	1.000	45	0.65700	20	0.530	1.680
Li	Li	1.000	55	1.04000	20	0.530	1.680
Li	Li	1.000	60	1.33000	20	0.530	1.680
Li	Li	1.000	70	2.06000	20	0.530	1.680
Li	Li	1.000	75	2.49000	20	0.530	1.680
Li	Li	1.000	80	2.82000	20	0.530	1.680
Li	Li	1.000	85	2.16000	20	0.530	1.680

Experimental Data

Target	Projectile	Energy	Symbol	y(0)	a	f
Mo	H	2.000	□	0.00222	82.7	2.15
Mo	H	8.000	o	0.00170	83.1	2.52
Mo	H	50.000	o	0.00168	88.0	1.66

Calculated Data

Target	Projectile	Energy	Symbol	y(o)	a	f
Mo	H	2.000	■	0.00599	82.7	1.91
Mo	H	50.000	•	0.00136	88.0	1.84

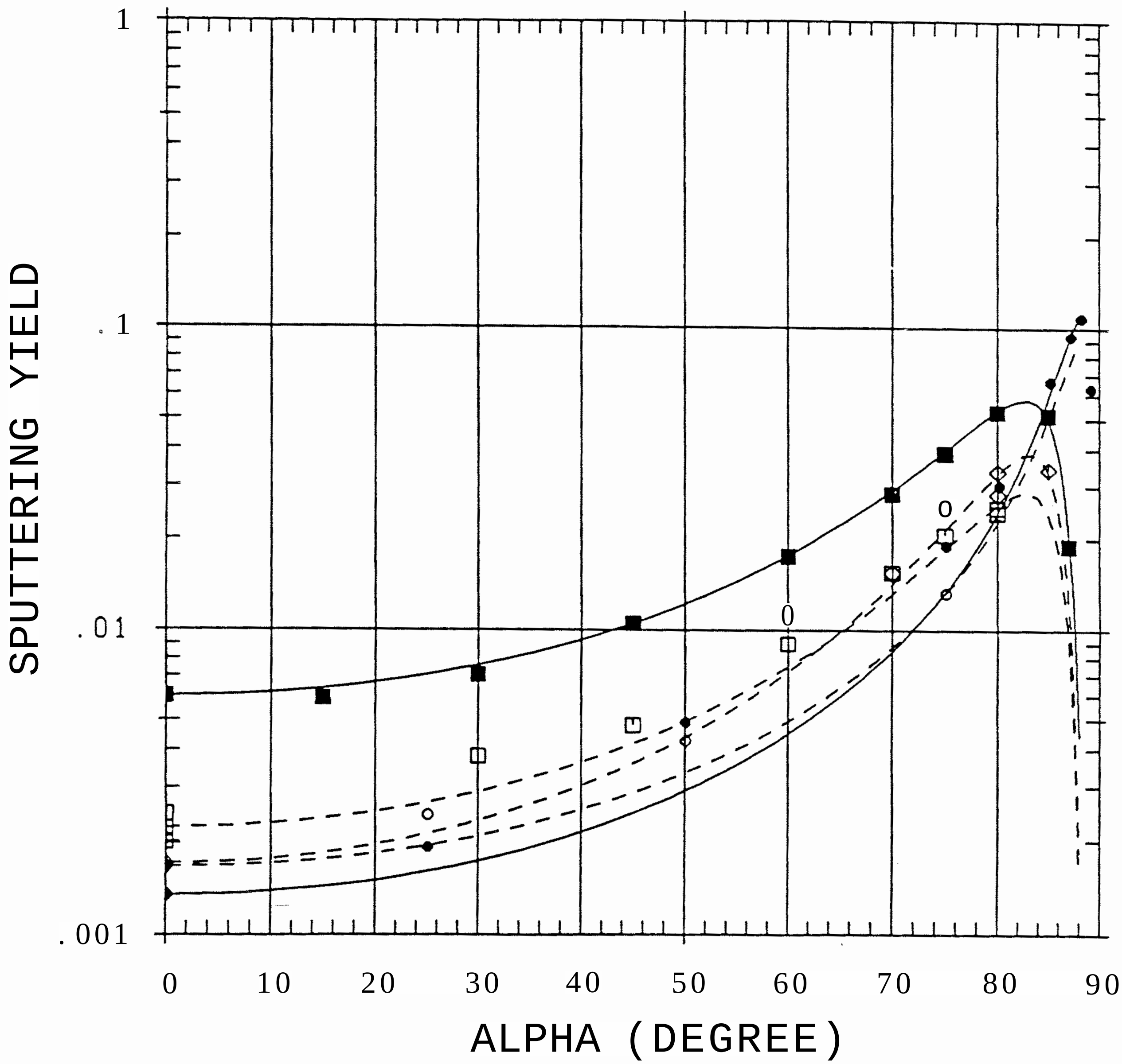


Fig. 108: Angular dependence of the sputtering yield of Mo with 2 , 8 and 50 keV H ions. The value of a_{opt} for the experimental data was taken from the calculated data or estimated for fitting. The data are partly published in [48,68].

Experimental Data

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
Mo	H	2.000	0	0.00200	20	3	II	47	15.07.76
Mo	H	2.000	0	0.00220	20	3	II	165	07.07.77
Mo	H	2.000	0	0.00246	90	3	V	177	25.05.82
Mo	H	2.000	30	0.00380	20	3	II	155	20.06.77
Mo	H	2.000	45	0.00480	20	3	II	151	08.06.77
Mo	H	2.000	60	0.00900	20	3	II	151	08.06.77
Mo	H	2.000	70	0.01550	20	3	II	158	23.06.77
Mo	H	2.000	75	0.02070	20	3	II	164	06.07.77
Mo	H	2.000	80	0.02450	20	3	II	161	29.06.77
Mo	H	2.000	80	0.02550	35	3	V	35	20.01.82

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
Mo	H	8.000	0	0.00170	20	1			GUESS
Mo	H	8.000	60	0.01120	20	1	III	27	25.11.77
Mo	H	8.000	70	0.01550	20	1	II	159	24.06.77
Mo	H	8.000	75	0.02550	20	1	III	26	23.11.77
Mo	H	8.000	80	0.03370	20	1	HI	25	21.11.77
Mo	H	8.000	80	0.02830	20	1	V	123	11.02.82
Mo	H	8.000	85	0.03430	20	1	III	26	24.11.77

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
Mo	H	50.000	0	0.00168	20	1			PHARAO82
Mo	H	50.000	25	0.00246	20	1			PHARAO82
Mo	H	50.000	50	0.00430	20	1			PHARAO82
Mo	H	50.000	75	0.01340	20	1			PHARAO82

Calculated Data

Target	Proj.	Energy	Angle	Yield	Temp.	P	SBE
Mo	H	2.000	0	0.00599	20	10.210	6.830
Mo	H	2.000	15	0.00589	20	10.210	6.830
Mo	H	2.000	30	0.00706	20	10.210	6.830
Mo	H	2.000	45	0.01050	20	10.210	6.830
Mo	H	2.000	60	0.01750	20	10.210	6.830
Mo	H	2.000	70	0.02840	20	10.210	6.830
Mo	H	2.000	75	0.03870	20	10.210	6.830
Mo	H	2.000	80	0.05300	20	10.210	6.830
Mo	H	2.000	85	0.05160	20	10.210	6.830
Mo	H	2.000	87	0.01900	20	10.210	6.830

Target	Proj.	Energy	Angle	Yield	Temp.	ρ	SBE
Mo	H	50.000	0	0.00136	20	10.200	6.890
Mo	H	50.000	25	0.00194	20	10.200	6.890
Mo	H	50.000	50	0.00495	20	10.200	6.890
Mo	H	50.000	75	0.01910	20	10.200	6.890
Mo	H	50.000	80	0.03013	20	10.200	6.890
Mo	H	50.000	85	0.06630	20	10.200	6.890
Mo	H	50.000	87	0.09427	20	10.200	6.890
Mo	H	50.000	88	0.10890	20	10.200	6.890
Mo	H	50.000	89	0.06297	20	10.200	6.890

Experimental Data

Target	Projectile	Energy	Symbol	y(0)	Q	f
Mo	D	0.450	□	0.00380	73.6	2.52
Mo	D	2.000	0	0.00832	79.4	2.40
Mo	D	8.000	o	0.00553	78.4	3.09

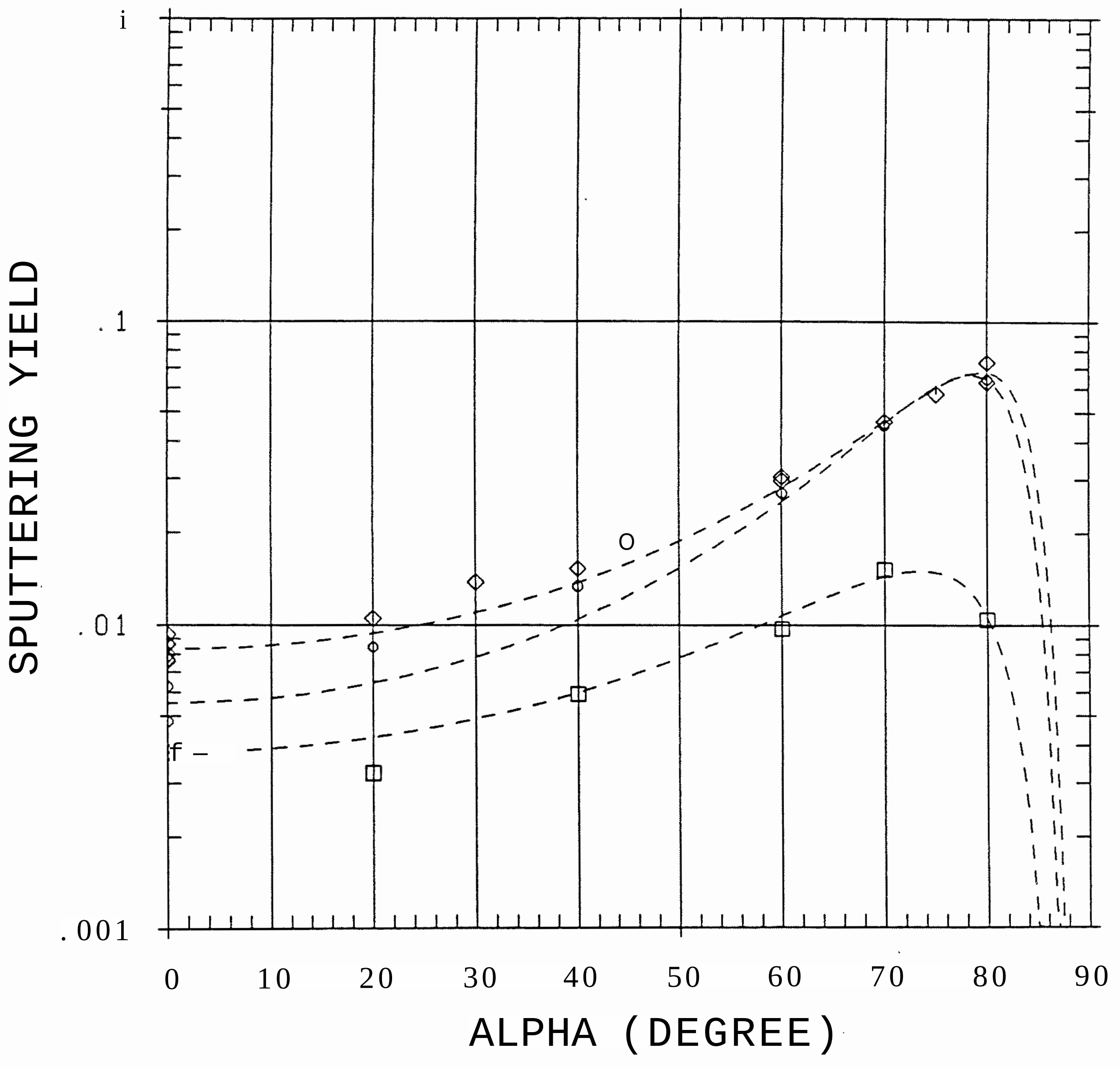


Fig. 109: Angular dependence of the sputtering yield of Mo with 0.45 , 2 and 8 keV D ions. The data are published in [68].

Experimental Data

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
Mo	D	0.450	0	0.00380	20	3	V	78	07.04.81
Mo	D	0.450	20	0.00324	25	3	V	76	20.03.81
Mo	D	0.450	40	0.00592	20	3	V	77	31.03.81
Mo	D	0.450	60	0.00970	20	3	V	77	30.03.81
Mo	D	0.450	70	0.01520	20	3	V	131	11.03.82
Mo	D	0.450	80	0.01040	20	3	V	78	01.04.81

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
Mo	D	2.000	0	0.00760	20	3	II	42	24.06.76
Mo	D	2.000	0	0.00770	20	3	II	43	30.06.76
Mo	D	2.000	0	0.00800	20	3	II	48	16.07.76
Mo	D	2.000	0	0.00930	20	3	II	166	08.07.77
Mo	D	2.000	0	0.00862	20	3	V	2	13.05.80
Mo	D	2.000	0	0.00868	72	3	V	75	19.03.81
Mo	D	2.000	20	0.01050	68	3	V	75	20.03.81 '
Mo	D	2.000	30	0.01380	20	3	II	154	14.06.77
Mo	D	2.000	40	0.01530	55	3	V	79	09.04.81
Mo	D	2.000	45	0.01890	20	3	II	152	13.06.77
Mo	D	2.000	60	0.02970	20	3	II	152	13.06.77
Mo	D	2.000	60	0.03060	50	3	V	77	31.03.81
Mo	D	2.000	70	0.04660	20	3	II	159	27.06.77
Mo	D	2.000	75	0.05750	20	3	II	164	06.07.77
Mo	D	2.000	80	0.07330	20	3	11	161	30.06.77
Mo	D	2.000	80	0.06300	42	3	V	79	04.05.81

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
Mo	D	8.000	0	0.00480	20	1	II	57	14.08.76
Mo	D	8.000	0	0.00627	90	1	V	80	04.05.81
Mo	D	8.000	20	0.00846	65	1	V	75	19.03.81
Mo	D	8.000	40	0.01340	58	1	V	76	24.03.81
Mo	D	8.000	60	0.02700	20	1	V	76	26.03.81
Mo	D	8.000	70	0.04520	20	1	II	159	27.06.77
Mo	D	8.000	80	0.06440	42	1	V	78	01.04.81

Projectile: D

Experimental Data

Target	Projectile	Energy	Symbol	y(o)	a	f
Mo	D	50.000	□	0.00290	87.1	1.70
Mo	D	100.000	0	0.00224	88.5	1.76

Calculated Data

Target	Projectile	Energy	Symbol	y(0)	a	f
Mo	D	50.000	■	0.00350	87.1	1.94
Mo	D	100.000	♦	0.00250	88.5	1.61

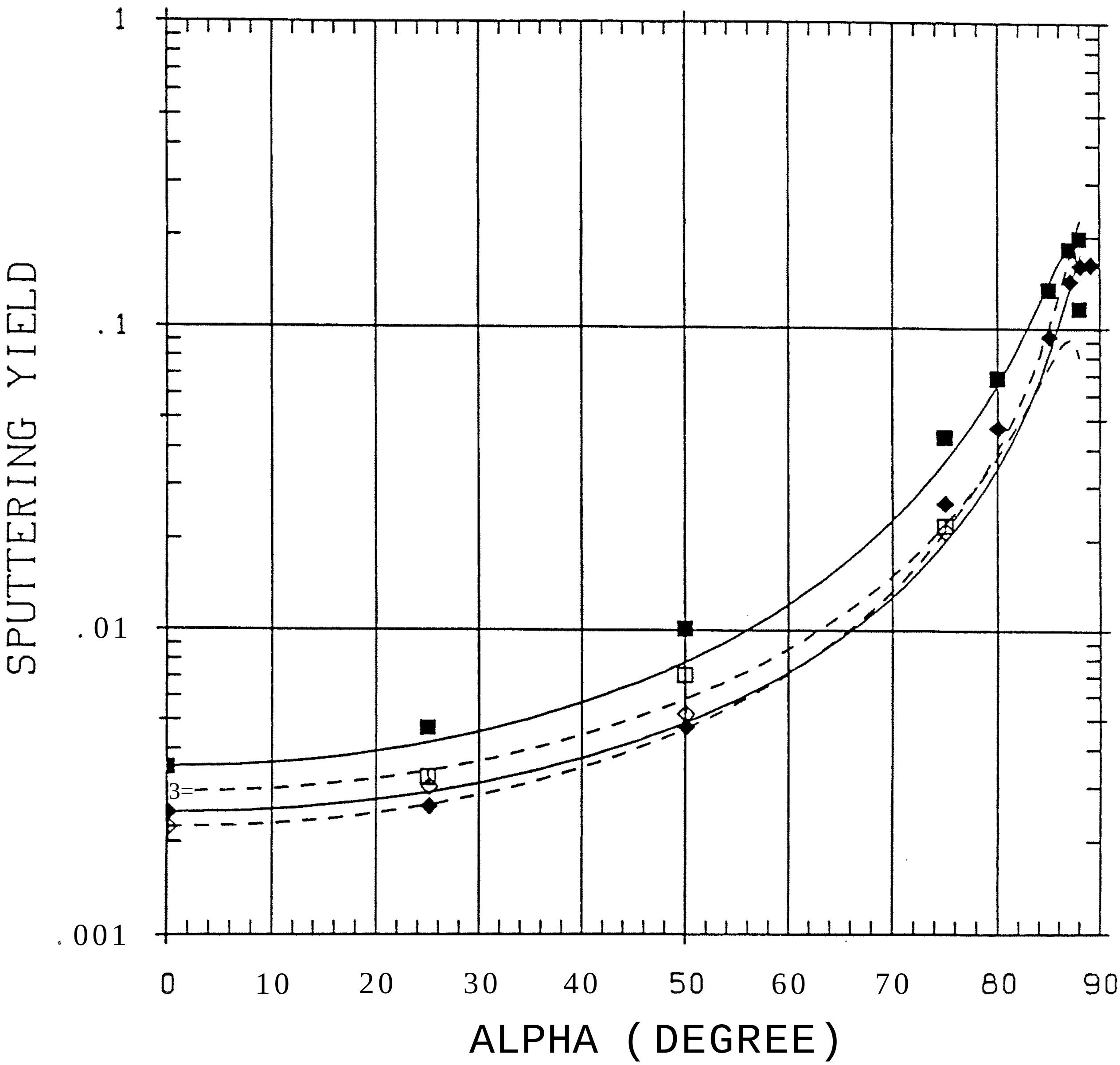


Fig. 110: Angular dependence of the sputtering yield of Mo with 50 and 100 keV D ions. The value of a_{opt} for the experimental data was taken from the calculated data for fitting. The data are published in [48].

Experimental Data

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
Mo	D	50.000	0	0.00290	20	1	“		GUESS
Mo	D	50.000	25	0.00324	20	1			PHARAO82
Mo	D	50.000	50	0.00708	20	1			PHARAO82
Mo	D	50.000	75	0.02240	20	1			PHARAO82

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
Mo	D	100.000	0	0.00224	20	1			PHARAO82
Mo	D	100.000	25	0.00304	20	1			PHARAO82
Mo	D	100.000	50	0.00530	20	1			PHARAO82
Mo	D	100.000	75	0.02110	20	1			PHARAO82

Calculated Data

Target	Proj.	Energy	Angle	Yield	Temp.	P	SBE
Mo	D	50.000	0	0.00350	20	10.200	6.890
Mo	D	50.000	25	0.00470	20	10.200	6.890
Mo	D	50.000	50	0.01010	20	10.200	6.890
Mo	D	50.000	75	0.04380	20	10.200	6.890
Mo	D	50.000	80	0.06837	20	10.200	6.890
Mo	D	50.000	85	0.13440	20	10.200	6.890
Mo	D	50.000	87	0.18210	20	10.200	6.890
Mo	D	50.000	88	0.19780	20	10.200	6.890
Mo	D	50.000	88	0.11640	20	10.200	6.890

Target	Proj.	Energy	Angle	Yield	Temp.	P	SBE
Mo	D	100.000	0	0.00250	20	10.200	6.890
Mo	D	100.000	25	0.00262	20	10.200	6.890
Mo	D	100.000	50	0.00480	20	10.200	6.890
Mo	D	100.000	75	0.02600	20	10.200	6.890
Mo	D	100.000	80	0.04590	20	10.200	6.890
Mo	D	100.000	85	0.09240	20	10.200	6.890
Mo	D	100.000	87	0.14100	20	10.200	6.890
Mo	D	100.000	88	0.15820	20	10.200	6.890
Mo	D	100.000	89	0.16030	20	10.200	6.890

Projectile: He

Experimental Data

Target	Projectile	Energy	Symbol	y(0)	Or	f
Mo	He	4.000	□	0.05290	78.0	2.19
Mo	He	50.000	0	0.02520	86.7	1.81
Mo	He	100.000	0	0.03227	87.8	1.35

Calculated Data

Target	Projectile	Energy	Symbol	y(0)	*a*	f
Mo	He	50.000	♦	0.02640	86.7	1.72
Mo	He	100.000	•	0.01670	87.8	1.59

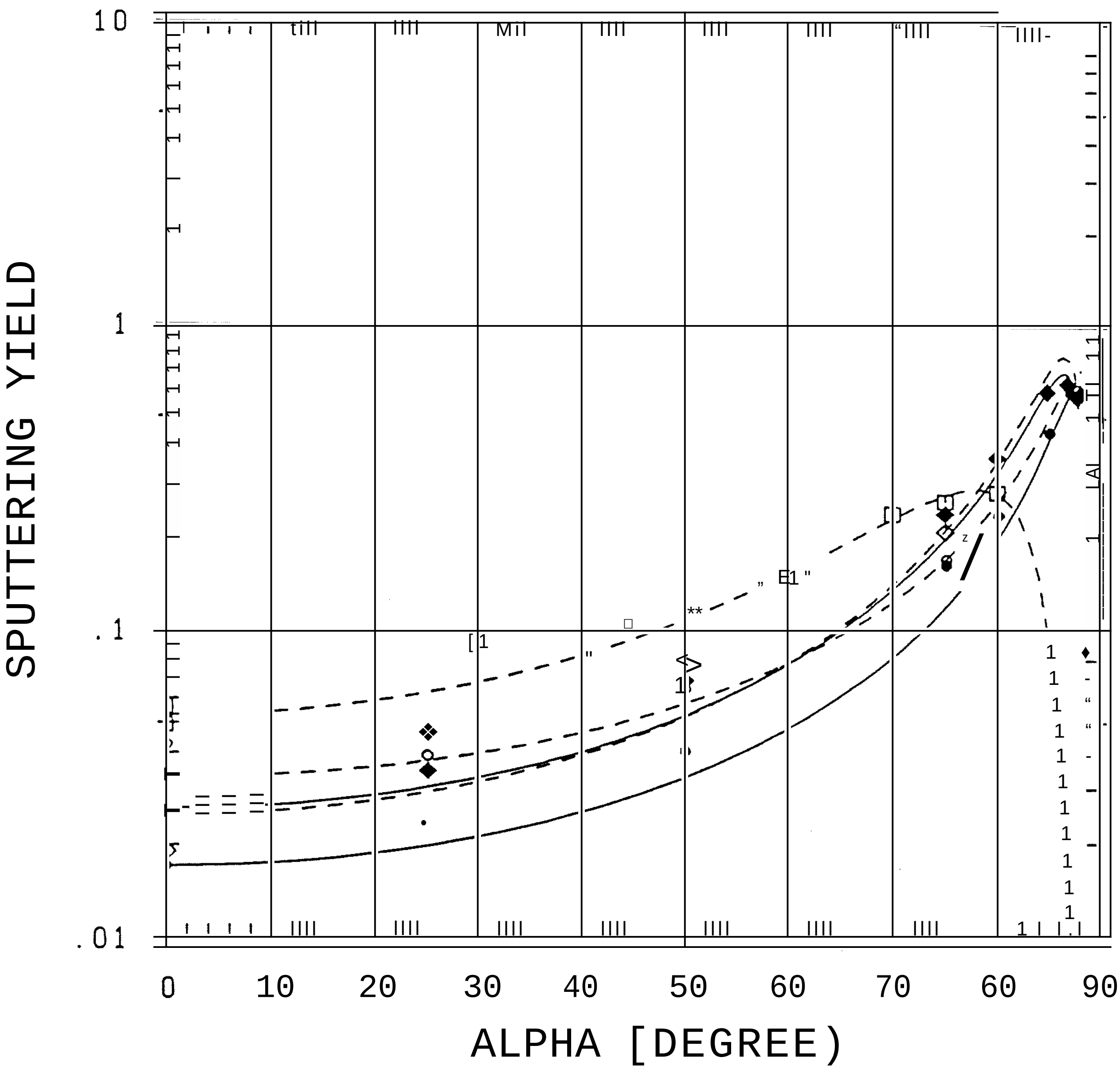


Fig. Ill: Angular dependence of the sputtering yield of Mo with 4 , 50 and 100 keV He ions. The value of a opt for the 50 and 100 keV experimental data was taken from calculated data for fitting. The data are published in [48,681.

Experimental Data

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
Mo	He	4.000	0	0.04930	20	1	II	58	17.08.76
Mo	He	4.000	0	0.05650	20	1	II	166	08.07.77
Mo	He	4.000	30	0.09300	20	1	II	157	22.06.77
Mo	He	4.000	45	0.10900	20	1	II	152	14.06.77
Mo	He	4.000	60	0.15100	20	1	II	153	14.06.77
Mo	He	4.000	70	0.24000	20	1	II	158	24.06.77
Mo	He	4.000	75	0.26400	20	1	II	165	07.07.77
Mo	He	4.000	80	0.28400	20	1	II	162	02.07.77

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
Mo	He	50.000	0	0.01910	20	1			PHARAO82
Mo	He	50.000	0	0.03130	20	1			PHARAO82
Mo	He	50.000	25	0.04750	20	1			PHARAO82
Mo	He	50.000	50	0.08020	20	1			PHARAO82
Mo	He	50.000	75	0.21400	20	1			PHARAO82

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
Mo	He	100.000	0	0.03160	20	1			PHARAO82
Mo	He	100.000	0	0.02700	20	1			PHARAO82
Mo	He	100.000	0	0.02900	20	1			PHARAO82
Mo	He	100.000	0	0.04150	20	1			PHARAO82
Mo	He	100.000	25	0.03820	20	1			PHARAO82
Mo	He	100.000	50	0.06360	20	1			PHARAO82
Mo	He	100.000	75	0.17100	20	1			PHARAO82

Calculated Data

Target	Proj.	Energy	Angle	Yield	Temp.	P	SBE
Mo	He	50.000	0	0.02640	20	10.200	6.890
Mo	He	50.000	25	0.03500	20	10.200	6.890
Mo	He	50.000	50	0.06950	20	10.200	6.890
Mo	He	50.000	75	0.24500	20	10.200	6.890
Mo	He	50.000	80	0.37520	20	10.200	6.890
Mo	He	50.000	85	0.61660	20	10.200	6.890
Mo	He	50.000	87	0.65580	20	10.200	6.890
Mo	He	50.000	88	0.59080	20	10.200	6.890
Mo	He	50.000	89	0.09490	20	10.200	6.890

Target	Proj.	Energy	Angle	Yield	Temp.	P	SBE
Mo	He	100.000	0	0.01670	20	10.200	6.890
Mo	He	100.000	25	0.02270	20	10.200	6.890
Mo	He	100.000	50	0.03970	20	10.200	6.890
Mo	He	100.000	75	0.16400	20	10.200	6.890
Mo	He	100.000	80	0.23950	20	10.200	6.890
Mo	He	100.000	85	0.44720	20	10.200	6.890
Mo	He	100.000	87	0.60410	20	10.200	6.890
Mo	He	100.000	88	0.60960	20	10.200	6.890
Mo	He	100.000	89	0.36520	20	10.200	6.890

Calculated Data

Target	Projectile	Energy	Symbol	y(0)	α	f
Mo	Ar	0.160	◆	0.21200	58.0	4.78
Mo	Ar	1.601	▶	1.37000	67.0	2.57
Mo	Ar	16.010	▶	2.23000	78.0	1.79

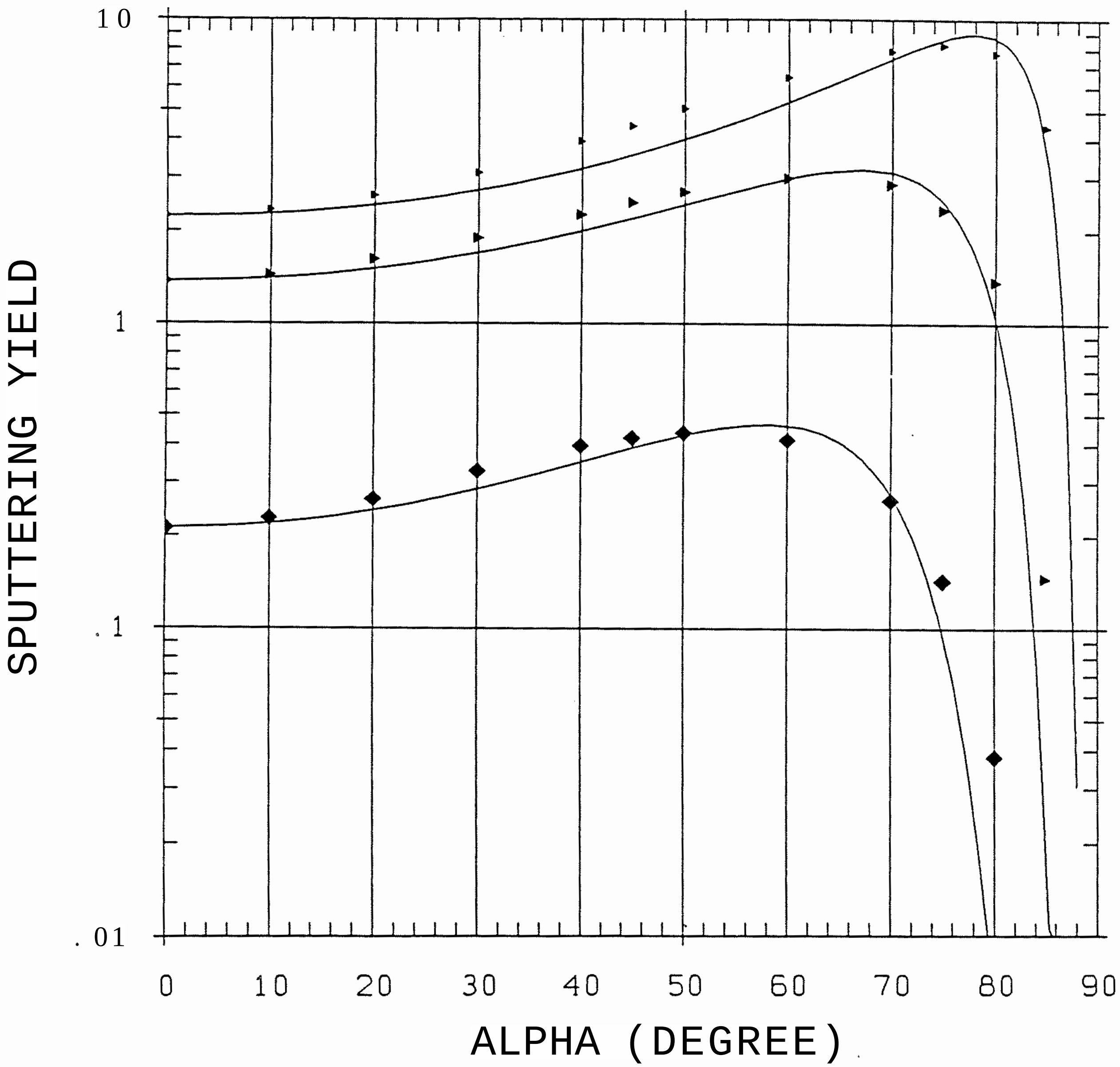


Fig. 112: Angular dependence of the sputtering yield of Mo with 0.16 , 1.601 and 16.01 keV Ar ions. The data are unpublished.

Calculated Data

Target ■	Proj.	Energy	Angle	Yield	Temp.	*P*	SBE
Mo	Ar	0.160	0	0.2120	20	10.200	6.830
Mo	Ar	0.160	10	0.2290	20	10.200	6.830
Mo	Ar	0.160	20	0.2640	20	10.200	6.830
Mo	Ar	0.160	30	0.3270	20	10.200	6.830
Mo	Ar	0.160	40	0.3960	20	10.200	6.830
Mo	Ar	0.160	45	0.4200	20	10.200	6.830
Mo	Ar	0.160	50	0.4370	20	10.200	6.830
Mo	Ar	0.160	60	0.4140	20	10.200	6.830
Mo	Ar	0.160	70	0.2630	20	10.200	6.830
Mo	Ar	0.160	75	0.1430	20	10.200	6.830
Mo	Ar	0.160	80	0.0380	20	10.200	6.830
Mo	Ar	0.160	85	0.0006	20	10.200	6.830

Target	Proj.	Energy	Angle	Yield	Temp.	*P*	SBE
Mo	Ar	1.601	0	1.3700	20	10.200	6.830
Mo	Ar	1.601	10	1.4400	20	10.200	6.830
Mo	Ar	1.601	20	1.6200	20	10.200	6.830
Mo	Ar	1.601	30	1.9000	20	10.200	6.830
Mo	Ar	1.601	40	2.2700	20	10.200	6.830
Mo	Ar	1.601	45	2.4900	20	10.200	6.830
Mo	Ar	1.601	50	2.6900	20	10.200	6.830
Mo	Ar	1.601	60	2.9900	20	10.200	6.830
Mo	Ar	1.601	70	2.8600	20	10.200	6.830
Mo	Ar	1.601	75	2.3600	20	10.200	6.830
Mo	Ar	1.601	80	1.3700	20	10.200	6.830
Mo	Ar	1.601	85	0.1460	20	10.200	6.830

Target	Proj.	Energy	Angle	Yield	Temp.	*P*	SBE
Mo	Ar	16.010	0	2.2300	20	10.200	6.830
Mo	Ar	16.010	10	2.3500	20	10.200	6.830
Mo	Ar	16.010	20	2.6200	20	10.200	6.830
Mo	Ar	16.010	30	3.1100	20	10.200	6.830
Mo	Ar	16.010	40	3.9500	20	10.200	6.830
Mo	Ar	16.010	45	4.4400	20	10.200	6.830
Mo	Ar	16.010	50	5.0800	20	10.200	6.830
Mo	Ar	16.010	60	6.4300	20	10.200	6.830
Mo	Ar	16.010	70	7.8900	20	10.200	6.830
Mo	Ar	16.010	75	8.2700	20	10.200	6.830
Mo	Ar	16.010	80	7.7600	20	10.200	6.830
Mo	Ar	16.010	85	4.4300	20	10.200	6.830

Projectile: Mo

Calculated Data

Target	Projectile	Energy	Symbol	y(o)	*a*	f
Mo	**Mo**	0.300	■	0.31500	60.9	6.34
Mo	**Mo**	0.350	♦	0.39000	60.5	6.24
Mo	**Mo**	1.000	•	1.13000	67.6	2.91
Mo	**Mo**	2.000	▶	1.76500	68.5	2.65

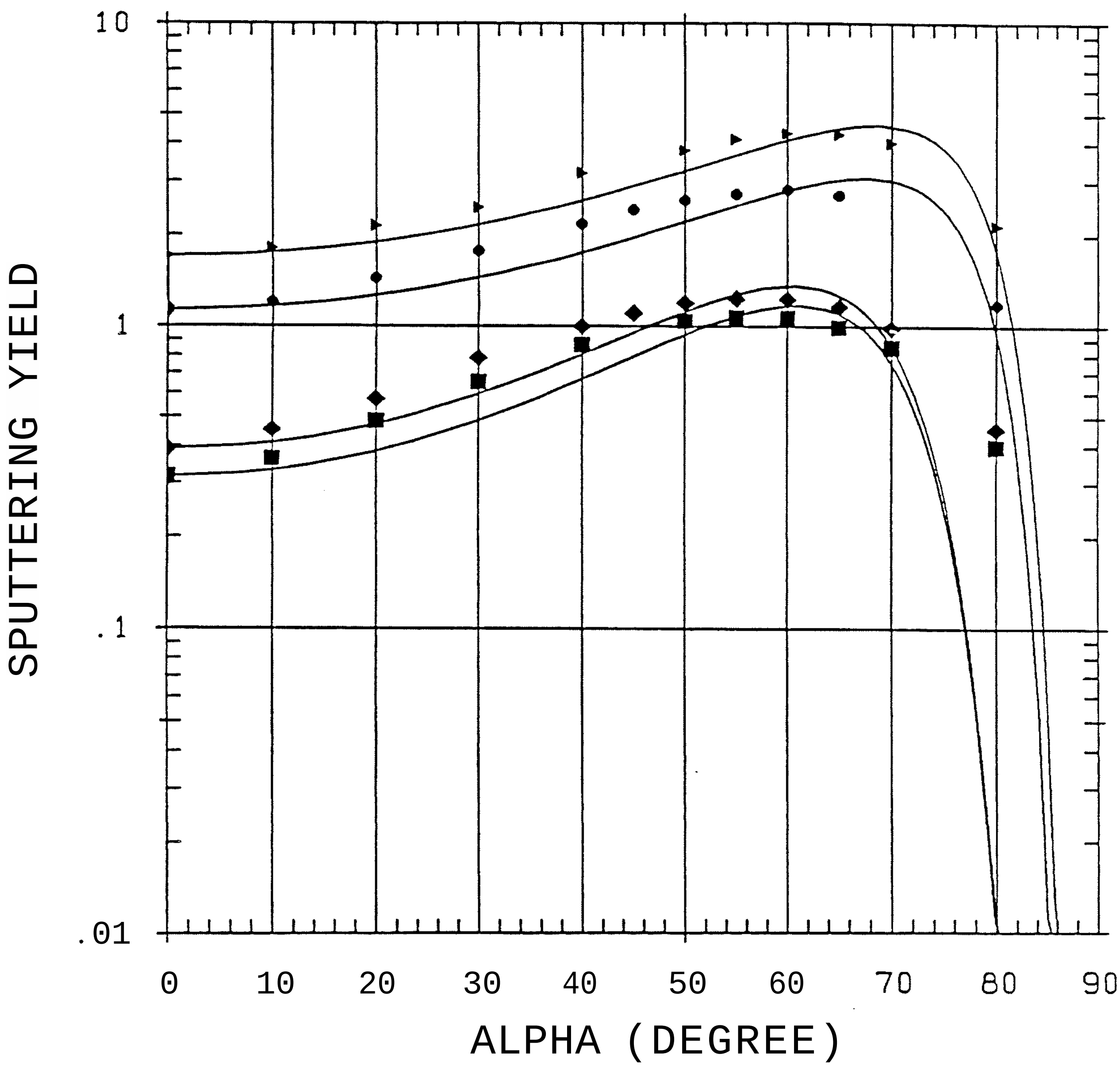


Fig. 113: Angular dependence of the sputtering yield of Mo with 0.3 , 0.35 , 1 and 2 keV Mo ions. The data are published in [53].

Calculated Data

Target	Proj.	Energy	Angle	Yield	Temp.	P	SBE
Mo	Mo	0.300	0	0.31500	20	10.200	6.890
Mo	Mo	0.300	10	0.36100	20	10.200	6.890
Mo	Mo	0.300	20	0.48400	20	10.200	6.890
Mo	Mo	0.300	30	0.65000	20	10.200	6.890
Mo	Mo	0.300	40	0.86800	20	10.200	6.890
Mo	Mo	0.300	50	1.04000	20	10.200	6.890
Mo	Mo	0.300	55	1.07000	20	10.200	6.890
Mo	Mo	0.300	60	1.07000	20	10.200	6.890
Mo	Mo	0.300	65	0.99200	20	10.200	6.890
Mo	Mo	0.300	70	0.85300	20	10.200	6.890
Mo	Mo	0.300	80	0.39900	20	10.200	6.890

Target	Proj.	Energy	Angle	Yield	Temp.	P	SBE
Mo	Mo	0.350	0	0.39000	20	10.200	6.890
Mo	Mo	0.350	10	0.45100	20	10.200	6.890
Mo	Mo	0.350	20	0.57100	20	10.200	6.890
Mo	Mo	0.350	30	0.78300	20	10.200	6.890
Mo	Mo	0.350	40	0.99400	20	10.200	6.890
Mo	Mo	0.350	45	1.10000	20	10.200	6.890
Mo	Mo	0.350	50	1.19000	20	10.200	6.890
Mo	Mo	0.350	55	1.23000	20	10.200	6.890
Mo	Mo	0.350	60	1.23000	20	10.200	6.890
Mo	Mo	0.350	65	1.16000	20	10.200	6.890
Mo	Mo	0.350	70	0.98400	20	10.200	6.890
Mo	Mo	0.350	80	0.45500	20	10.200	6.890

Target	Proj.	Energy	Angle	Yield	Temp.	P	SBE
Mo	Mo	1.000	0	1.14000	20	10.200	6.890
Mo	Mo	1.000	0	1.12000	20	10.200	6.890
Mo	Mo	1.000	10	1.20000	20	10.200	6.890
Mo	Mo	1.000	20	1.44000	20	10.200	6.890
Mo	Mo	1.000	30	1.77000	20	10.200	6.890
Mo	Mo	1.000	40	2.17000	20	10.200	6.890
Mo	Mo	1.000	45	2.41000	20	10.200	6.890
Mo	Mo	1.000	50	2.60000	20	10.200	6.890
Mo	Mo	1.000	55	2.73000	20	10.200	6.890
Mo	Mo	1.000	60	2.82000	20	10.200	6.890
Mo	Mo	1.000	65	2.71000	20	10.200	6.890
Mo	Mo	1.000	65	2.71000	20	10.200	6.890
Mo	Mo	1.000	80	1.18000	20	10.200	6.890

Target	Proj.	Energy	Angle	Yield	Temp.	P	SBE
Mo	Mo	2.000	0	1.7700	20	10.200	6.890
Mo	Mo	2.000	0	1.7600	20	10.200	6.890
Mo	Mo	2.000	10	1.8700	20	10.200	6.890
Mo	Mo	2.000	20	2.2100	20	10.200	6.890
Mo	Mo	2.000	30	2.5300	20	10.200	6.890
Mo	Mo	2.000	40	3.2800	20	10.200	6.890
Mo	Mo	2.000	50	3.8800	20	10.-200	6.890
Mo	Mo	2.000	55	4.2200	20	10.200	6.890
Mo	Mo	2.000	60	4.4200	20	10.200	6.890
Mo	Mo	2.000	65	4.4000	20	10.200	6.890
Mo	Mo	2.000	65	4.3800	20	10.200	6.890
Mo	Mo	2.000	70	4.1100	20	10.200	6.890
Mo	Mo	2.000	80	2.2100	20	10.200	6.890

Projectile: H

Experimental Data

Target	Projectile	Energy	Symbol	y(0)	*a*	*f*
~Ni	H	0.450	Ä	0.00982	73T	24?

Calculated Data

Target	Projectile	Energy	Symbol	y(0)	a	f
Ni	H	0.150	■	0.00200	47.9	2.18
Ni	H	0.200	♦	0.00450	57.3	1.99
Ni	H	0.400	•	0.01160	73.0	1.85

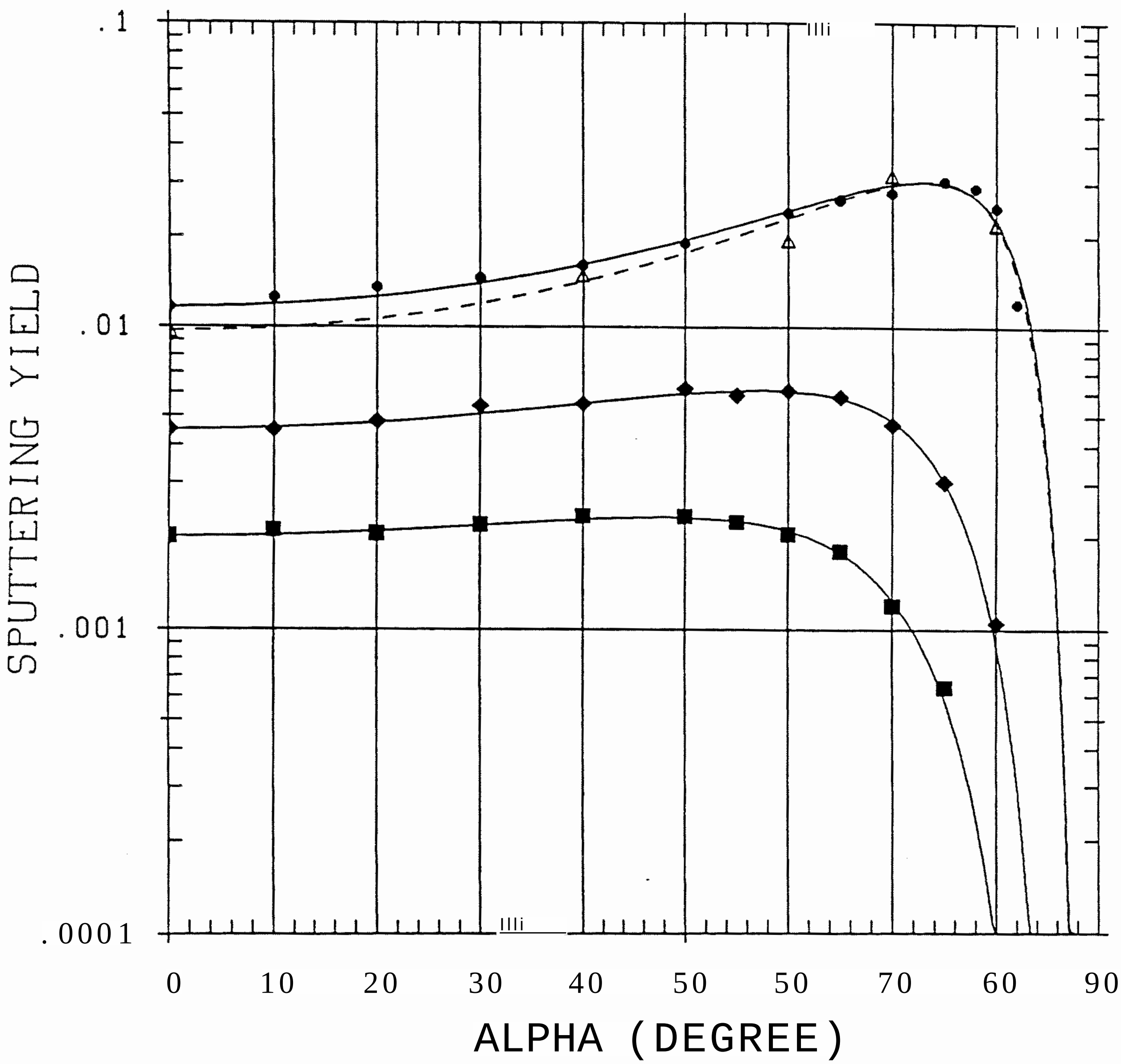


Fig. 114: Angular dependence of the sputtering yield of Ni with 150 , 200 , 400 and 450 eV H ions. The data are partly published in [48,711.

Experimental Data

Target	■ Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
Ni	H	0.450	0	0.00982	20	3	V	69	18.05.81
Ni	H	0.450	40	0.01500	20	3	V	69	19.05.81
Ni	H	0.450	60	0.01960	20	3	V	70	20.02.81
Ni	H	0.450	70	0.03180	20	3	V	131	12.03.82
Ni	H	0.450	80	0.02220	20	3	V	70	23.02.81
Ni	H	0.450	80	0.02200	20	3	V	71	24.02.81

Calculated Data

Target	Proj.	Energy	Angle	Yield	Temp.	P	SBE
Ni	H	0.150	0	0.00200	20	8.900	4.460
Ni	H	0.150	10	0.00210	20	8.900	4.460
Ni	H	0.150	20	0.00205	20	8.900	4.460
Ni	H	0.150	30	0.00220	20	8.900	4.460
Ni	H	0.150	40	0.00235	20	8.900	4.460
Ni	H	0.150	50	0.00235	20	8.900	4.460
Ni	H	0.150	55	0.00225	20	8.900	4.460
Ni	H	0.150	60	0.00205	20	8.900	4.460
Ni	H	0.150	65	0.00180	20	8.900	4.460
Ni	H	0.150	70	0.00120	20	8.900	4.460
Ni	H	0.150	75	0.00064	20	8.900	4.460

Target	Proj.	Energy	Angle	Yield	Temp.	P	SBE
Ni	H	0.200	0	0.00450	20	8.900	4.460
Ni	H	0.200	10	0.00450	20	8.900	4.460
Ni	H	0.200	20	0.00480	20	8.900	4.460
Ni	H	0.200	30	0.00540	20	8.900	4.460
Ni	H	0.200	40	0.00550	20	8.900	4.460
Ni	H	0.200	50	0.00620	20	8.900	4.460
Ni	H	0.200	55	0.00590	20	8.900	4.460
Ni	H	0.200	60	0.00610	20	8.900	4.460
Ni	H	0.200	65	0.00580	20	8.900	4.460
Ni	H	0.200	70	0.00470	20	8.900	4.460
Ni	H	0.200	75	0.00305	20	8.900	4.460
Ni	H	0.200	80	0.00105	20	8.900	4.460

Target	Proj.	Energy	Angle	Yield	Temp.	P	SBE
Ni	H	0.400	0	0.01160	20	8.900	4.460
Ni	H	0.400	10	0.01250	20	8.900	4.460
Ni	H	0.400	20	0.01350	20	8.900	4.460
Ni	H	0.400	30	0.01450	20	8.900	4.460
Ni	H	0.400	40	0.01600	20	8.900	4.460
Ni	H	0.400	50	0.01900	20	8.900	4.460
Ni	H	0.400	60	0.02400	20	8.900	4.460
Ni	H	0.400	65	0.02650	20	8.900	4.460
Ni	H	0.400	70	0.02800	20	8.900	4.460
Ni	H	0.400	75	0.03050	20	8.900	4.460
Ni	H	0.400	78	0.02900	20	8.900	4.460
Ni	H	0.400	80	0.02500	20	8.900	4.460
Ni	H	0.400	82	0.01200	20	8.900	4.460

Experimental Data

Target	Projectile	Energy	Symbol	y(0)	a	f
Ni	H	1.000	A	0.01515	80.3	1.98
Ni	H	4.000	0	0.01263	83.8	1.82
Ni	H	50.000	□	0.00365	87.8	1.61

Calculated Data

Target	Projectile	Energy	Symbol	y(0)	*a*	f
Ni	H	1.000	A	0.01520	78.7	2.29
Ni	H	50.000	■	0.00278	87.8	1.78

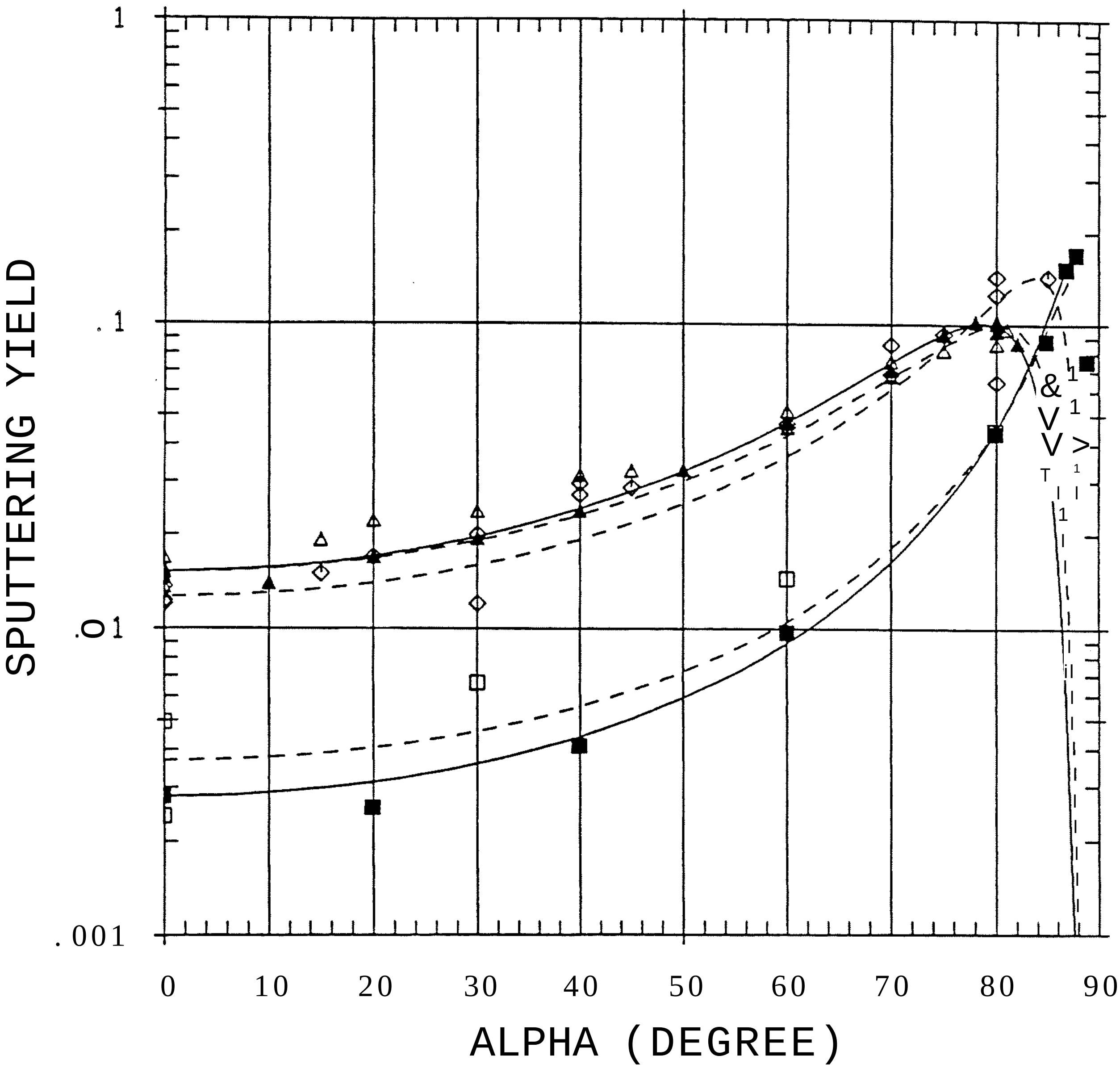


Fig. 115: Angular dependence of the sputtering yield of Ni with 1 , 4 and 50 keV H ions. The value of »opt for the 4 and 50 keV experimental data was estimated or taken from the calculated data for fitting. The data are partly published in [48,71].

Experimental Data

Target	■Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
Ni	H	1.000	0	0.01360	20	3	II	85	03.12.76
Ni	H	1.000	0	0.01460	20	3	II	98	18.12.76
Ni	H	1.000	0	0.01550	20	3	II	135	20.04.77
Ni	H	1.000	0	0.01690	20	3	III	152	03.10.78
Ni	H	1.000	15	0.01930	20	3	II	133	15.04.77
Ni	H	1.000	20	0.02230	20	3	III	153	05.10.78
Ni	H	1.000	30	0.02390	20	3	II	130	13.04.77
Ni	H	1.000	40	0.03170	20	3	III	150	28.09.78
Ni	H	1.000	45	0.03270	20	3	II	129	05.04.77
Ni	H	1.000	60	0.04560	20	3	II	128	05.04.77
Ni	H	1.000	60	0.05200	20	3	III	150	29.09.78
Ni	H	1.000	70	0.06760	20	3	II	140	03.05.77
Ni	H	1.000	70	0.07580	20	3	III	153	06.10.78
Ni	H	1.000	75	0.08250	20	3	II	140	04.05.77
Ni	H	1.000	80	0.10100	20	3	II	141	04.05.77
Ni	H	1.000	80	0.10300	20	3	III	150	29.09.78
Ni	H	1.000	80	0.08640	20	3	V	130	02.03.82
Ni	H	1.000	81	0.09640	20	3	II	142	06.05.77
Ni	H	1.000	85	0.06350	20	3	II	163	04.07.77

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
Ni	H	4.000	0	0.01200	20	2	II	84	01.12.76
Ni	H	4.000	0	0.01230	20	2	II	134	19.04.77
Ni	H	4.000	0	0.01360	20	2	III	147	22.09.78
Ni	II	4.000	15	0.01500	20	2	II	133	15.04.77
Ni	H	4.000	20	0.01700	20	2	III	152	04.10.78
Ni	H	4.000	30	0.01200	20	2	II	130	13.04.77
Ni	H	4.000	30	0.02000	20	2	II	134	18.04.77
Ni	H	4.000	40	0.02960	20	2	III	148	25.09.78
Ni	H	4.000	40	0.02710	20	2	III	149	27.09.78
Ni	H	4.000	45	0.02870	20	2	II	129	06.04.77
Ni	H	4.000	60	0.04710	20	2	II	129	06.04.77
Ni	H	4.000	60	0.04580	20	2	III	149	26.09.78
Ni	H	4.000	70	0.06850	20	2	II	140	04.05.77
Ni	H	4.000	70	0.08570	20	2	III	154	06.10.78
Ni	H	4.000	75	0.09290	20	2	II	147	16.05.77
Ni	H	4.000	80	0.12500	20	2	II	147	12.05.77
Ni	H	4.000	80	0.14300	20	2	III	149	27.09.78
Ni	H	4.000	80	0.06460	31	2	V	113	14.12.81
Ni	H	4.000	85	0.14300	20	2	II	148	18.05.77

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
Ni	II	50.000	0	0.00490	20	1			PHARAO82
Ni	H	50.000	0	0.00240	20	1			PHARAO82
Ni	H	50.000	30	0.00660	20	1			PHARAO82
Ni	H	50.000	60	0.01450	20	1			PIIARAO82
Ni	H	50.000	80	0.04520	20	1			PHARAO82

Calculated Data

Target	Proj.	Energy	Angle	Yield	Temp.	p	SBE
Ni	H	1.000	0	0.01520	20	8.900	4.460
Ni	H	1.000	10	0.01400	20	8.900	4.460
Ni	H	1.000	20	0.01700	20	8.900	4.460
Ni	H	1.000	30	0.01950	20	8.900	4.460
Ni	H	1.000	40	0.02400	20	8.900	4.460
Ni	H	1.000	50	0.03300	20	8.900	4.460
Ni	H	1.000	60	0.04800	20	8.900	4.460
Ni	H	1.000	70	0.07100	20	8.900	4.460
Ni	H	1.000	75	0.09300	20	8.900	4.460
Ni	H	1.000	78	0.10200	20	8.900	4.460
Ni	H	1.000	80	0.10100	20	8.900	4.460
Ni	H	1.000	80	0.09500	20	8.900	4.460
Ni	H	1.000	82	0.08700	20	8.900	4.460
Ni	H	1.000	85	0.03800	20	8.900	4.460
Ni	H	1.000	87	0.00036	20	8.900	4.460

Target	Proj.	Energy	Angle	Yield	Temp.	ρ	SBE
Ni	H	50.000	0	0.00278	20	8.900	4.460
Ni	H	50.000	20	0.00255	20	8.900	4.460
Ni	H	50.000	40	0.00409	20	8.900	4.460
Ni	H	50.000	60	0.00968	20	8.900	4.460
Ni	H	50.000	80	0.04420	20	8.900	4.460
Ni	H	50.000	85	0.08970	20	8.900	4.460
Ni	H	50.000	87	0.15400	20	8.900	4.460
Ni	H	50.000	88	0.17200	20	8.900	4.460
Ni	H	50.000	89	0.07680	20	8.900	4.460

Experimental Data

Target	Projectile	Energy	Symbol	y(0)	a	f
~Ni	D	1.000	Ö	0.04255	80	177

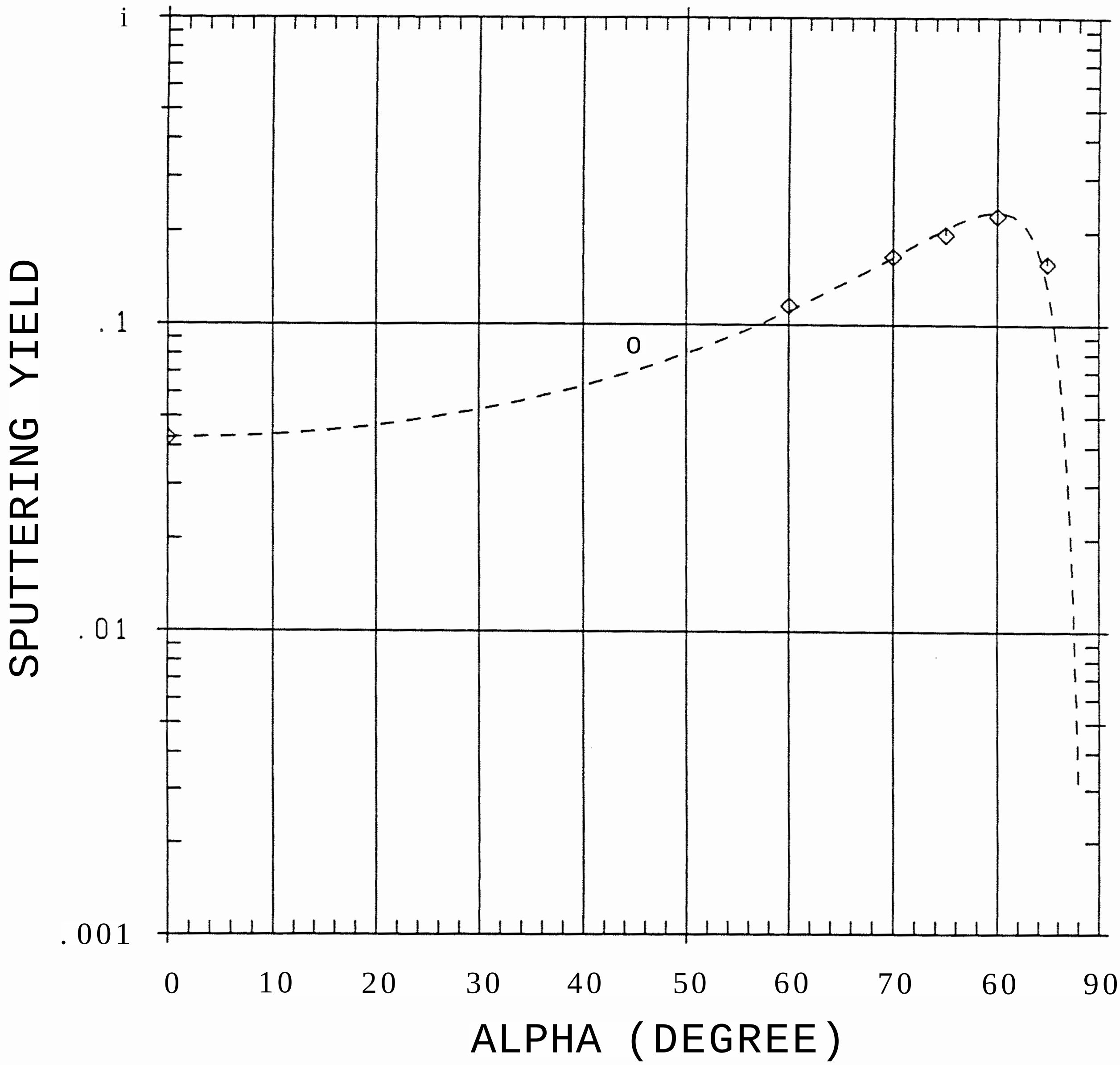


Fig. 116: Angular dependence of the sputtering yield of Ni with 1 keV D ions. The data are published in [69],

Experimental Data

Target	' Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
Ni	D	1.000	0	0.04250	20	3	II	154	16.06.77
Ni	D	1.000	0	0.04260	20	3	VIII	185	28.08.86
Ni	D	1.000	45	0.08500	20	3	II	151	08.06.77
Ni	D	1.000	60	0.11500	20	3	II	150	07.06.77
Ni	D	1.000	70	0.16600	20	3	II	146	11.05.77
Ni	D	1.000	75	0.19600	20	3	II	146	11.05.77
Ni	D	1.000	80	0.22600	20	3	II	146	11.05.77
Ni	D	1.000	85	0.15800	20	3	II	163	04.07.77

Experimental Data

Target	Projectile	Energy	Symbol	y(0)	a	f
Ni	He	4.000	0	0.19500	82.2	1.29
Ni	He	100.000	A	0.05495	87.6	1.10

Calculated Data

Target	Projectile	Energy	Symbol	y(0)	a	f
Ni	He	100.000	A	0.02320	87.6	1.71

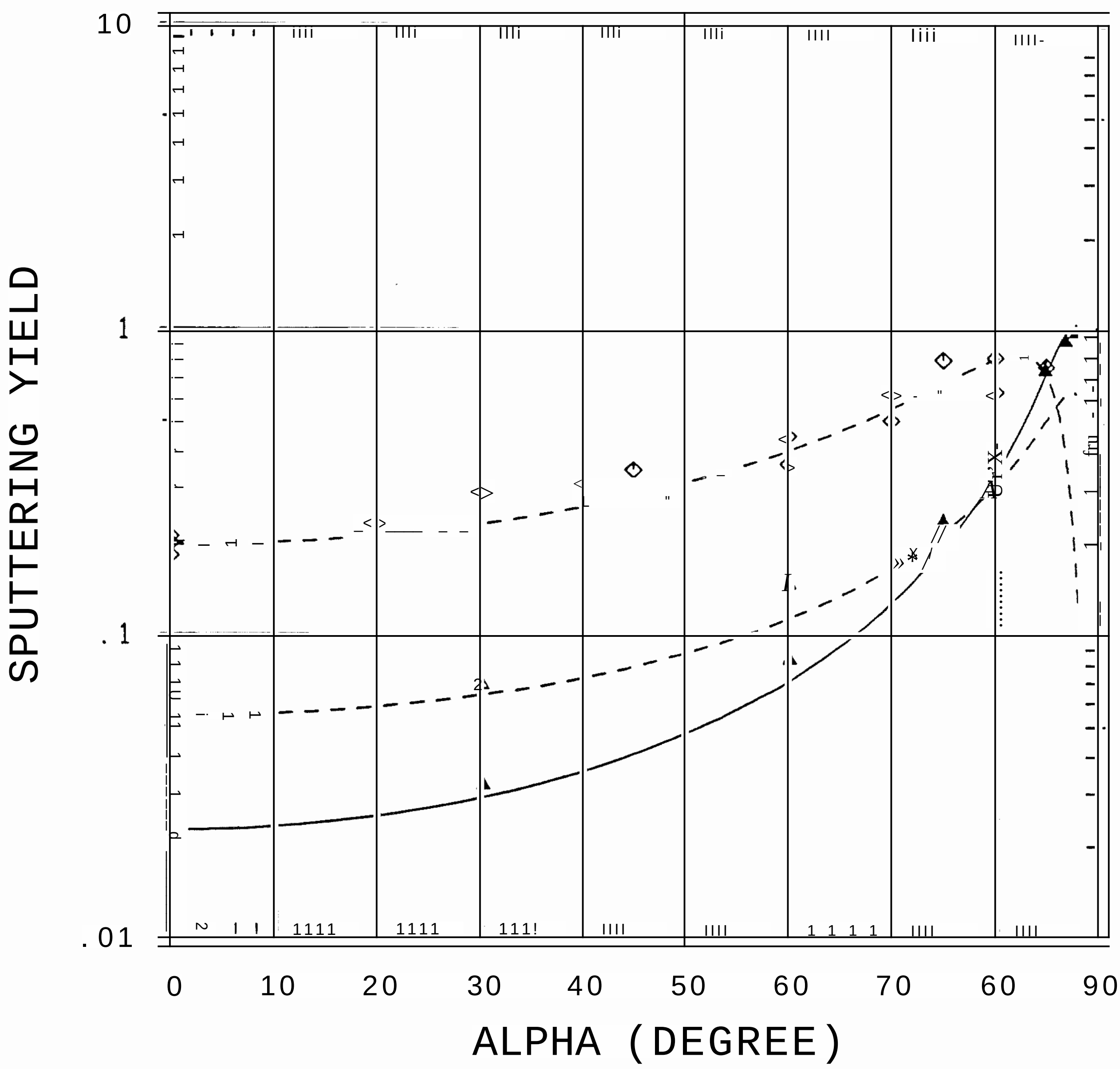


Fig. 117: Angular dependence of the sputtering yield of Ni with 4 and 100 keV He ions. The value of a $_{opt}$ for the 100 keV experimental data was taken from the calculated data for fitting. The data are partly published in [69].

Experimental Data

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
Ni	He	4.000	0	0.20800	20	1	II	88	09.12.76
Ni	He	4.000	0	0.19700	20	1	II	155	21 06.77
Ni	He	4.000	0	0.18000	20	1	III	152	04.10.78
Ni	He	4.000	20	0.23300	20	2	III	153	05.10.78
Ni	He	4.000	30	0.29600	20	1	II	156	21.06.77
Ni	He	4.000	40	0.30700	20	1	III	151	02.10.78
Ni	He	4.000	45	0.34600	20	1	II	150	07.06.77
Ni	He	4.000	60	0.44900	20	1	II	150	07.06.77
Ni	He	4.000	60	0.36200	20	1	III	151	03.10.78
Ni	He	4.000	70	0.50800	20	1	II	149	03.06.77
Ni	He	4.000	70	0.63700	20	1	II	167	12.07.77
Ni	He	4.000	75	0.80600	20	1	II	165	07.07.77
Ni	He	4.000	80	0.63600	20	1	II	149	06.06.77
Ni	He	4.000	80	0.82200	20	1	III	151	02.10.78
Ni	He	4.000	85	0.76900	20	1	II	163	04.07.77

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
Ni	He	100.000	0	0.04580	20	1			PHARAO82
Ni	He	100.000	0	0.06410	20	1			PHARAO82
Ni	He	100.000	30	0.07060	20	1			PHARAO82
Ni	He	100.000	60	0.14800	20	1			PHARAO82
Ni	He	100.000	80	0.29600	20	1			PHARAO82

Calculated Data

Target	Proj.	Energy	Angle	Yield	Temp.	P	SBE
Ni	He	100.000	0	0.02320	20	8.900	4.460
Ni	He	100.000	30	0.03280	20	8.900	4.460
Ni	He	100.000	60	0.08440	20	8.900	4.460
Ni	He	100.000	75	0.23350	20	8.900	4.460
Ni	He	100.000	80	0.32700	20	8.900	4.460
Ni	He	100.000	85	0.75020	20	8.900	4.460
Ni	He	100.000	87	0.93740	20	8.900	4.460
Ni	He	100.000	88	0.99870	20	8.900	4.460
Ni	He	100.000	89	0.41230	20	8.900	4.460

Projectile: Ni

Calculated Data

Target	Projectile	Energy	Symbol	y(0)	a	f
Ni	Ni	0.100	■	0.12420	62.4	6.40
Ni	Ni	1.000	♦	2.03300	62.5	2.98

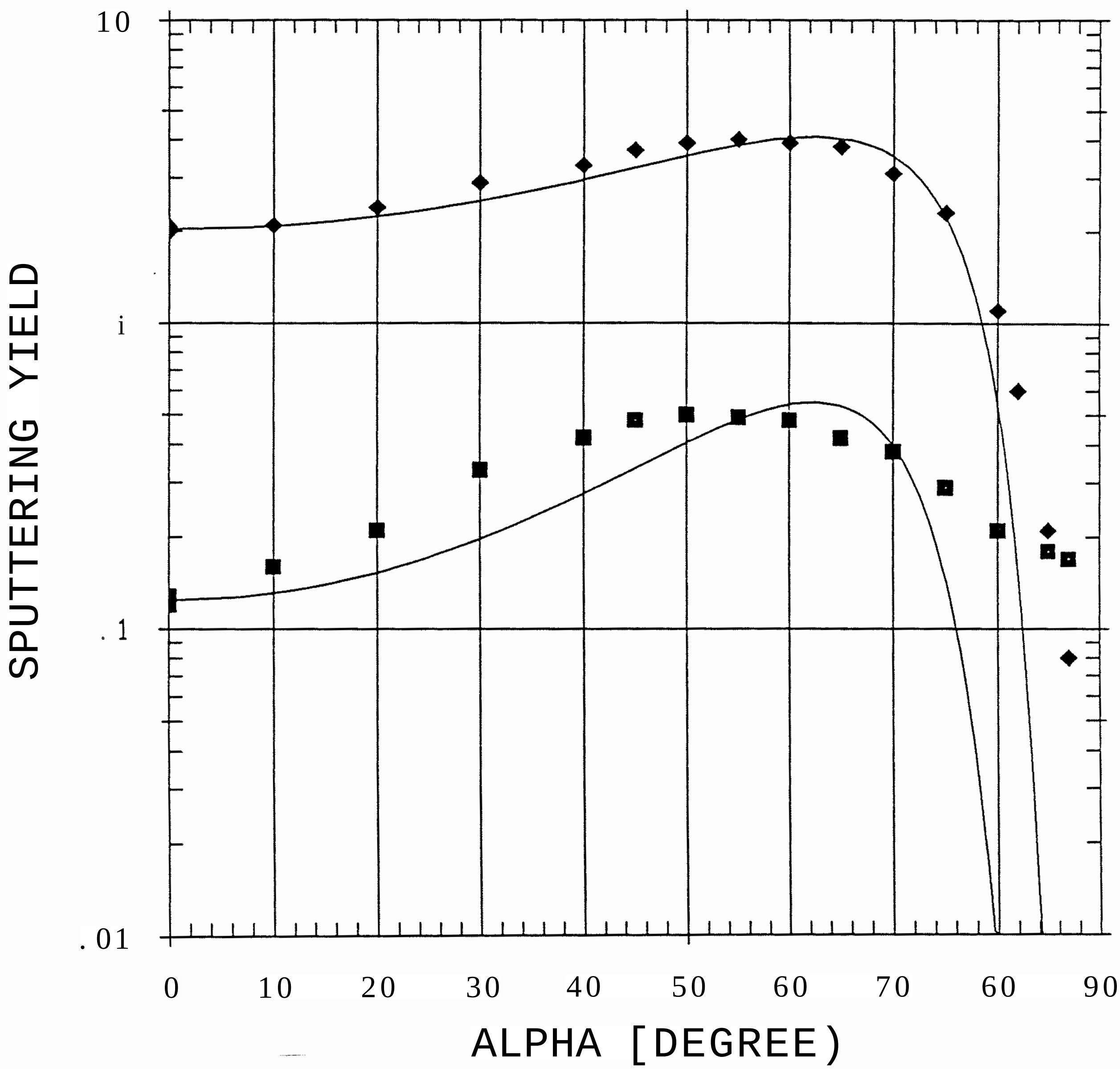


Fig. 118: Angular dependence of the sputtering yield of Ni with 0.1 and 1 keV Ni ions. The data are published in [38].

Calculated Data

Target ■	Proj.	Energy	Angle	Yield	Temp.	*P*	SEE
Ni	Ni	0.100	0	0.12840	20	8.900	4.460
Ni	Ni	0.100	0	0.12000	20	8.900	4.460
Ni	Ni	0.100	10	0.16000	20	8.900	4.460
Ni	Ni	0.100	20	0.21000	20	8.900	4.460
Ni	Ni	0.100	30	0.33000	20	8.900	4.460
Ni	Ni	0.100	40	0.42000	20	8.900	4.460
Ni	Ni	0.100	45	0.48000	20	8.900	4.460
Ni	Ni	0.100	50	0.50000	20	8.900	4.460
Ni	Ni	0.100	55	0.49000	20	8.900	4.460
Ni	Ni	0.100	60	0.48000	20	8.900	4.460
Ni	Ni	0.100	65	0.42000	20	8.900	4.460
Ni	Ni	0.100	70	0.38000	20	8.900	4.460
Ni	Ni	0.100	75	0.29000	20	8.900	4.460
Ni	Ni	0.100	80	0.21000	20	8.900	4.460
Ni	Ni	0.100	85	0.18000	20	8.900	4.460
Ni	Ni	0.100	87	0.17000	20	8.900	4.460

Target	Proj.	Energy	Angle	Yield	Temp.	*P*	SBE
Ni	Ni	1.000	0	2.06600	20	8.900	4.460
Ni	Ni	1.000	0	2.00000	20	8.900	4.460
Ni	Ni	1.000	10	2.10000	20	8.900	4.460
Ni	Ni	1.000	20	2.40000	20	8.900	4.460
Ni	Ni	1.000	30	2.90000	20	8.900	4.460
Ni	Ni	1.000	40	3.30000	20	8.900	4.460
Ni	Ni	1.000	45	3.70000	20	8.900	4.460
Ni	Ni	1.000	50	3.90000	20	8.900	4.460
Ni	Ni	1.000	55	4.00000	20	8.900	4.460
Ni	Ni	1.000	60	3.90000	20	8.900	4.460
Ni	Ni	1.000	65	3.80000	20	8.900	4.460
Ni	Ni	1.000	70	3.10000	20	8.900	4.460
Ni	Ni	1.000	75	2.30000	20	8.900	4.460
Ni	Ni	1.000	80	1.10000	20	8.900	4.460
Ni	Ni	1.000	82	0.60000	20	8.900	4.460
Ni	Ni	1.000	85	0.21000	20	8.900	4.460
Ni	Ni	1.000	87	0.08000	20	8.900	4.460

Projectile: He

Experimental Data						
Target	Projectile	Energy	Symbol	y(0)	ϱ	f
Si	He	0.200	A	0.04610	71.4	3.62
Si	He	3.000	▹	0.09735	74.6	2.69

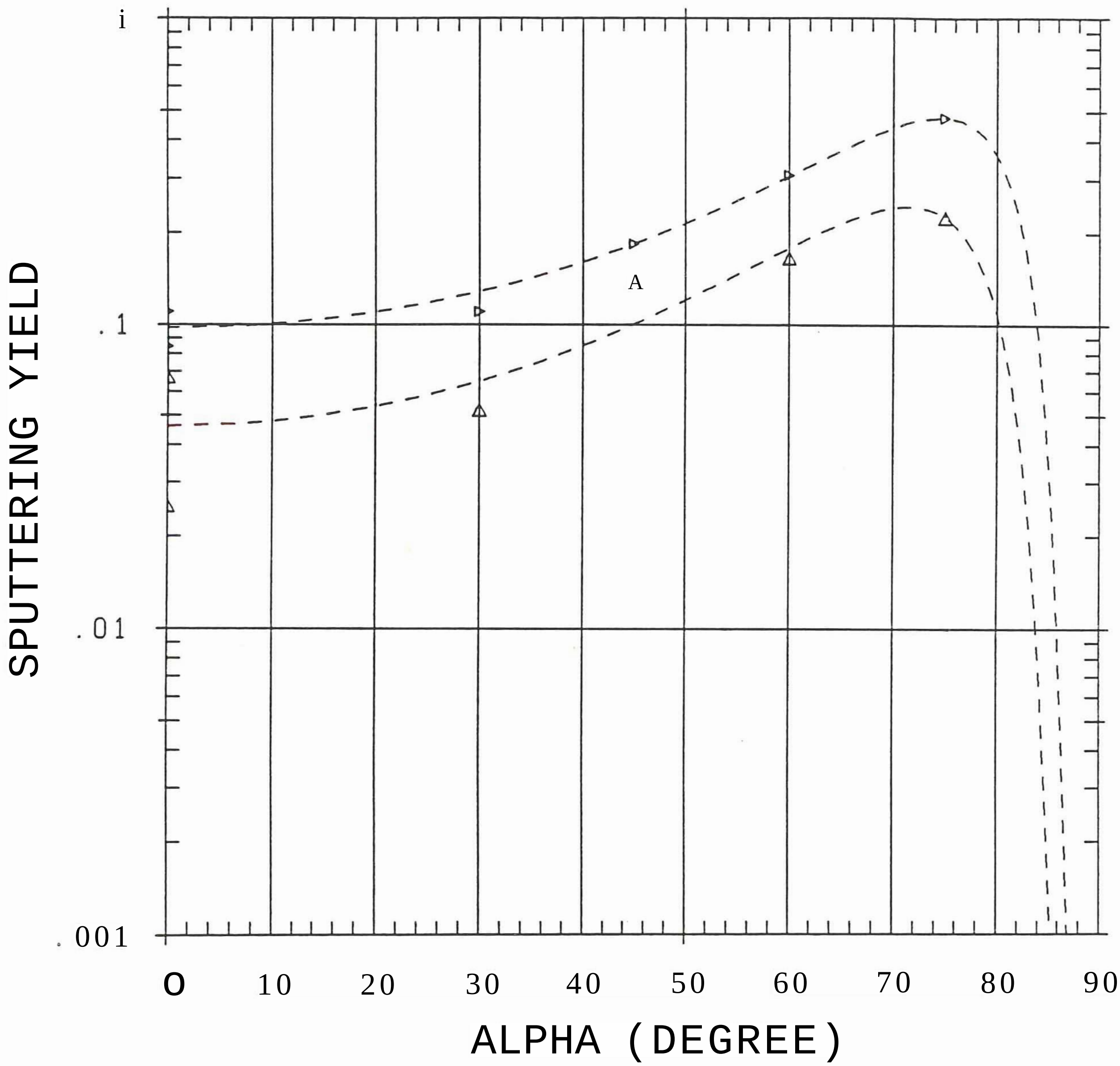


Fig. 119: Angular dependence of the sputtering yield of Si with 0.2 and 3 keV He ions. The data are unpublished.

Experimental Data

Target	-Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
Si	He	0.200	0	0.06700	20	1	III	50	22.02.78
Si	He	0.200	0	0.02520	20	1	IX	149	29.03.88
Si	He	0.200	30	0.05210	20	1	IX	155	14.04.88
Si	He	0.200	45	0.13700	20	1	IX	149	28.03.88
Si	He	0.200	60	0.16600	20	1	IX	149	28.03.88
Si	He	0.200	75	0.22600	20	1	IX	148	23.03.88

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
Si	He	3.000	0	0.08470	20	1	IX	145	08.03.88
Si	He	3.000	0	0.11000	20	1	IX	146	11.03.88
Si	He	3.000	30	0.11000	20	1	IX	146	09.03.88
Si	He	3.000	45	0.18400	20	1	IX	146	10.03.88
Si	He	3.000	60	0.30900	20	1	IX	145	09.03.88
Si	He	3.000	75	0.47600	20	1	IX	145	08.03.88

Experimental Data

Target	Projectile	Energy	Symbol	y(0)	a	f
~ Ta	H	25.000	□	0.00232	8T2	2T5

Calculated Data

Target	Projectile	Energy	Symbol	y(0)	*a*	*f*
~Ta	H	25.000	■	0.00195	8T2	L83

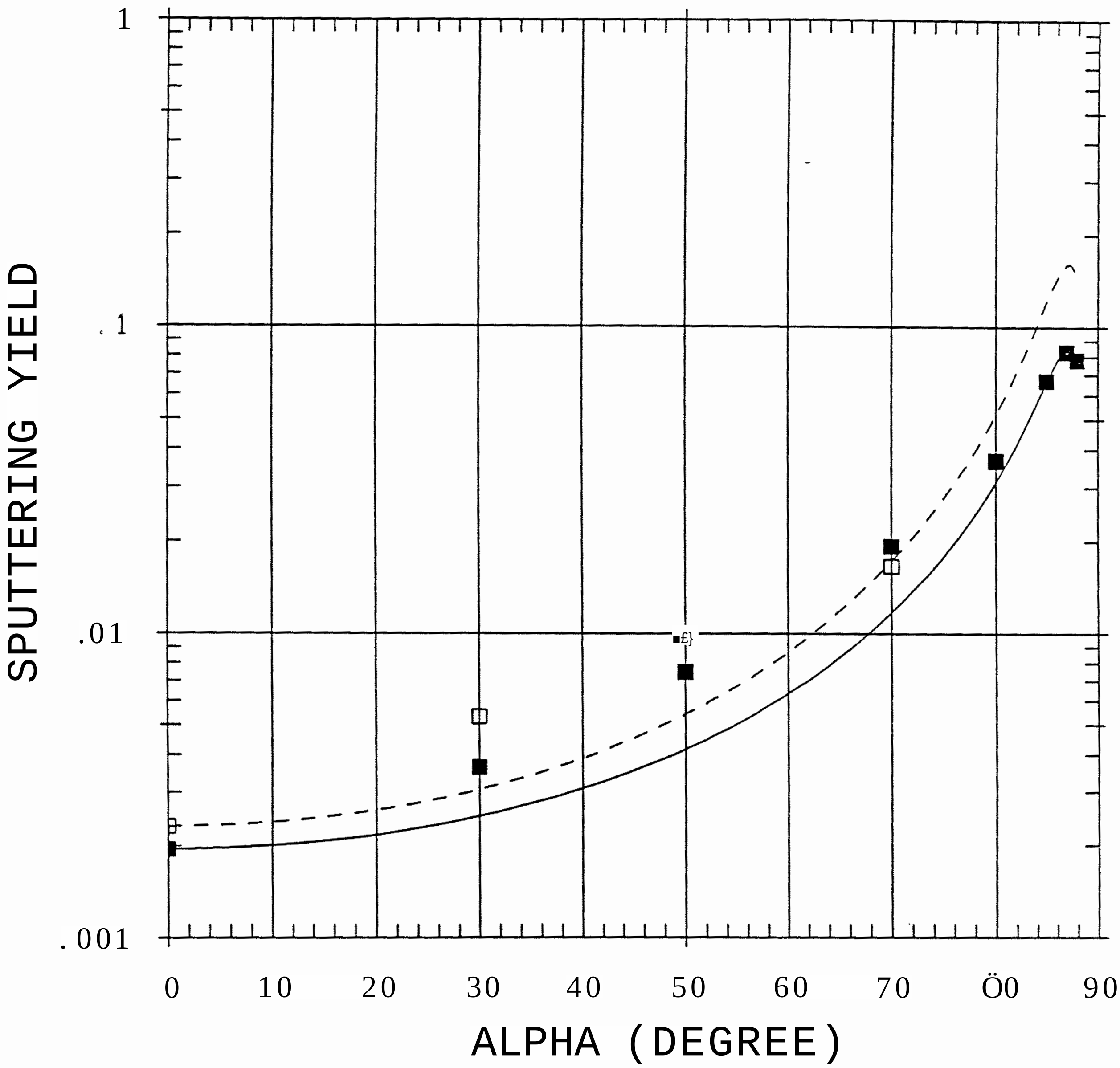


Fig. 120: Angular dependence of the sputtering yield of Ta with 25 keV II ions. The value of a $_{opt}$ for the experimental data was taken from the calculated data for fitting. The data are published in [48].

Experimental Data

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
Ta	H	25.000	0	0.00232	20	1			1976
Ta	H	25.000	30	0.00532	20	1			PHARAO82
Ta	H	25.000	50	0.00994	20	1			PHARAO82
Ta	H	25.000	70	0.01660	20	1			PHARAO82

Calculated Data

Target	Proj.	Energy	Angle	Yield	Temp.	p	SBE
Ta	H	25.000	0	0.00195	20	16.600	8.100
Ta	H	25.000	30	0.00363	20	16.600	8.100
Ta	H	25.000	50	0.00748	20	16.600	8.100
Ta	H	25.000	70	0.01930	20	16.600	8.100
Ta	H	25.000	80	0.03678	20	16.600	8.100
Ta	H	25.000	85	0.06692	20	16.600	8.100
Ta	H	25.000	87	0.08296	20	16.600	8.100
Ta	H	25.000	88	0.07810	20	16.600	8.100

Projectile: He

Experimental Data

Target	Projectile	Energy	Symbol	y(0)	a	f
~T	He	100.000	Ä	0.01260	855	E68

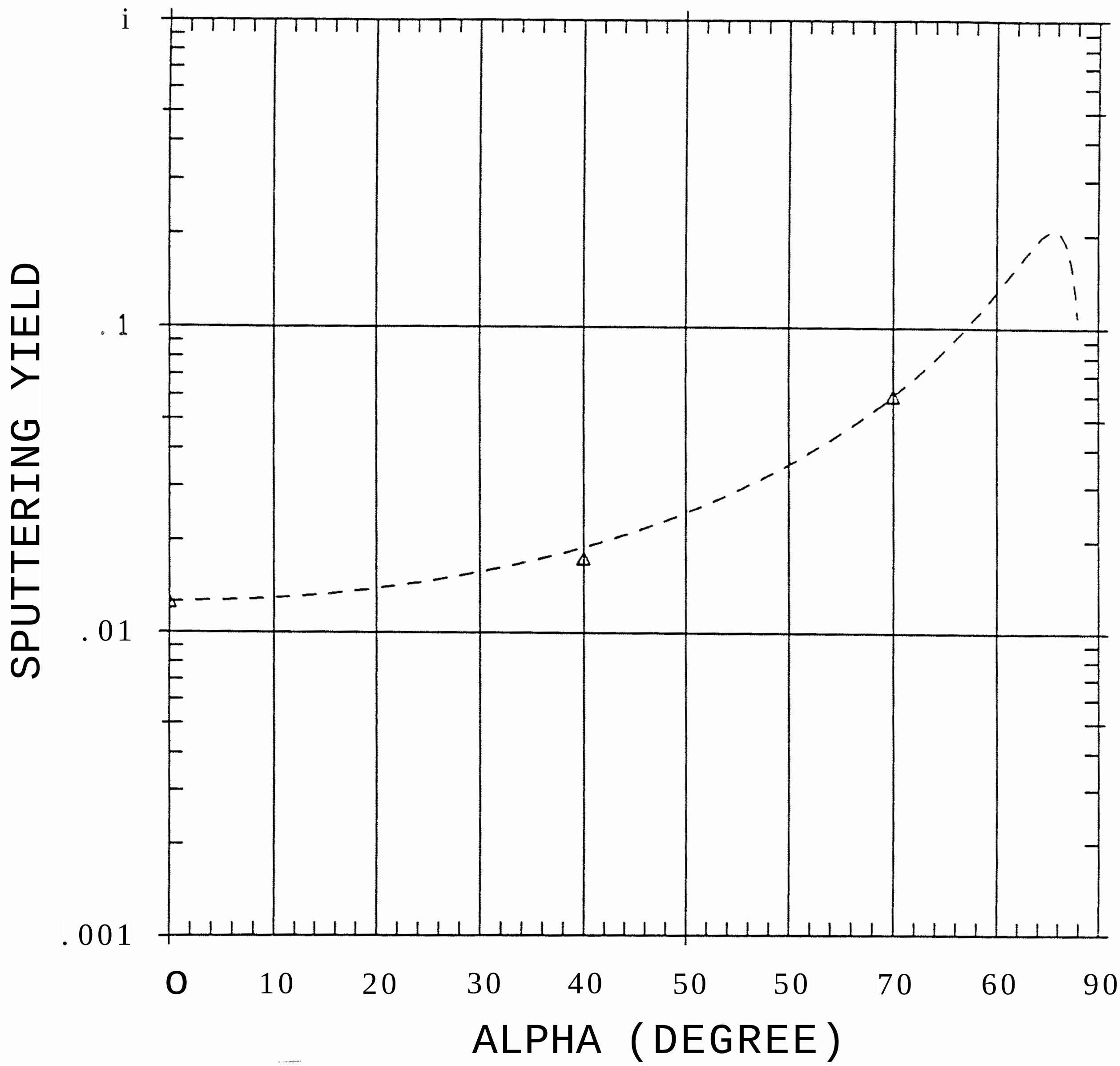


Fig. 121: Angular dependence of the sputtering yield of Ti with 100 keV He ions. The value of a_{op}t was estimated for fitting. The data are unpublished.

Experimental Data

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
Ti	He	100.000	0	0.01260	20	1			PHARAO82
Ti	He	100.000	40	0.01750	20	1			PHARAO82
Ti	He	100.000	70	0.06000	20	1			PHARAO82

Calculated Data

Target	Projectile	Energy	Symbol	y(0)	a	f
Ti	Ne	0.038	■	0.01020	60.0	7.44
Ti	Ne	0.380	▶	0.53300	64.3	3.79
Ti	Ne	3.800	▸	1.08000	75.8	2.24

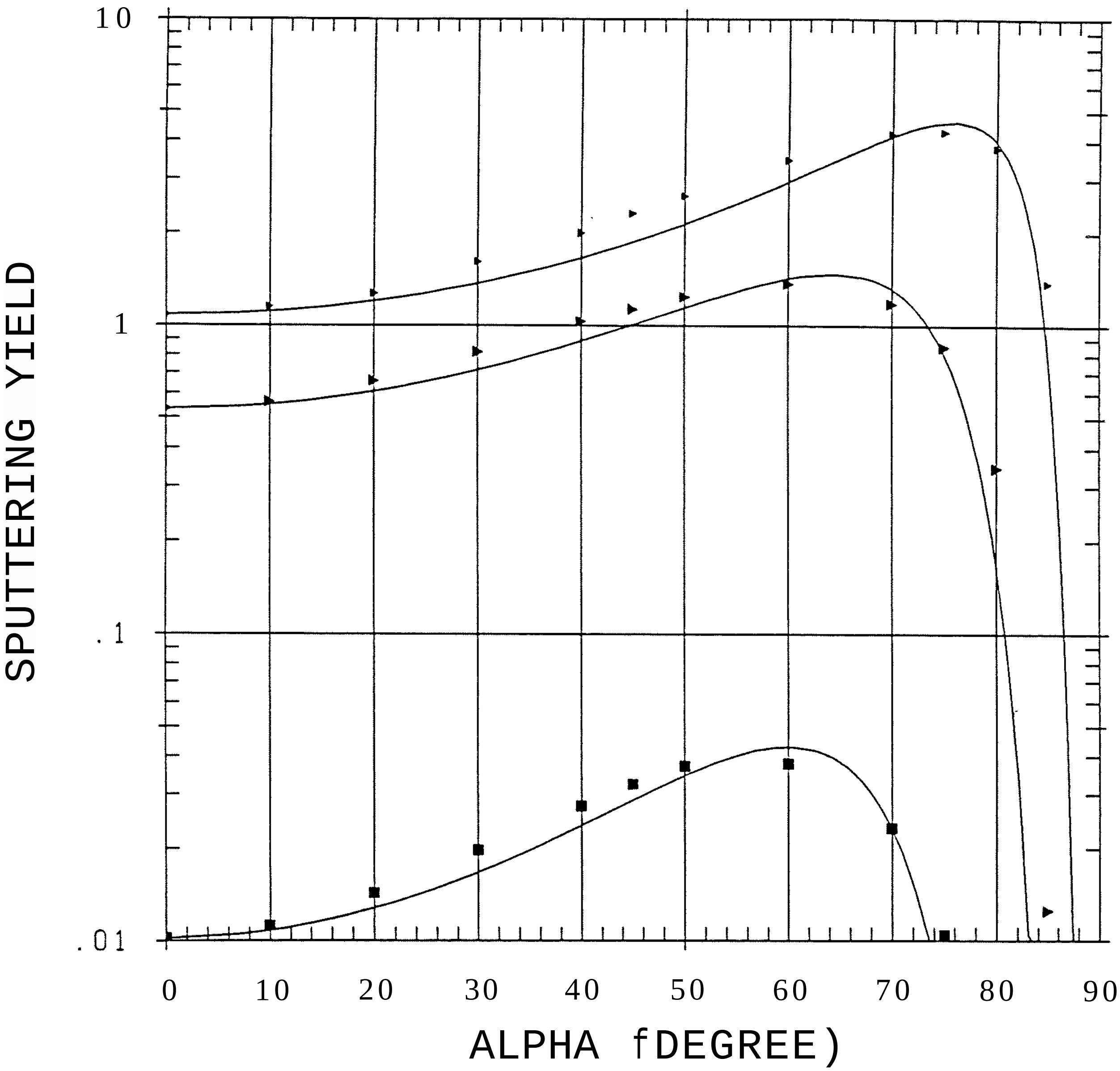


Fig. 122: Angular dependence of the sputtering yield of Ti with 0.038 , 0.38 and 3.8 keV Ne ions. The data are unpublished.

Calculated Data

Target	Proj.	Energy	Angle	Yield	Temp.	P	SEE
Ti	Ne	0.038	0	0.0102	20	4.510	4.890
Ti	Ne	0.038	10	0.0112	20	4.510	4.890
Ti	Ne	0.038	20	0.0143	20	4.510	4.890
Ti	Ne	0.038	30	0.0198	20	4.510	4.890
Ti	Ne	0.038	40	0.0275	20	4.510	4.890
Ti	Ne	0.038	45	0.0324	20	4.510	4.890
Ti	Ne	0.038	50	0.0371	20	4.510	4.890
Ti	Ne	0.038	60	0.0379	20	4.510	4.890
Ti	Ne	0.038	70	0.0234	20	4.510	4.890
Ti	Ne	0.038	75	0.0104	20	4.510	4.890
Ti	Ne	0.038	80	0.0021	20	4.510	4.890
Ti	Ne	0.038	85	0.0000	20	4.510	4.890

Target	Proj.	Energy	Angle	Yield	Temp.	P	SEE
Ti	Ne	0.380	0	0.5330	20	4.510	4.890
Ti	Ne	0.380	10	0.5620	20	4.510	4.890
Ti	Ne	0.380	20	0.6580	20	4.510	4.890
Ti	Ne	0.380	30	0.8170	20	4.510	4.890
Ti	Ne	0.380	40	1.0300	20	4.510	4.890
Ti	Ne	0.380	45	1.1300	20	4.510	4.890
Ti	Ne	0.380	50	1.2400	20	4.510	4.890
Ti	Ne	0.380	60	1.3700	20	4.510	4.890
Ti	Ne	0.380	70	1.1800	20	4.510	4.890
Ti	Ne	0.380	75	0.8510	20	4.510	4.890
Ti	Ne	0.380	80	0.3460	20	4.510	4.890
Ti	Ne	0.380	85	0.0125	20	4.510	4.890

Target	Proj.	Energy	Angle	Yield	Temp.	P	SEE
Ti	Ne	3.800	0	1.0800	20	4.510	4.890
Ti	Ne	3.800	10	1.1500	20	4.510	4.890
Ti	Ne	3.800	20	1.2700	20	4.510	4.890
Ti	Ne	3.800	30	1.6100	20	4.510	4.890
Ti	Ne	3.800	40	2.0000	20	4.510	4.890
Ti	Ne	3.800	45	2.3200	20	4.510	4.890
Ti	Ne	3.800	50	2.6500	20	4.510	4.890
Ti	Ne	3.800	60	3.4700	20	4.510	4.890
Ti	Ne	3.800	70	4.2200	20	4.510	4.890
Ti	Ne	3.800	75	4.3000	20	4.510	4.890
Ti	Ne	3.800	80	3.8100	20	4.510	4.890
Ti	Ne	3.800	85	1.3800	20	4.510	4.890

Calculated Data

Target	Projectile	Energy	Symbol	y(0)	a	f
“	H	2.000	i	0.00413	8X5	E37

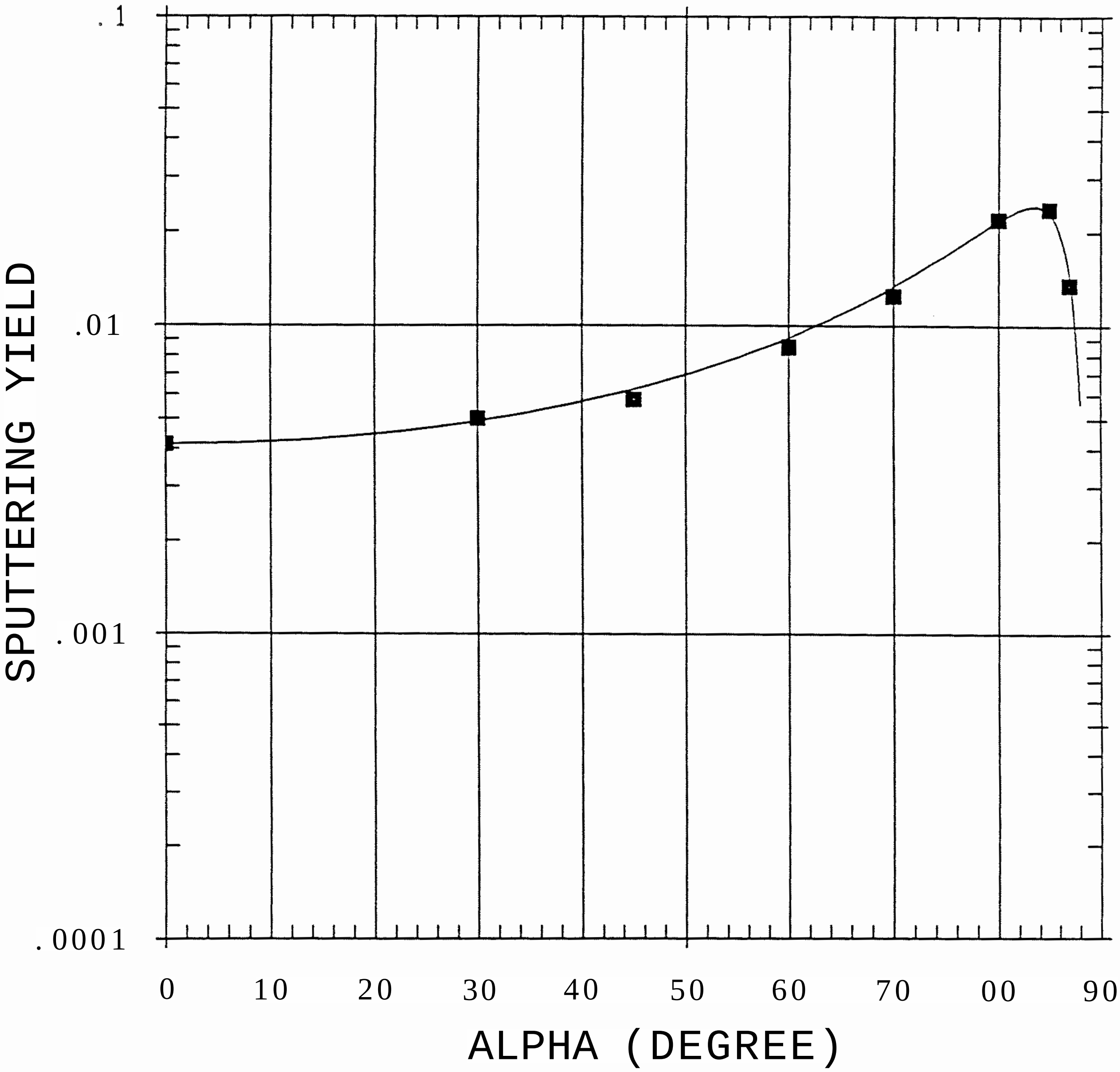


Fig. 123: Angular dependence of the sputtering yield of U with 2 keV H ions. The data are unpublished.

Calculated Data

Target •	Proj.	Energy	Angle	Yield	Temp.	p	SBE
U	H	2.000	0	0.00413	20	19.070	5.420
U	H	2.000	30	0.00501	20	19.070	5.420
U	H	2.000	45	0.00578	20	19.070	5.420
U	H	2.000	60	0.00853	20	19.070	5.420
U	H	2.000	70	0.01242	20	19.070	5.420
U	H	2.000	80	0.02196	20	19.070	5.420
U	H	2.000	85	0.02375	20	19.070	5.420
U	H	2.000	87	0.01350	20	19.070	5.420

Calculated Data

Target	Projectile	Energy	Symbol	y(0)	*a*	f
U	Kr	17.900	■	5.76000	75T	L28

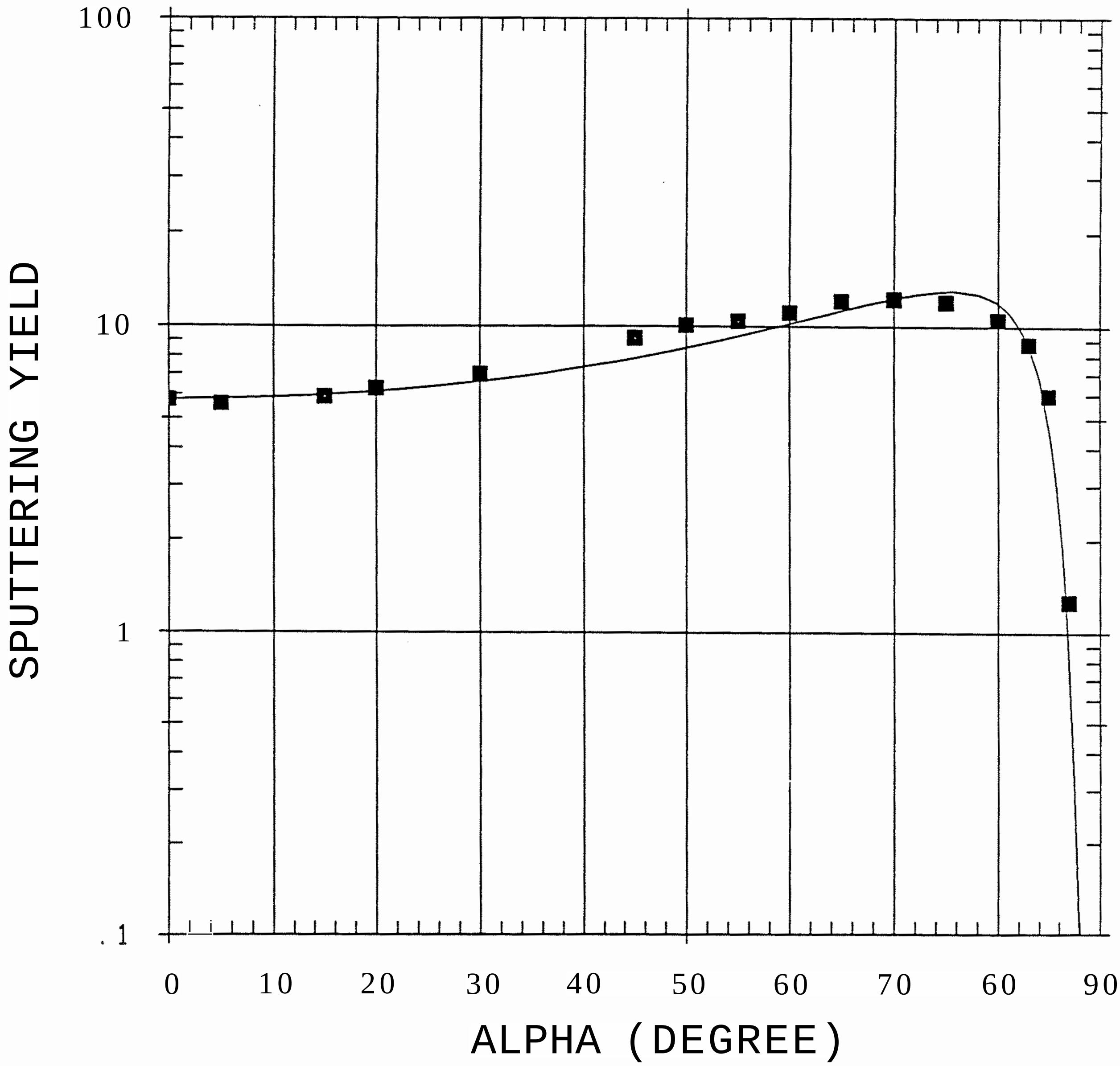


Fig. 124: Angular dependence of the sputtering yield of U with 17.9 keV Kr ions. The data are unpublished.

Calculated Data

Target .	Proj.	Energy	Angle	Yield	Temp.	*P*	SBE
U	Kr	17.900	0	5.76000	20	19.070	5.420
U	Kr	17.900	5	5.57000	20	19.070	5.420
U	Kr	17.900	15	5.88000	20	19.070	5.420
u	Kr	17.900	20	6.26000	20	19.070	5.420
u	Kr	17.900	30	6.97000	20	19.070	5.420
u	Kr	17.900	45	9.15000	20	19.070	5.420
u	Kr	17.900	50	10.09000	20	19.070	5.420
u	Kr	17.900	55	10.39000	20	19.070	5.420
u	Kr	17.900	60	11.08000	20	19.070	5.420
u	Kr	17.900	65	12.08000	20	19.070	5.420
u	Kr	17.900	70	12.25000	20	19.070	5.420
u	Kr	17.900	75	12.01000	20	19.070	5.420
u	Kr	17.900	80	10.53000	20	19.070	5.420
u	Kr	17.900	83	8.78000	20	19.070	5.420
u	Kr	17.900	85	5.96000	20	19.070	5.420
u	Kr	17.900	87	1.26000	20	19.070	5.420

Projectile: H

Calculated Data

Target	Projectile	Energy	Symbol	y(0)	*a*	f
W	H	2.000	■	0.00242	82?3	E46

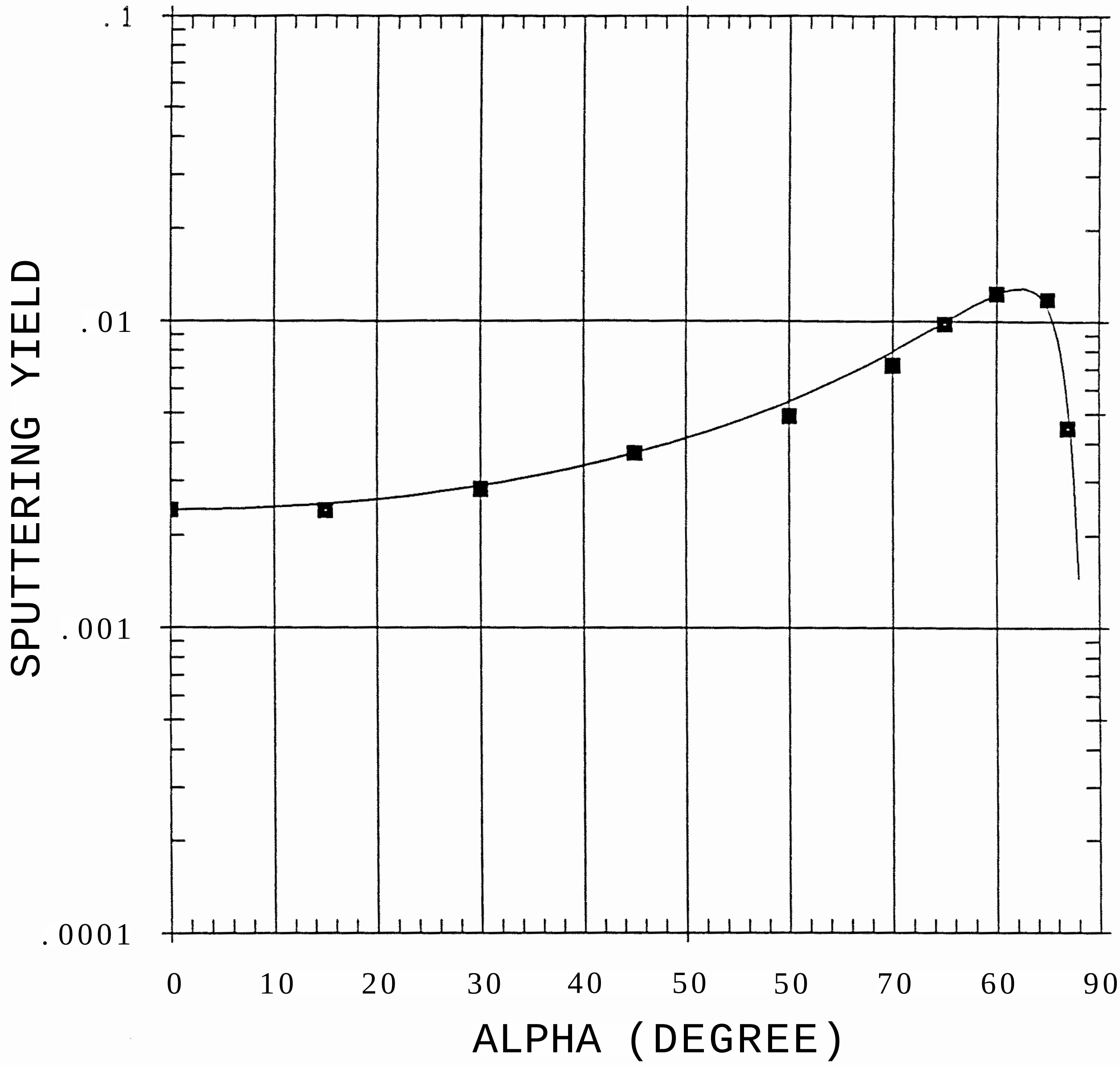


Fig. 125: Angular dependence of the sputtering yield of W with 2 keV II ions. The data are unpublished.

Calculated Data

Target ■	Proj.	Energy	Angle	Yield	Temp.	ρ	SBE
W	H	2.000	0	0.00242	20	19.300	8.680
W	H	2.000	15	0.00241	20	19.300	8.680
W	H	2.000	30	0.00282	20	19.300	8.680
W	H	2.000	45	0.00370	20	19.300	8.680
W	H	2.000	60	0.00490	20	19.300	8.680
W	H	2.000	70	0.00716	20	19.300	8.680
W	H	2.000	75	0.00977	20	19.300	8.680
W	H	2.000	80	0.01230	20	19.300	8.680
W	H	2.000	85	0.01180	20	19.300	8.680
W	H	2.000	87	0.00448	20	19.300	8.680

Experimental Data

Target	Projectile	Energy	Symbol	y(0)	a	f
~ W	OH	6.000	<	0.37800	717	L88

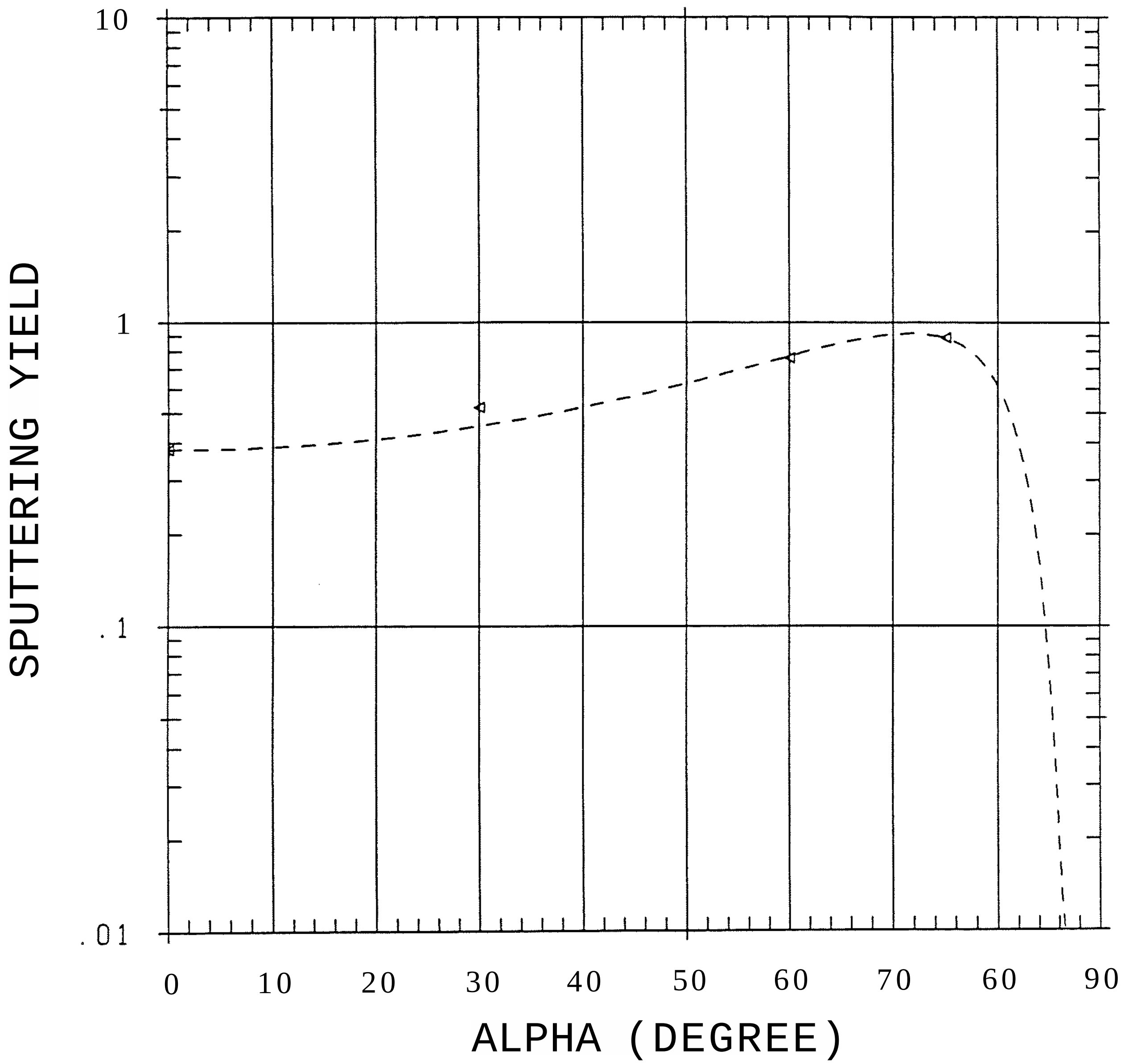


Fig. 126: Angular dependence of the sputtering yield of W with 6 keV OH ions. The data are unpublished.

Experimental Data

Target	■Proj.	Energy	Angle	Yield	Temp .	N	Book	Page	Date
ω	OH	6.000	0	0.37800	20	1	X	81	03.07 1989
	OH	6.000	30	0.52100	20	1	X	85	07.07.1989
ω	OH	6.000	60	0.75900	20	1	X	86	11.07 1989
ω	OH	6.000	75	0.88700	20	1	X	85	06.07.1989

Calculated Data

Target	Projectile	Energy	Symbol	y(0)	a	f
W	W	0.030	■	0.00001	82.5	6.14
w	W	•0.050	♦	0.00018	76.1	8.30
w	W	0.100	•	0.00831	69.0	8.67

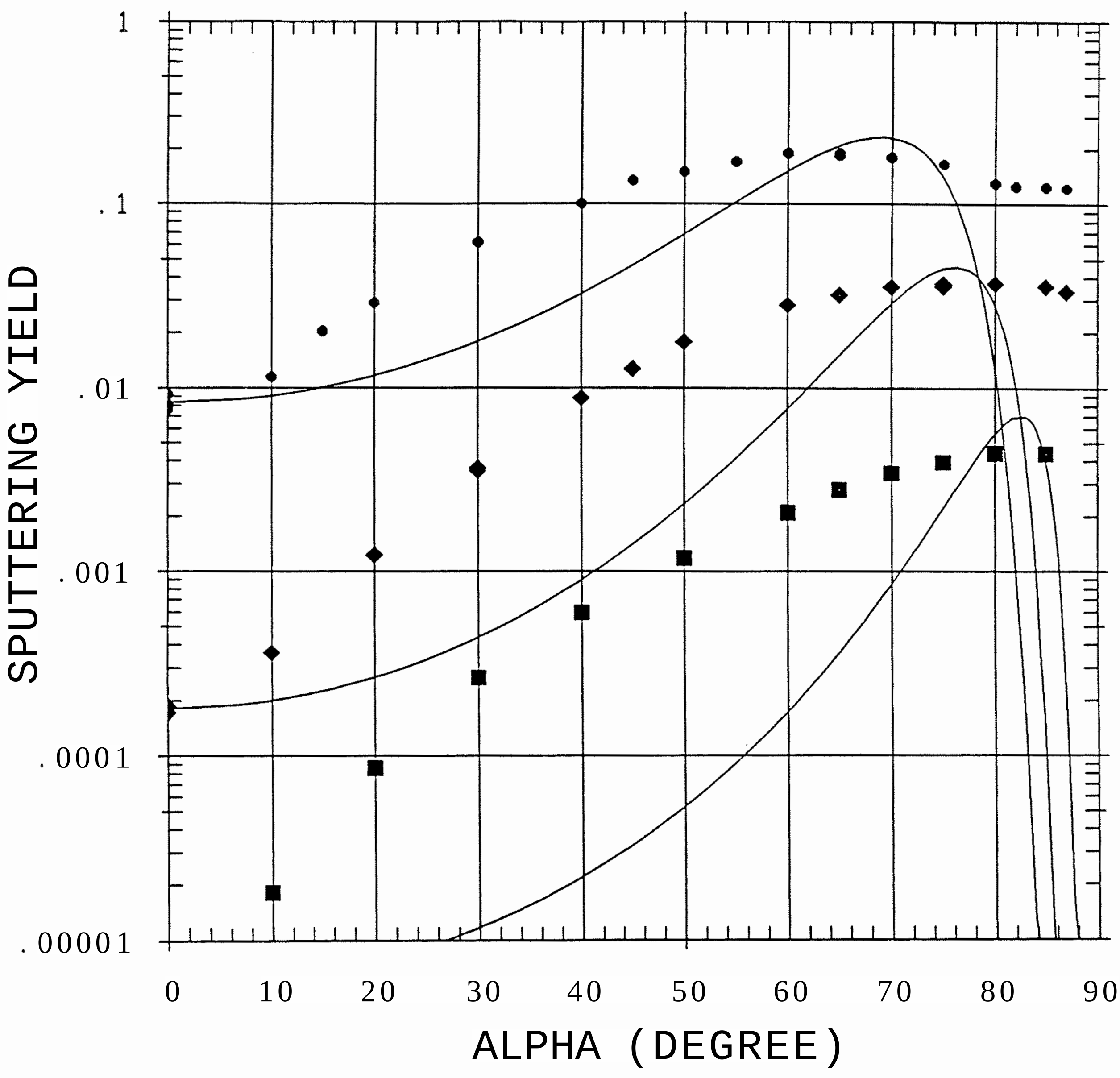


Fig. 127: Angular dependence of the sputtering yield of W with 30 , 50 and 100 eV W ions. The data are partly published in [38].

Calculated Data

Target	Proj.	Energy	Angle	Yield	Temp.	*P*	SEE
W	W	0.030	0	0.00001	20	19.300	8.680
W	W	0.030	10	0.00002	20	19.300	8.680
W	W	0.030	20	0.00009	20	19.300	8.680
W	W	0.030	30	0.00026	20	19.300	8.680
W	W	0.030	40	0.00060	20	19.300	8.680
W	W	0.030	50	0.00118	20	19.300	8.680
W	W	0.030	60	0.00209	20	19.300	8.680
W	W	0.030	65	0.00279	20	19.300	8.680
W	W	0.030	70	0.00343	20	19.300	8.680
W	W	0.030	75	0.00394	20	19.300	8.680
W	W	0.030	80	0.00442	20	19.300	8.680
W	W	0.030	85	0.00439	20	19.300	8.680

Target	Proj.	Energy	Angle	Yield	Temp.	*P*	SEE
W	W	0.050	0	0.00018	20	19.300	8.680
W	W	0.050	0	0.00017	20	19.300	8.680
W	W	0.050	0	0.00019	20	19.300	8.680
W	W	0.050	10	0.00036	20	19.300	8.680
W	W	0.050	20	0.00123	20	19.300	8.680
W	W	0.050	30	0.00365	20	19.300	8.680
W	W	0.050	30	0.00352	20	19.300	8.680
W	W	0.050	40	0.00885	20	19.300	8.680
W	W	0.050	45	0.01270	20	19.300	8.680
W	W	0.050	50	0.01780	20	19.300	8.680
W	W	0.050	60	0.02820	20	19.300	8.680
W	W	0.050	65	0.03217	20	19.300	8.680
W	W	0.050	70	0.03540	20	19.300	8.680
W	W	0.050	75	0.03570	20	19.300	8.680
W	W	0.050	75	0.03680	20	19.300	8.680
W	W	0.050	80	0.03690	20	19.300	8.680
W	W	0.050	85	0.03580	20	19.300	8.680
W	W	0.050	87	0.03350	20	19.300	8.680

Target	Proj.	Energy	Angle	Yield	Temp.	*P*	SEE
W	W	0.100	0	0.00810	20	19.300	8.680
W	W	0.100	0	0.00923	20	19.300	8.680
W	W	0.100	0	0.00760	20	19.300	8.680
W	W	0.100	10	0.01150	20	19.300	8.680
W	W	0.100	15	0.02030	20	19.300	8.680
W	W	0.100	20	0.02900	20	19.300	8.680
W	W	0.100	30	0.06190	20	19.300	8.680
W	W	0.100	40	0.10000	20	19.300	8.680
W	W	0.100	45	0.13400	20	19.300	8.680
W	W	0.100	50	0.15000	20	19.300	8.680
W	W	0.100	55	0.17000	20	19.300	8.680
W	W	0.100	60	0.18900	20	19.300	8.680
W	W	0.100	65	0.18960	20	19.300	8.680
W	W	0.100	65	0.18500	20	19.300	8.680
W	W	0.100	70	0.18000	20	19.300	8.680
W	W	0.100	75	0.16520	20	19.300	8.680
W	W	0.100	80	0.13000	20	19.300	8.680
W	W	0.100	82	0.12500	20	19.300	8.680
W	W	0.100	85	0.12400	20	19.300	8.680
W	W	0.100	87	0.12200	20	19.300	8.680

Projectile: W

Calculated Data

Target	Projectile	Energy	Symbol	y(0)	*a*	f
W	W	0.350	■	0.29390	61.4	6.02
W	W	'0.400	♦	0.35770	61.9	5.43
W	W	0.500	•	0.49407	64.3	4.11

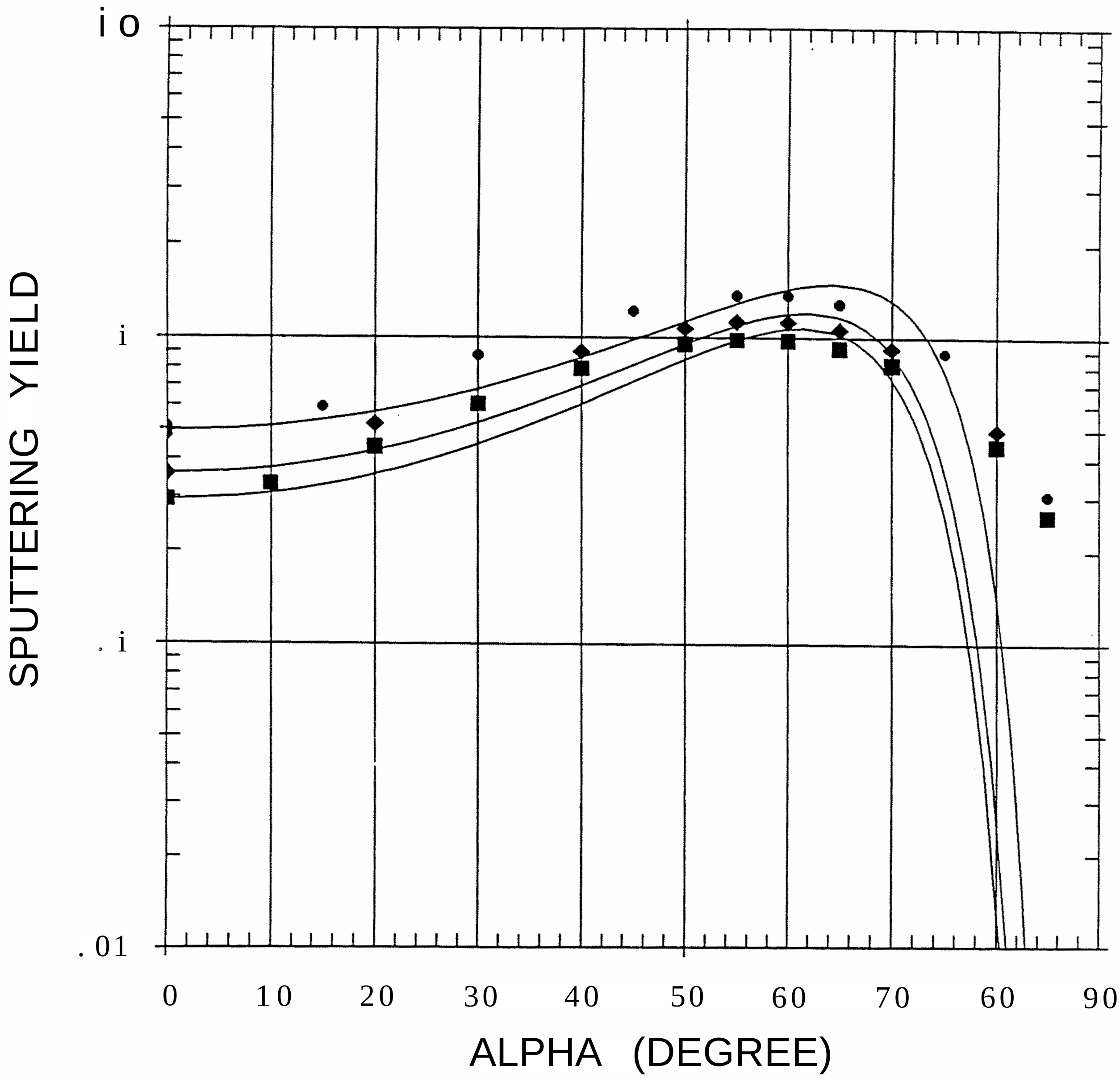


Fig. 128: Angular dependence of the sputtering yield of W with 350 , 400 and 500 eV W ions. The data are partly published in [53].

Calculated Data

Target .	Proj.	Energy	Angle	Yield	Temp.	ρ	SEE
W	W	0.350	0	0.29390	20	19.300	8.680
W	W	0.350	10	0.33100	20	19.300	8.680
W	W	0.350	20	0.43700	20	19.300	8.680
W	W	0.350	30	0.60600	20	19.300	8.680
W	W	0.350	40	0.79260	20	19.300	8.680
W	W	0.350	50	0.95220	20	19.300	8.680
W	W	0.350	55	0.98380	20	19.300	8.680
W	W	0.350	60	0.97940	20	19.300	8.680
W	W	0.350	65	0.92300	20	19.300	8.680
W	W	0.350	70	0.81540	20	19.300	8.680
W	W	0.350	80	0.44380	20	19.300	8.680
W	W	0.350	85	0.26200	20	19.300	8.680

Target	Proj.	Energy	Angle	Yield	Temp.	ρ	SBE
W	W	0.400	0	0.35770	20	19.300	8.680
W	W	0.400	20	0.52010	20	19.300	8.680
W	W	0.400	40	0.89750	20	19.300	8.680
W	W	0.400	50	1.07000	20	19.300	8.680
W	W	0.400	55	1.12400	20	19.300	8.680
W	W	0.400	60	1.12200	20	19.300	8.680
W	W	0.400	65	1.06100	20	19.300	8.680
W	W	0.400	70	0.91870	20	19.300	8.680
W	W	0.400	80	0.49670	20	19.300	8.680

Target	Proj.	Energy	Angle	Yield	Temp.	ρ	SBE
W	W	0.500	0	0.50930	20	19.300	8.680
W	W	0.500	0	0.47700	20	19.300	8.680
W	W	0.500	0	0.49500	20	19.300	8.680
W	W	0.500	0	0.49500	20	19.300	8.680
W	W	0.500	15	0.59200	20	19.300	8.680
W	W	0.500	30	0.87300	20	19.300	8.680
W	W	0.500	45	1.22000	20	19.300	8.680
W	W	0.500	55	1.36800	20	19.300	8.680
W	W	0.500	55	1.37000	20	19.300	8.680
W	W	0.500	60	1.37000	20	19.300	8.680
W	W	0.500	65	1.28800	20	19.300	8.680
W	W	0.500	75	0.89000	20	19.300	8.680
W	W	0.500	85	0.30620	20	19.300	8.680

Projectile: W

Calculated Data

Target	Projectile	Energy	Symbol	y(0)	a	f
W	W	0.800	■	0.82940	67.2	2.80
W	W	1.000	♦	1.05275	66.4	2.82
W	W	2.000	•	1.81250	65.4	2.79

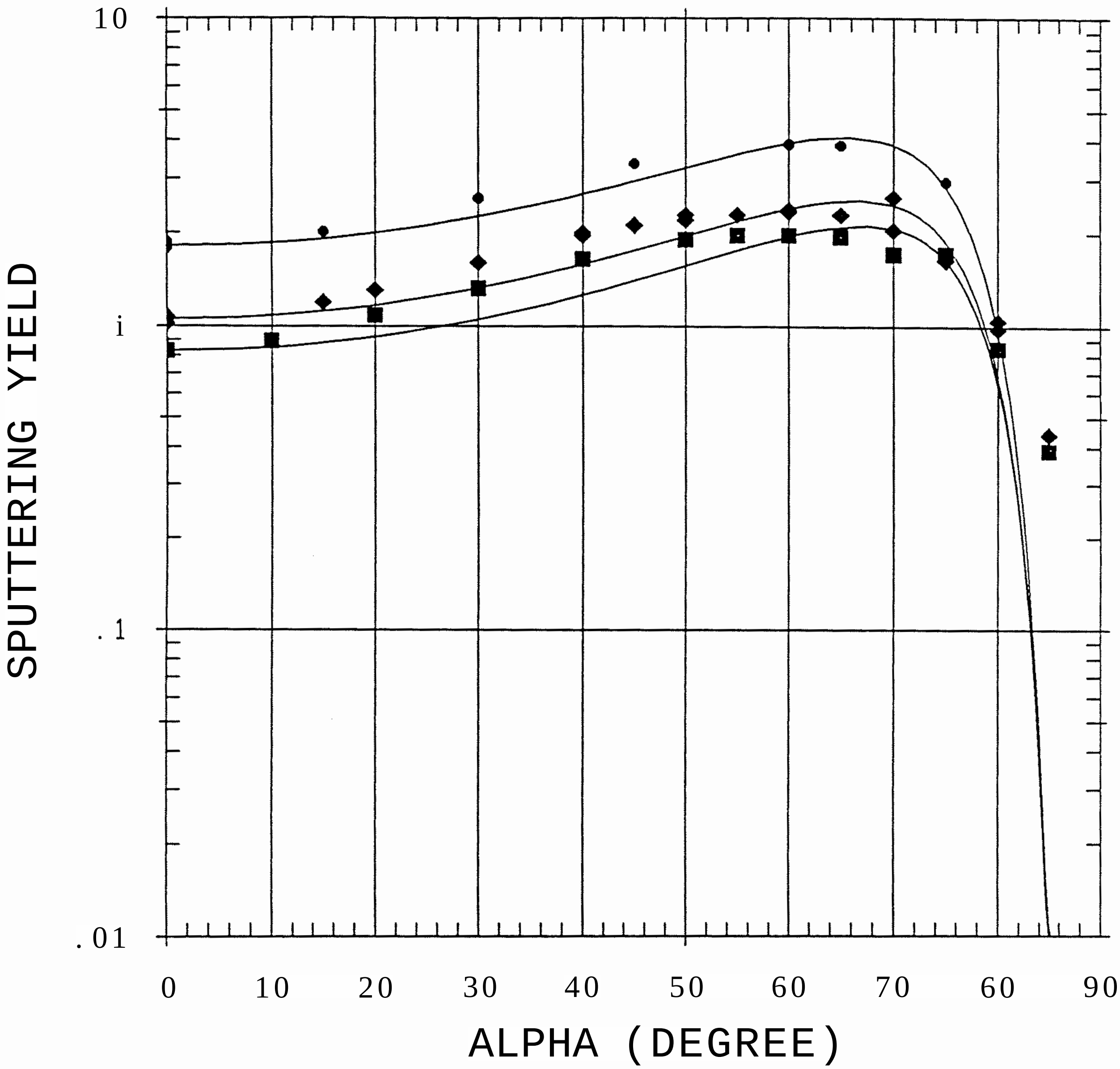


Fig. 129: Angular dependence of the sputtering yield of W with 0.8 , 1 and 2 keV W ions. The data are partly published in [53].

Calculated Data

Target	Proj.	Energy	Angle	Yield	Temp.	P	SBE
W	W	0.800	0	0.82940	20	19.300	8.680
W	W	0.800	10	0.89360	20	19.300	8.680
W	W	0.800	20	1.08200	20	19.300	8.680
W	W	0.800	30	1.32200	20	19.300	8.680
W	W	0.800	40	1.64600	20	19.300	8.680
W	W	0.800	50	1.90200	20	19.300	8.680
W	W	0.800	55	1.96800	20	19.300	8.680
W	W	0.800	60	1.97300	20	19.300	8.680
W	W	0.800	65	1.95200	20	19.300	8.680
W	W	0.800	70	1.71600	20	19.300	8.680
W	W	0.800	75	1.71600	20	19.300	8.680
W	W	0.800	80	0.84740	20	19.300	8.680
W	W	0.800	85	0.38880	20	19.300	8.680

Target	Proj.	Energy	Angle	Yield	Temp.	P	SBE
W	W	1.000	0	1.06100	20	19.300	8.680
W	W	1.000	0	1.06300	20	19.300	8.680
W	W	1.000	0	1.06700	20	19.300	8.680
W	W	1.000	0	1.02000	20	19.300	8.680
W	W	1.000	15	1.19000	20	19.300	8.680
W	W	1.000	20	1.30500	20	19.300	8.680
W	W	1.000	30	1.60000	20	19.300	8.680
W	W	1.000	40	1.96000	20	19.300	8.680
W	W	1.000	40	2.00000	20	19.300	8.680
W	W	1.000	45	2.12000	20	19.300	8.680
W	W	1.000	50	2.29000	20	19.300	8.680
W	W	1.000	50	2.20000	20	19.300	8.680
W	W	1.000	55	2.29000	20	19.300	8.680
W	W	1.000	60	2.35100	20	19.300	8.680
W	W	1.000	60	2.38000	20	19.300	8.680
W	W	1.000	65	2.30000	20	19.300	8.680
W	W	1.000	70	2.61900	20	19.300	8.680
W	W	1.000	70	2.05000	20	19.300	8.680
W	W	1.000	75	1.64000	20	19.300	8.680
W	W	1.000	80	1.03900	20	19.300	8.680
W	W	1.000	80	0.98000	20	19.300	8.680
W	W	1.000	85	0.43900	20	19.300	8.680

Target	Proj.	Energy	Angle	Yield	Temp.	P	SBE
W	W	2.000	0	1.79000	20	19.300	8.680
W	W	2.000	0	1.87000	20	19.300	8.680
W	W	2.000	0	1.81000	20	19.300	8.680
W	W	2.000	0	1.78000	20	19.300	8.680
W	W	2.000	15	2.02000	20	19.300	8.680
W	W	2.000	30	2.59000	20	19.300	8.680
W	W	2.000	45	3.37000	20	19.300	8.680
W	W	2.000	60	3.89000	20	19.300	8.680
W	W	2.000	65	3.86800	20	19.300	8.680
W	W	2.000	75	2.94000	20	19.300	8.680

Calculated Data

Target	Projectile	Energy	Symbol	y(0)	a	f
W	W	2.500	■	2.15600	67.6	2.19
W	W	■5.000	♦	3.11175	67.5	2.50

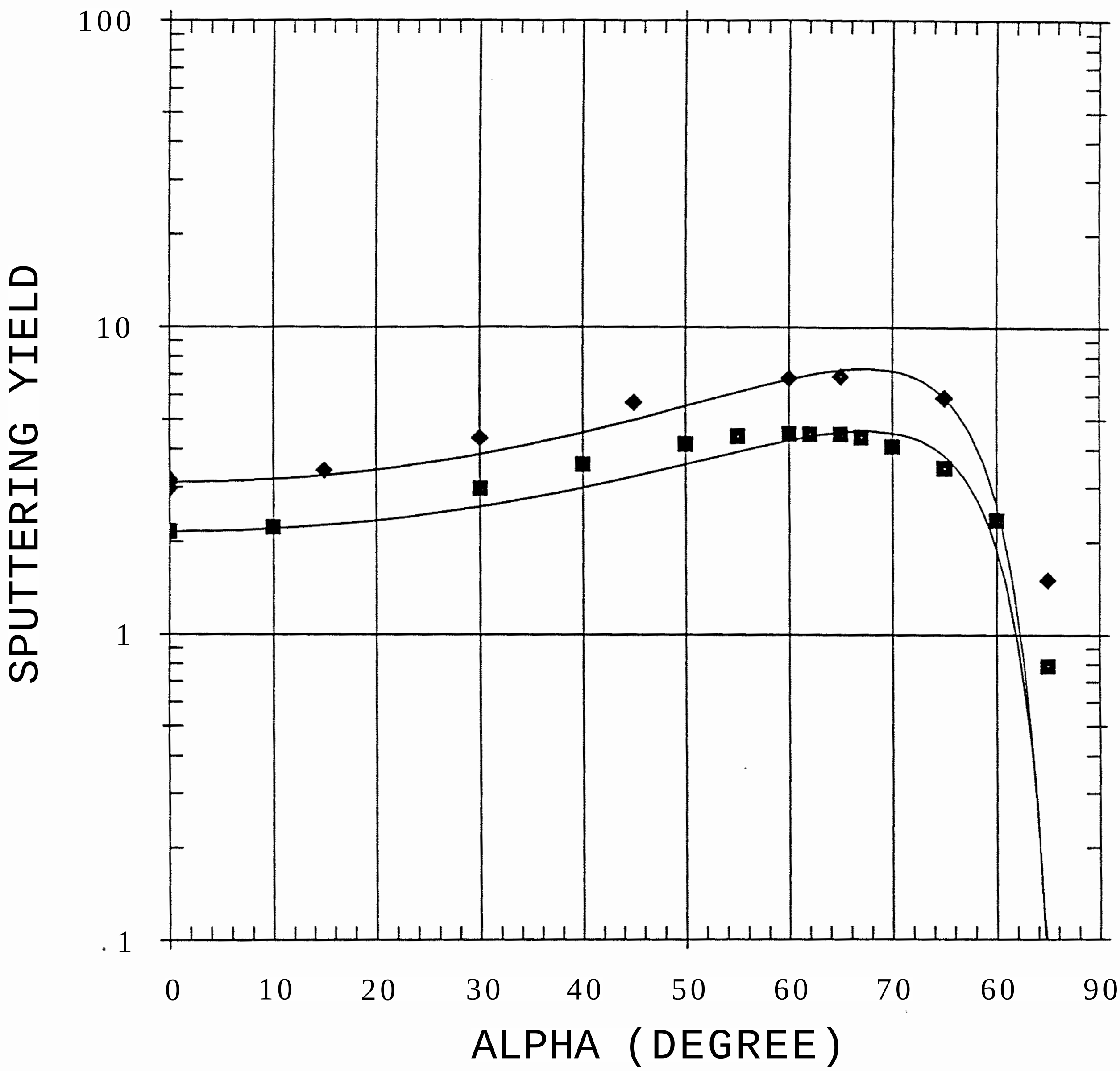


Fig. 130: Angular dependence of the sputtering yield of W with 2.5 and 5 keV W ions. The data are partly published in [53].

Calculated Data

Target-	Proj.	Energy	Angle	Yield	Temp.	p	SEE
W	W	2.500	0	2.15600	20	19.300	8.680
W	W	2.500	10	2.22800	20	19.300	8.680
W	W	2.500	20	0.00025	20	19.300	8.680
W	W	2.500	30	2.97300	20	19.300	8.680
W	W	2.500	40	3.56500	20	19.300	8.680
W	W	2.500	50	4.15100	20	19.300	8.680
W	W	2.500	55	4.40600	20	19.300	8.680
W	W	2.500	60	4.49800	20	19.300	8.680
W	W	2.500	62	4.48900	20	19.300	8.680
W	W	2.500	65	4.48400	20	19.300	8.680
W	W	2.500	67	4.38700	20	19.300	8.680
W	W	2.500	70	4.09400	20	19.300	8.680
W	W	2.500	75	3.47900	20	19.300	8.680
W	W	2.500	80	2.35700	20	19.300	8.680
W	W	2.500	85	0.78940	20	19.300	8.680

Target	Proj.	Energy	Angle	Yield	Temp.	p	SEE
W	W	5.000	0	3.11000	20	19.300	8.680
W	W	5.000	0	2.97500	20	19.300	8.680
W	W	5.000	0	3.18200	20	19.300	8.680
W	W	5.000	0	3.18000	20	19.300	8.680
W	W	5.000	15	3.40600	20	19.300	8.680
W	W	5.000	30	4.33700	20	19.300	8.680
W	W	5.000	45	5.67300	20	19.300	8.680
W	W	5.000	60	6.81300	20	19.300	8.680
W	W	5.000	65	6.91000	20	19.300	8.680
W	W	5.000	75	5.90100	20	19.300	8.680
W	W	5.000	85	1.50800	20	19.300	8.680

Experimental Data

Target	Projectile	Energy	Symbol	y(o)	*a*	f
B_4C	D	0.100	0	0.02485	69.3	2.21
b_4c	D	0)500	t>	0.03517	71.9	3.15

Calculated Data

Target	Projectile	Energy	Symbol	y(o)	*a*	f
B_4C	D	0.100	♦	0.01400	69.3	4.35
b_4c	D	0.500	▶	0.01970	77.9	3.45

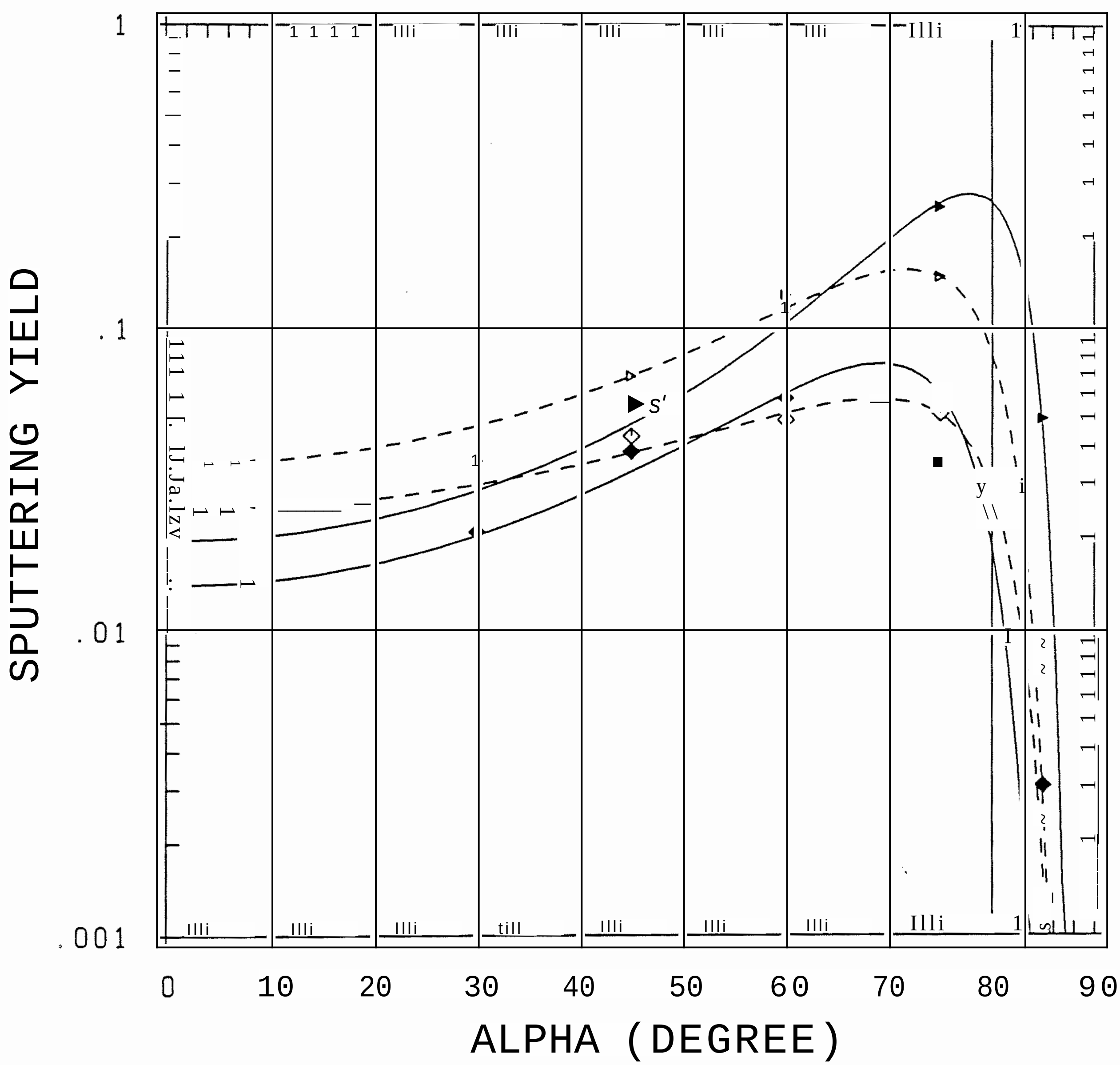


Fig. 131: Angular dependence of the sputtering yield of B_4C with 100 and 500 eV D ions. The data are unpublished.

Experimental Data

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
B_4C	D	0.100	0	0.02880	20	3	III	16	27.10.1977
b_4c	D	0.100	0	0.02050	800	3	VI	157	04.07.1983
b_4c	D	0.100	0	0.02210	20	3	VI	157	04.07.1983
b_4c	D	0.100	0	0.02800	20	1	X	105	22.08.1989
b_4c	D	0.100	45	0.04400	20	1	X	105	22.08.1989
b_4c	D	0.100	60	0.05000	20	1	X	105	23.08.1989
b_4c	D	0.100	75	0.05300	20	1	X	104	21.08.1989

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
B_4C	D	0.500	0	0.02820	20	3	III	7	30.09.1977
b_4c	D	0.500	0	0.03240	20	3	III	12	14.10.1977
b_4c	D	0.500	0	0.03980	800	3	VI	156	02.07.1983
b_4c	D	0.500	0	0.03090	20	3	VI	160	06.07.1983
b_4c	D	0.500	0	0.03780	800	3	VI	161	07.07.1983
b_4c	D	0.500	0	0.04750	500	3	X	42	14.02.1989
b_4c	D	0.500	0	0.02960	20	1	X	103	17.08.1989
b_4c	D	0.500	45	0.06980	20	1	X	104	21.08.1989
b_4c	D	0.500	60	0.11700	20	1	X	104	18.08.1989
b_4c	D	0.500	75	0.15100	20	1	X	103	17.08.1989

Calculated Data

Target	Proj.	Energy	Angle	Yield	Temp.	P	SBE
B_4C	D	0.100	0	0.01400	20	2.520	5.980
b_4c	D	0.100	30	0.02120	20	2.520	5.980
b_4c	D	0.100	45	0.03910	20	2.520	5.980
b_4c	D	0.100	60	0.05910	20	2.520	5.980
b_4c	D	0.100	75	0.06170	20	2.520	5.980
b_4c	D	0.100	85	0.00311	20	2.520	5.980

Target	Proj.	Energy	Angle	Yield	Temp.	P	SBE
B_4C	D	0.500	0	0.01970	20	2.520	5.980
b_4c	D	0.500	30	0.03630	20	2.520	5.980
b_4c	D	0.500	45	0.05470	20	2.520	5.980
b_4c	D	0.500	60	0.13000	20	2.520	5.980
b_4c	D	0.500	75	0.25600	20	2.520	5.980
b_4c	D	0.500	85	0.05100	20	2.520	5.980

Projectile: He

Experimental Data

Target	Projectile	Energy	Symbol	y(0)	a	f
B_4C	Ik	0.800	Ä	0.10500	60	3?80

Calculated Data

Target	Projectile	Energy	Symbol	y(0)	a	f
B_4C	Ik	0.800	Ä	0.07440	73d	4?57

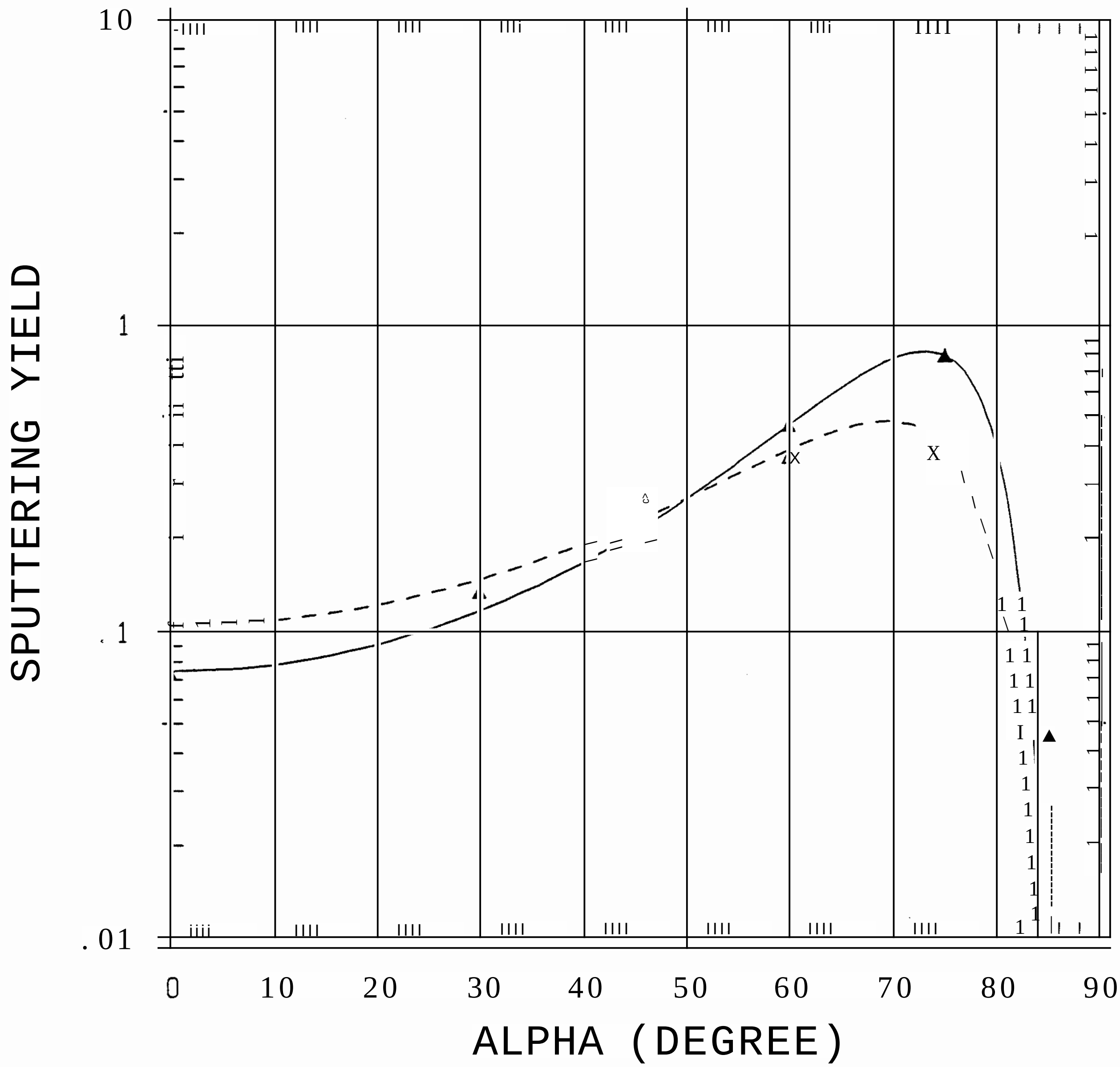


Fig. 132: Angular dependence of the sputtering yield of B_4C with 800 eV He ions. The data are unpublished.

Experimental Data

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
B_4C	He	0.800	0	0.10500	20	1	X	~106	24.08.1989
b_4c	He	0.800	45	0.27600	20	1	X	106	30.08.1989
b_4c	He	0.800	60	0.36900	20	1	X	107	31.08.1989
b_4c	He	0.800	75	0.40400	20	1	X	106	24.08.1989

Calculated Data

Target	Proj.	Energy	Angle	Yield	Temp.	p	SBE
b_4c	He	0.800	0	0.07440	20	2.520	5.980
b_4c	He	0.800	30	0.13500	20	2.520	5.980
b_4c	He	0.800	60	0.47000	20	2.520	5.980
b_4c	He	0.800	75	0.79700	20	2.520	5.980
b_4c	He	0.800	85	0.04600	20	2.520	5.980

Projectile: ^{12}C

Experimental Data

Target	Projectile	Energy	Symbol	y(0)	o	f
~b7c	*=C	lÖÖÖ	□	0.34200	774	2T2

Calculated Data

Target	Projectile	Energy	Symbol	y(0)	a	f
B_4C	^{12}C	1.000	■	0.25300	73.2	4.32

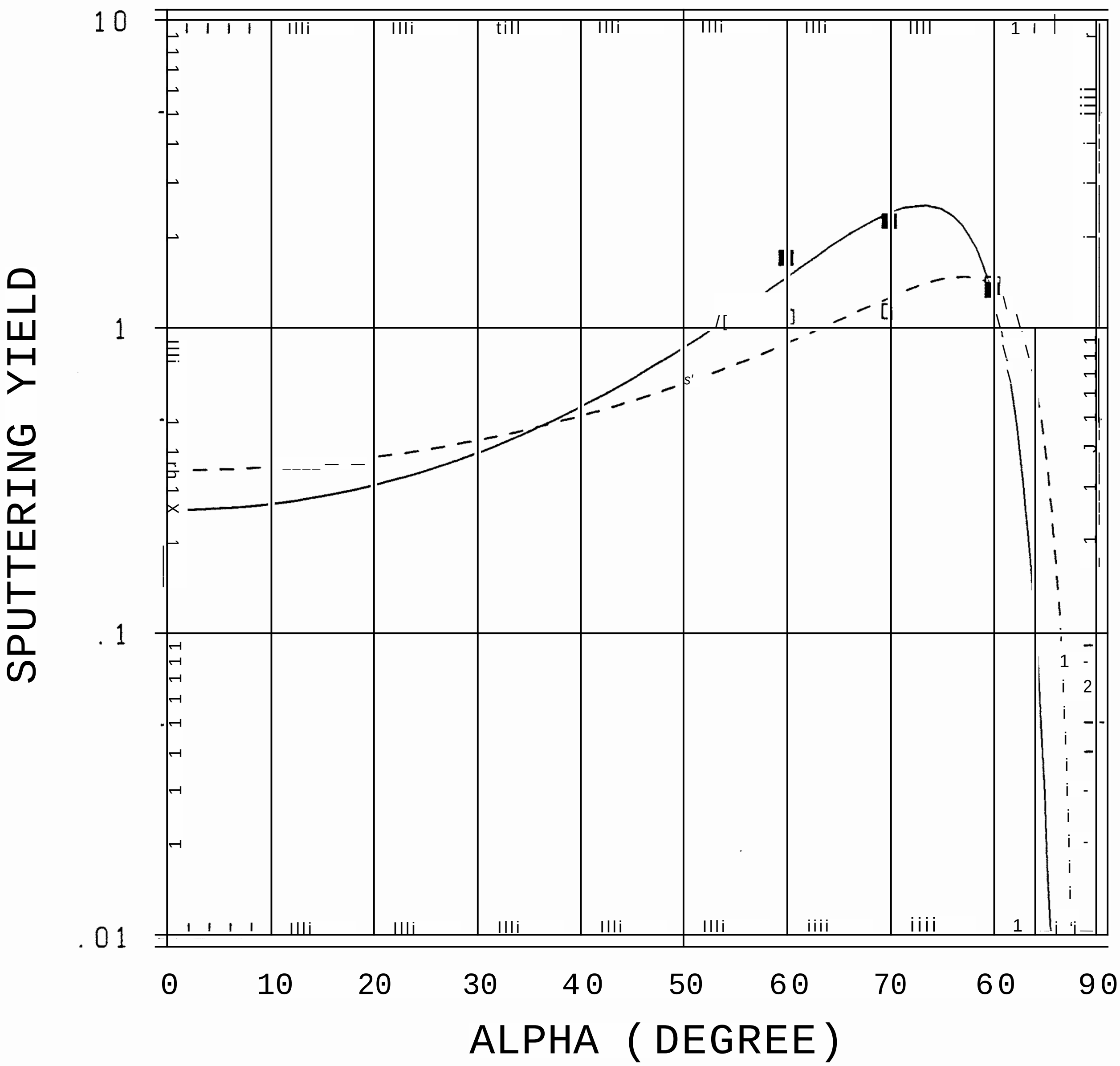


Fig. 133: Angular dependence of the sputtering yield of B_4C with 1 keV C ions. The data are unpublished.

Experimental Data

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
B_4C	^{12}C	1.000	0	0.34200	20	1	X	50	14.03.1989
B_4C	^{12}C	1.000	60	1.08000	20	1	X	50	9.03.1989
B_4C	^{12}C	1.000	70	1.13000	20	1	X	50	10.03.1989
B_4C	^{12}C	1.000	80	1.39000	20	1	X	49	8.03.1989

Calculated Data

Target	Proj.	Energy	Angle	Yield	Temp.	p	SBE
B_4C	^{12}C	1.000	0	0.25300	20	2.520	5.980
B_4C	^{12}C	1.000	60	1.68000	20	2.520	5.980
B_4C	^{12}C	1.000	70	2.22000	20	2.520	5.980
B_4C	^{12}C	1.000	80	1.33000	20	2.520	5.980

Calculated Data

Target	Projectile	Energy	Symbol	y(0)	a	f
BeO	O	0.200	■	0.07900	64.7	8.76
BeO	O	0.300	◆	0.13230	65.7	7.54
BeO	O	0.500	•	0.21400	68.3	5.78
BeO	O	1.000	▼	0.32600	71.1	4.69
BeO	O	3.000	▶	0.45000	73.4	4.02

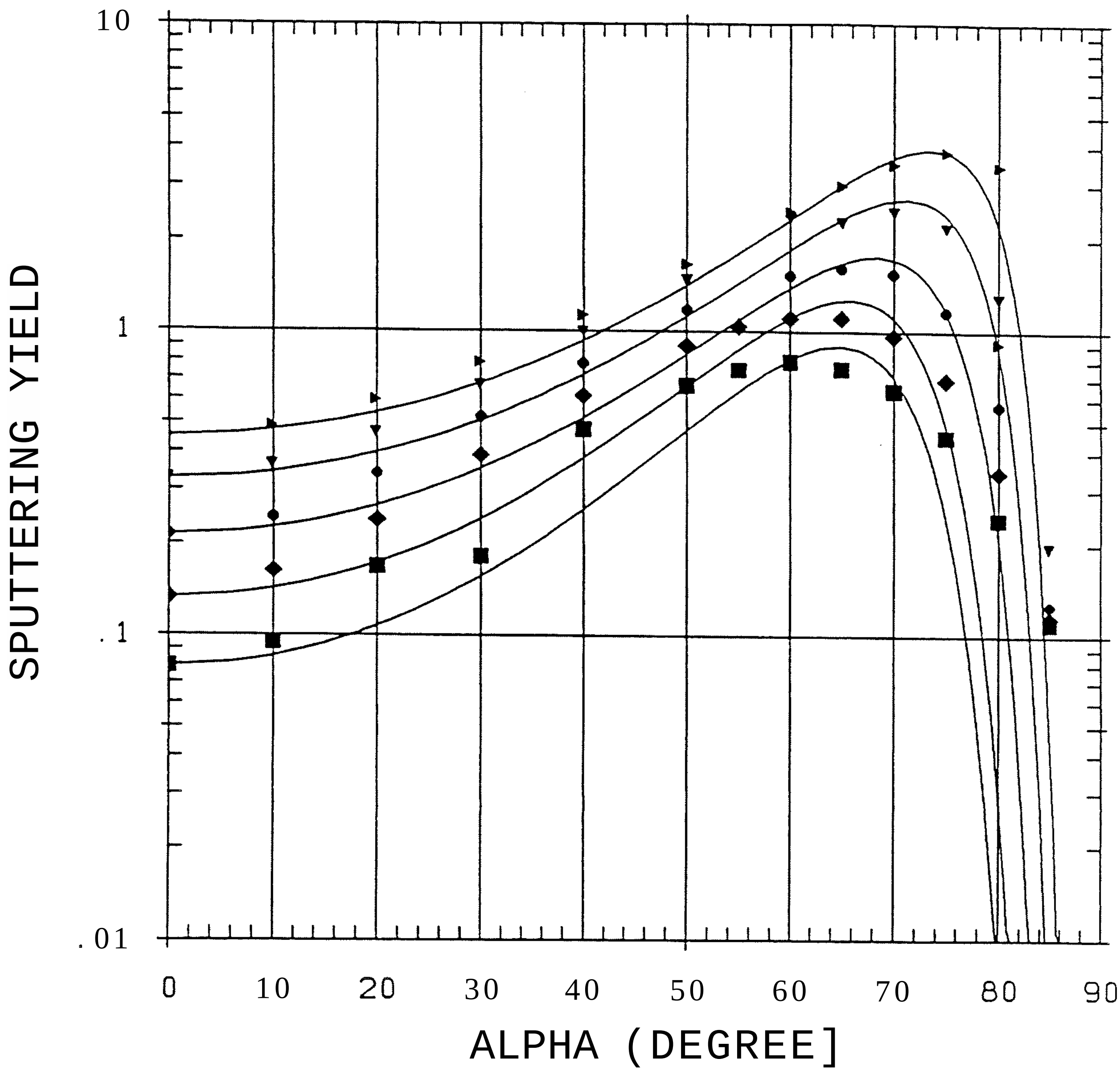


Fig. 134: Angular dependence of the sputtering yield of BeO with 0.2 , 0.3 , 0.5 , 1 and 3 keV O ions. The data are partly published in [36].

Calculated Data

Target	Proj.	Energy	Angle	Yield	Temp.	P	SBE
BeO	0	0.200	0	0.07900	20	3.010	3.380
BeO	0	0.200	10	0.09450	20	3.010	3.380
BeO	0	0.200	20	0.16800	20	3.010	3.380
BeO	0	0.200	30	0.18200	20	3.010	3.380
BeO	0	0.200	40	0.47500	20	3.010	3.380
BeO	0	0.200	50	0.66500	20	3.010	3.380
BeO	0	0.200	55	0.75000	20	3.010	3.380
BeO	0	0.200	60	0.79700	20	3.010	3.380
BeO	0	0.200	65	0.75700	20	3.010	3.380
BeO	0	0.200	70	0.64200	20	3.010	3.380
BeO	0	0.200	75	0.45000	20	3.010	3.380
BeO	0	0.200	80	0.24220	20	3.010	3.380
BeO	0	0.200	85	0.11000	20	3.010	3.380

Target	Proj.	Energy	Angle	Yield	Temp.	P	SBE
BeO	O	0.300	0	0.13230	20	3.010	3.380
BeO	O	0.300	10	0.16200	20	3.010	3.380
BeO	O	0.300	20	0.23990	20	3.010	3.380
BeO	O	0.300	30	0.38870	20	3.010	3.380
BeO	O	0.300	40	0.61480	20	3.010	3.380
BeO	O	0.300	50	0.89790	20	3.010	3.380
BeO	O	0.300	55	1.03710	20	3.010	3.380
BeO	O	0.300	60	1.10390	20	3.010	3.380
BeO	O	0.300	65	1.10780	20	3.010	3.380
BeO	O	0.300	70	0.96550	20	3.010	3.380
BeO	O	0.300	75	0.69470	20	3.010	3.380
BeO	O	0.300	80	0.34430	20	3.010	3.380
BeO	O	0.300	85	0.11470	20	3.010	3.380

Target	Proj.	Energy	Angle	Yield	Temp.	P	SBE
BeO	O	0.500	0	0.21400	20	3.010	3.380
BeO	O	0.500	10	0.24410	20	3.010	3.380
BeO	O	0.500	20	0.33960	20	3.010	3.380
BeO	O	0.500	30	0.52210	20	3.010	3.380
BeO	O	0.500	40	0.78550	20	3.010	3.380
BeO	O	0.500	50	1.17240	20	3.010	3.380
BeO	O	0.500	60	1.52470	20	3.010	3.380
BeO	O	0.500	65	1.61350	20	3.010	3.380
BeO	O	0.500	70	1.55090	20	3.010	3.380
BeO	O	0.500	75	1.15940	20	3.010	3.380
BeO	O	0.500	80	0.57090	20	3.010	3.380
BeO	O	0.500	85	0.12560	20	3.010	3.380

Target	Proj.	Energy	Angle	Yield	Temp.	*P*	SBE
BeO	0	1.000	0	0.32600	20	3.010	3.380
BeO	0	1.000	10	0.36170	20	3.010	3.380
BeO	0	1.000	20	0.46200	20	3.010	3.380
BeO	0	1.000	30	0.66380	20	3.010	3.380
BeO	0	1.000	40	0.99000	20	3.010	3.380
BeO	0	1.000	50	1.46540	20	3.010	3.380
BeO	0	1.000	60	2.34900	20	3.010	3.380
BeO	0	1.000	65	2.27000	20	3.010	3.380
BeO	0	1.000	70	2.45100	20	3.010	3.380
BeO	0	1.000	75	2.17310	20	3.010	3.380
BeO	0	1.000	80	1.28000	20	3.010	3.380
BeO	0	1.000	85	0.19740	20	3.010	3.380

Target	Proj.	Energy	Angle	Yield	Temp.	*P*	SBE
BeO	O	3.000	0	0.45000	20	3.010	3.380
BeO	O	3.000	10	0.48500	20	3.010	3.380
BeO	O	3.000	20	0.59300	20	3.010	3.380
BeO	O	3.000	30	0.78740	20	3.010	3.380
BeO	O	3.000	40	1.12160	20	3.010	3.380
BeO	O	3.000	50	1.65100	20	3.010	3.380
BeO	O	3.000	60	2.45550	20	3.010	3.380
BeO	O	3.000	65	2.98870	20	3.010	3.380
BeO	O	3.000	70	3.51220	20	3.010	3.380
BeO	O	3.000	75	3.85850	20	3.010	3.380
BeO	O	3.000	80	3.46190	20	3.010	3.380
BeO	O	3.000	80	0.91330	20	3.010	3.380

Experimental Data

Target	Projectile	Energy	Symbol	y(0)	*a*	f
SiC	H	2.000	□	0.01244	78.7	2.23
SiC	D	2.000	0	0.02313	78.5	2.34
SiC	He	2.000	A	0.11140	76.4	2.81

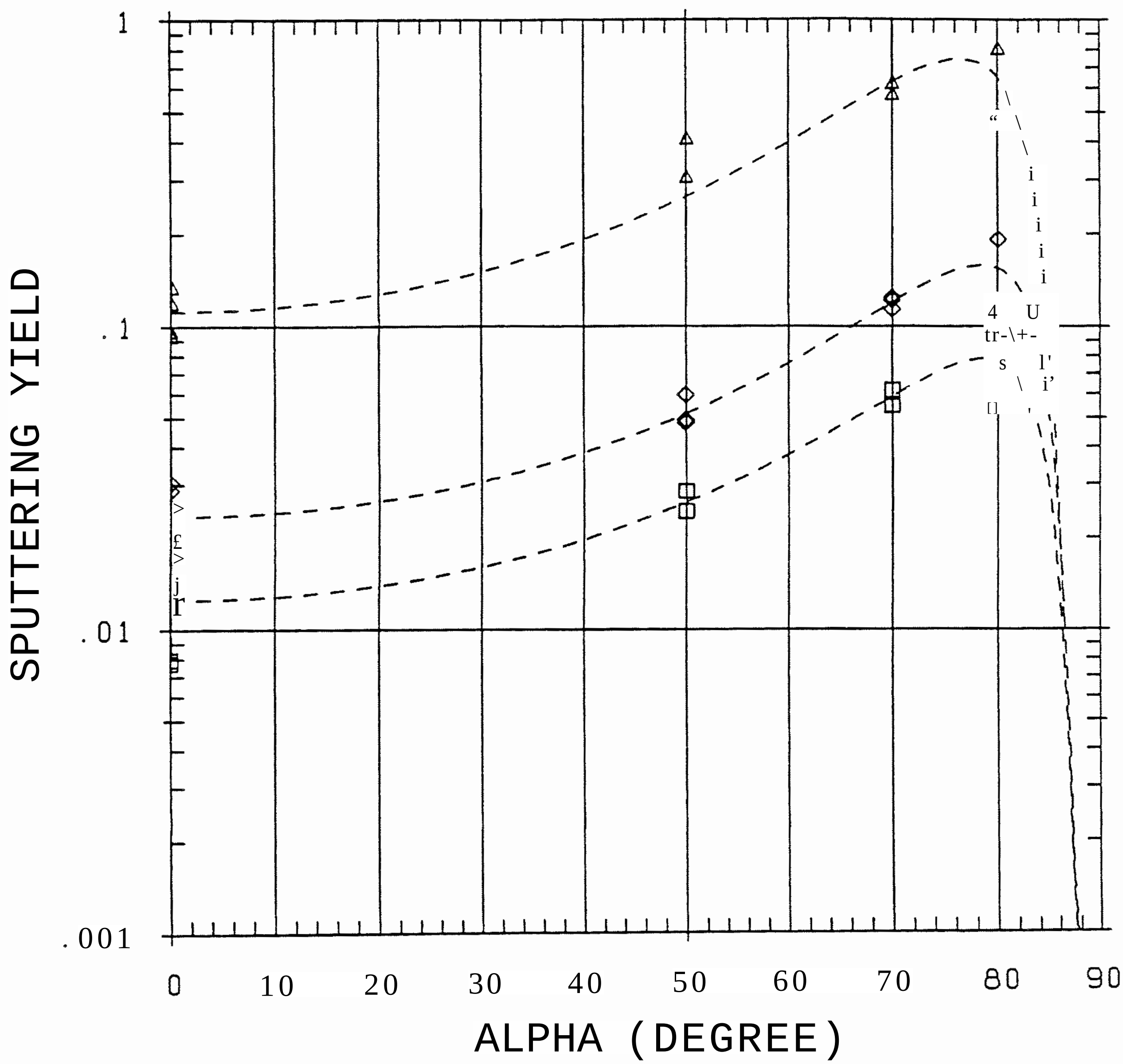


Fig. 135: Angular dependence of the sputtering yield of SiC with 2 keV H, D and He ions. The data are unpublished.

Experimental Data

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
SiC	H	2.000	0	0.00795	556	3	V	39	11.08.1980
SiC	H	2.000	0	0.02010	556	3	V	39	11.08.1980
SiC	H	2.000	0	0.01440	114	3	V	39	12.08.1980
SiC	H	2.000	0	0.00774	210	3	V	172	18.05.1982
SiC	H	2.000	0	0.01200	235	3	V	183	21.06.1982
SiC	H	2.000	50	0.02850	20	3	V	171	17.05.1982
SiC	H	2.000	50	0.02440	170	3	V	184	21.06.1982
SiC	H	2.000	70	0.06170	140	3	V	171	17.05.1982
SiC	H	2.000	70	0.05500	140	3	V	184	21.06.1982
SiC	H	2.000	80	0.09600	110	3	V	172	18.05.1982
SiC	H	2.000	80	0.05800	no	3	V	183	16.06.1982

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
SiC	D	2.000	0	0.02500	20	3	II	170	15.07.1977
SiC	D	2.000	0	0.02840	20	3	V	33	01.08.1980
SiC	D	2.000	0	0.01720	120	3	V	175	24.05.1982
SiC	D	2.000	0	0.02110	170	3	V	178	14.06.1982
SiC	D	2.000	0	0.01710	20	3	V	179	14.06.1982
SiC	D	2.000	0	0.03000	200	3	V	180	15.06.1982
SiC	D	2.000	50	0.04800	20	3	V	176	25.05.1982
SiC	D	2.000	50	0.04700	140	3	V	179	14.06.1982
SiC	D	2.000	50	0.05800	160	3	V	181	16.06.1982
SiC	D	2.000	70	0.12000	20	3	V	176	25.05.1982
SiC	D	2.000	70	0.11800	110	3	V	179	14.06.1982
SiC	D	2.000	70	0.11000	130	3	V	181	15.06.1982
SiC	D	2.000	80	0.18800	110	3	V	175	25.05.1982
SiC	D	2.000	80	0.11500	110	3	V	180	15.06.1982

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
SiC	He	2.000	0	0.13500	20	1	II	171	20.07.1977
SiC	He	2.000	0	0.09350	20	1	V	174	24.05.1982
SiC	He	2.000	0	0.09710	20	1	V	182	16.06.1982
SiC	He	2.000	0	0.12000	no	1	V	186	22.06.1982
SiC	He	2.000	50	0.41600	no	1	V	174	19.05.1982
SiC	He	2.000	50	0.31200	20	1	V	185	22.06.1982
SiC	He	2.000	70	0.63300	20	1	V	173	19.05.1982
SiC	He	2.000	70	0.58300	20	1	V	185	22.06.1982
SiC	He	2.000	80	0.82600	no	1	V	173	19.05.1982
SiC	He	2.000	80	0.50400	no	3	V	182	16.06.1982

Experimental Data

Target	Projectile	Energy	Symbol	y(0)	a	f
TiC sheet	H	2.000	□	0.01380	82.1	0.86
TiC sint.	H '	2.000	0	0.00889		
TiC pl.spr.	H	2.000	o	0.00684	73.0	0.33

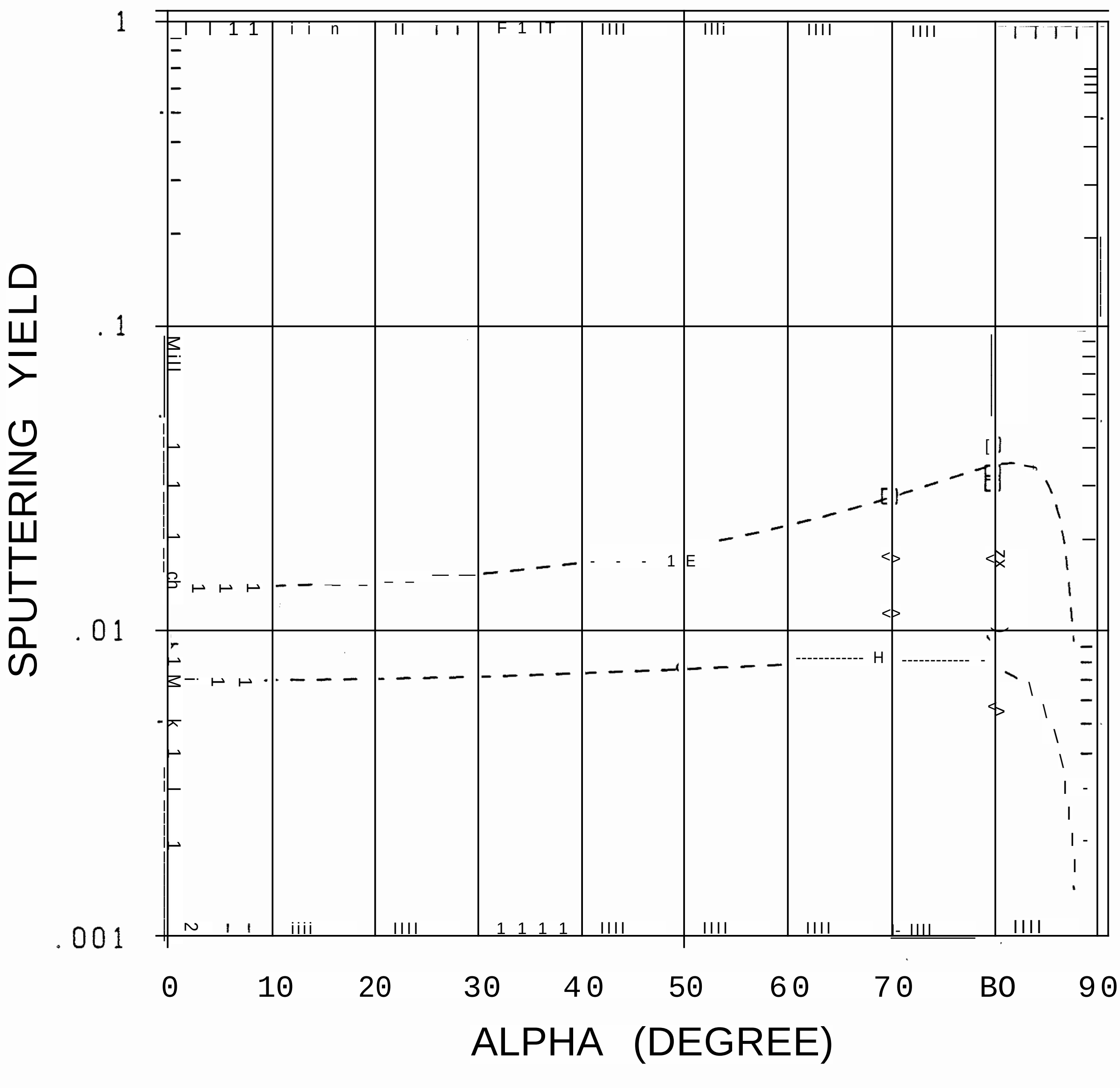


Fig. 136: Angular dependence of the sputtering yield of TiC with different degrees of surface roughness for 2 keV H ions. The roughness increases from TiC-sheet to sintered TiC to plasma sprayed TiC. The data are unpublished.

Experimental Data

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
TiC sheet	H	2.000	0	0.01310	230	3	V	158	05.05.1982
TiC sheet	H	2.000	0	0.01450	230	3	V	162	07.05.1982
TiC sheet	H	2.000	50	0.01730	220	3	V	157	05.05.1982
TiC sheet	H	2.000	70	0.02800	160	3	V	156	05.05.1982
TiC sheet	H	2.000	70	0.02800	160	3	V	166	12.05.1982
TiC sheet	H	2.000	80	0.04150	110	3	V	156	04.05.1982
TiC sheet	H	2.000	80	0.03360	110	3	V	157	05.05.1982
TiC sheet	H	2.000	80	0.03100	140	3	V	166	12.05.1982

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
TiC sint.	H	2.000	0	0.00889	240	3	V	155	03.05.1982
TiC sint.	H	2.000	70	0.01150	80	3	V	82	23.06.1981
TiC sint.	H	2.000	70	0.01780	170	3	V	151	29.04.1982
TiC sint.	H	2.000	80	0.01750	140	3	V	151	29.04.1982

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
TiC pl.spr.	H	2.000	0	0.00959	20	3	IV	149	28.01.1980
TiC pl.spr.	H	2.000	0	0.00477	150	3	IV	152	31.01.1980
TiC pl.spr.	H	2.000	0	0.00617	20	3	V	140	01.04.1982
TiC pl.spr.	H	2.000	50	0.00762	20	3	V	143	22.04.1982
TiC pl.spr.	H	2.000	70	0.00803	20	3	V	141	21.04.1982
TiC pl.spr.	H	2.000	80	0.00564	20	3	V	142	22.04.1982
TiC pl.spr.	H	2.000	80	0.00977	20	3	V	147	27.04.1982

Experimental Data

Target	Projectile	Energy	Symbol	y(0)	a	f
TiC sheet	D	2.000	□	0.01490	74.4	2.93
TiC sint.	D	2.000	o	0.01637	72.3	1.77
TiC pl.spr.	D	2.000	o	0.01595	76.4	0.81

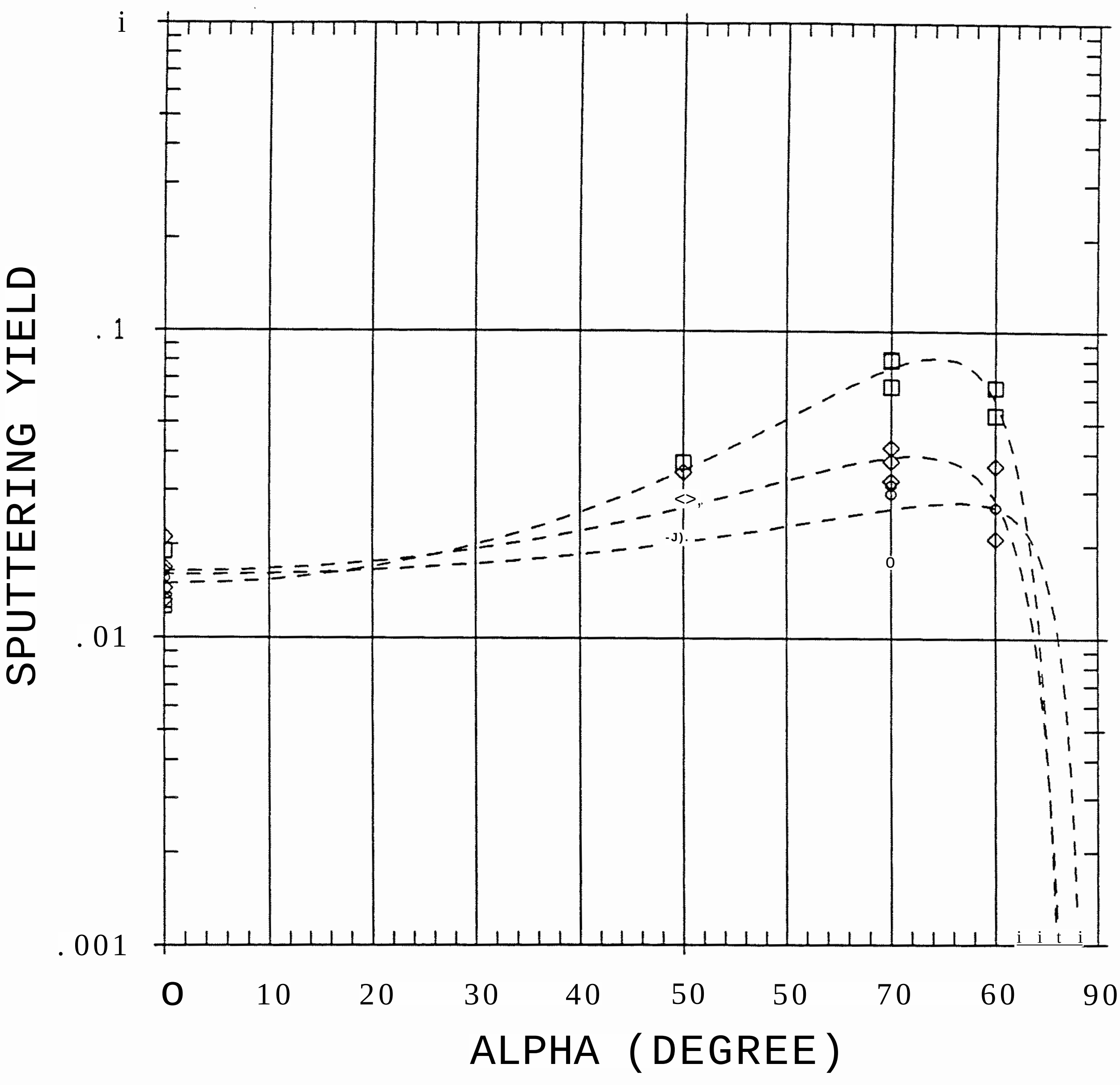


Fig. 137: Angular dependence of the sputtering yield of TiC with different degrees of surface roughness for 2 keV D ions. The roughness increases from TiC-sheet to sintered TiC to plasma sprayed TiC. The data are unpublished.

Experimental Data

Target •	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
TiC sheet	D	2.000	0	0.01260	20	3	V	64	29.01.1981
TiC sheet	D	2.000	0	0.01900	230	3	V	161	06.05.1982
TiC sheet	D	2.000	50	0.03730	230	3	V	162	06.05.1982
TiC sheet	D	2.000	70	0.08100	125	3	V	159	05.05.1982
TiC sheet	D	2.000	70	0.06590	20	3	V	163	07.05.1982
TiC sheet	D	2.000	70	0.08000	120	3	V	165	12.05.1982
TiC sheet	D	2.000	80	0.06560	110	3	V	158	05.05.1982
TiC sheet	D	2.000	80	0.05330	120	3	V	165	11.05.1982

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
TiC sint.	D	2.000	0	0.01440	0	3	V	86	15.07.1981
TiC sint.	D	2.000	0	0.01320	0	3	V	87	17.07.1981
TiC sint.	D	2.000	0	0.01680	20	3	V	148	28.04.1982
TiC sint.	D	2.000	0	0.02110	240	3	V	150	29.04.1982
TiC sint.	D	2.000	50	0.02840	50	3	V	86	16.07.1981
TiC sint.	D	2.000	50	0.03460	190	3	V	150	29.04.1982
TiC sint.	D	2.000	70	0.03250	68	3	V	82	24.06.1981
TiC sint.	D	2.000	70	0.04170	70	3	V	86	14.07.1981
TiC sint.	D	2.000	70	0.03760	145	3	V	149	28.04.1982
TiC sint.	D	2.000	80	0.02110	110	3	V	149	29.04.1982
TiC sint.	D	2.000	80	0.03640	110	3	V	155	03.05.1982

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
TiC pl.spr.	D	2.000	0	0.01550	20	3	V	139	01.04.1982
TiC pl.spr.	D	2.000	0	0.01640	20	3	V	140	02.04.1982
TiC pl.spr.	D	2.000	50	0.02130	20	3	V	143	22.04.1982
TiC pl.spr.	D	2.000	70	0.01760	20	3	V	144	22.04.1982
TiC pl.spr.	D	2.000	70	0.02960	20	3	V	147	27.04.1982
TiC pl.spr.	D	2.000	70	0.03150	20	3	V	148	28.04.1982
TiC pl.spr.	D	2.000	80	0.02670	20	3	V	146	27.04.1982

Experimental Data

Target	Projectile	Energy	Symbol	y(0)	*a*	f
TiC sheet	Ik	2.000	Ä	0.06035	75Ä	TG3

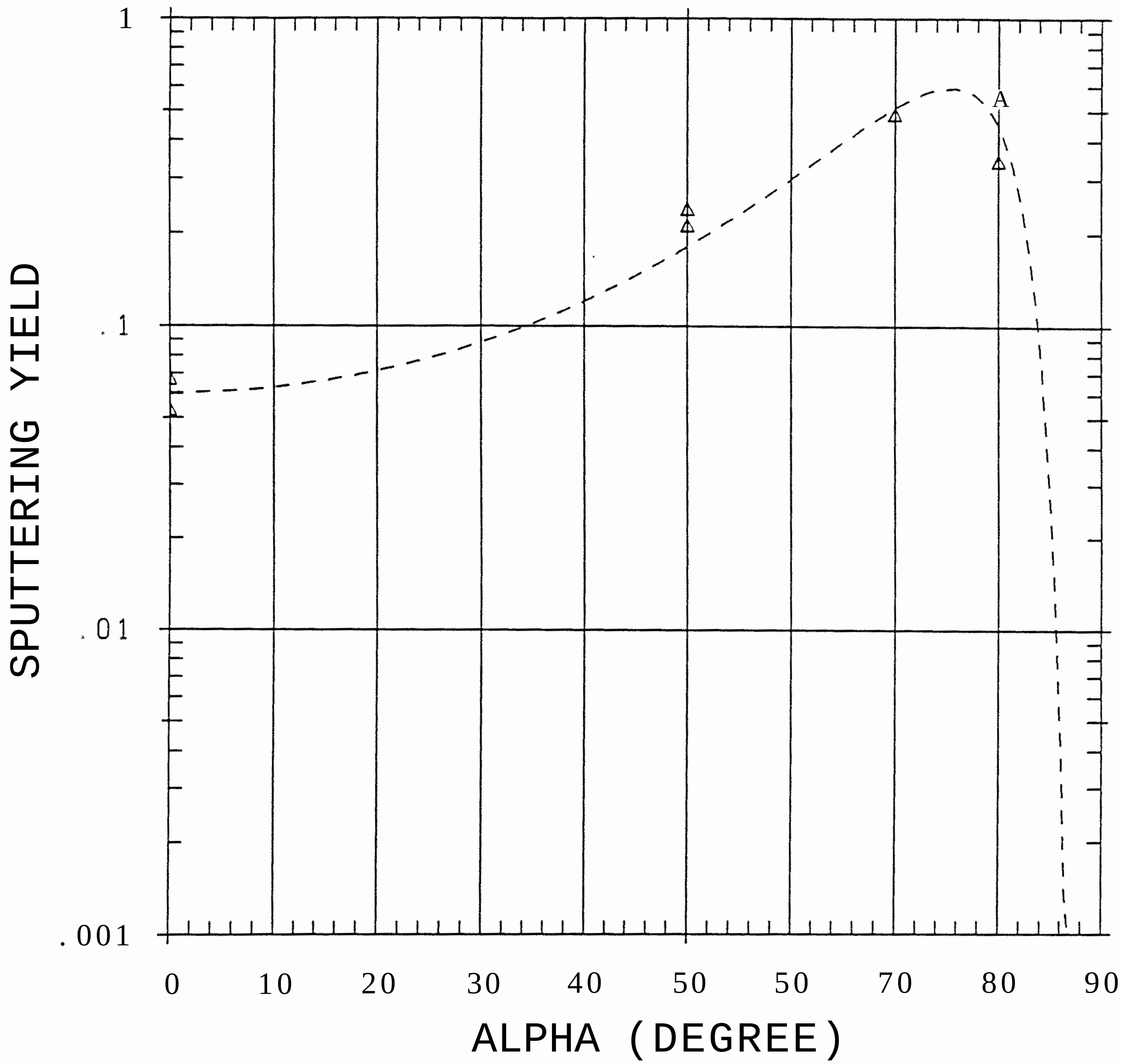


Fig. 138: Angular dependence of the sputtering yield of TiC-sheet with 2 keV He ions. The data are unpublished.

Experimental Data

Target •	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
TiC sheet	He	2.000	0	0.05330	20	1	V	168	13.05.1982
TiC sheet	He	2.000	0	0.06740	20	1	V	170	14.05.1982
TiC sheet	He	2.000	50	0.21300	20	1	V	169	14.05.1982
TiC sheet	He	2.000	50	0.24000	20	1	V	170	14.05.1982
TiC sheet	He	2.000	70	0.49000	20	1	V	169	13.05.1982
TiC sheet	He	2.000	80	0.34600	no	1	V	159	05.05.1982
TiC sheet	He	2.000	80	0.55100	20	1	V	168	13.05.1982

Experimental Data

Target	Projectile	Energy	Symbol	y(0)	Or	f
TiC sheet	He	6.000	□	0.05575	78.1	2.40
TiC sint.	He	6.000	O	0.10700	75.3	1.36
TiC pl.spr.	He	6.000	o	0.07550	69.8	1.31

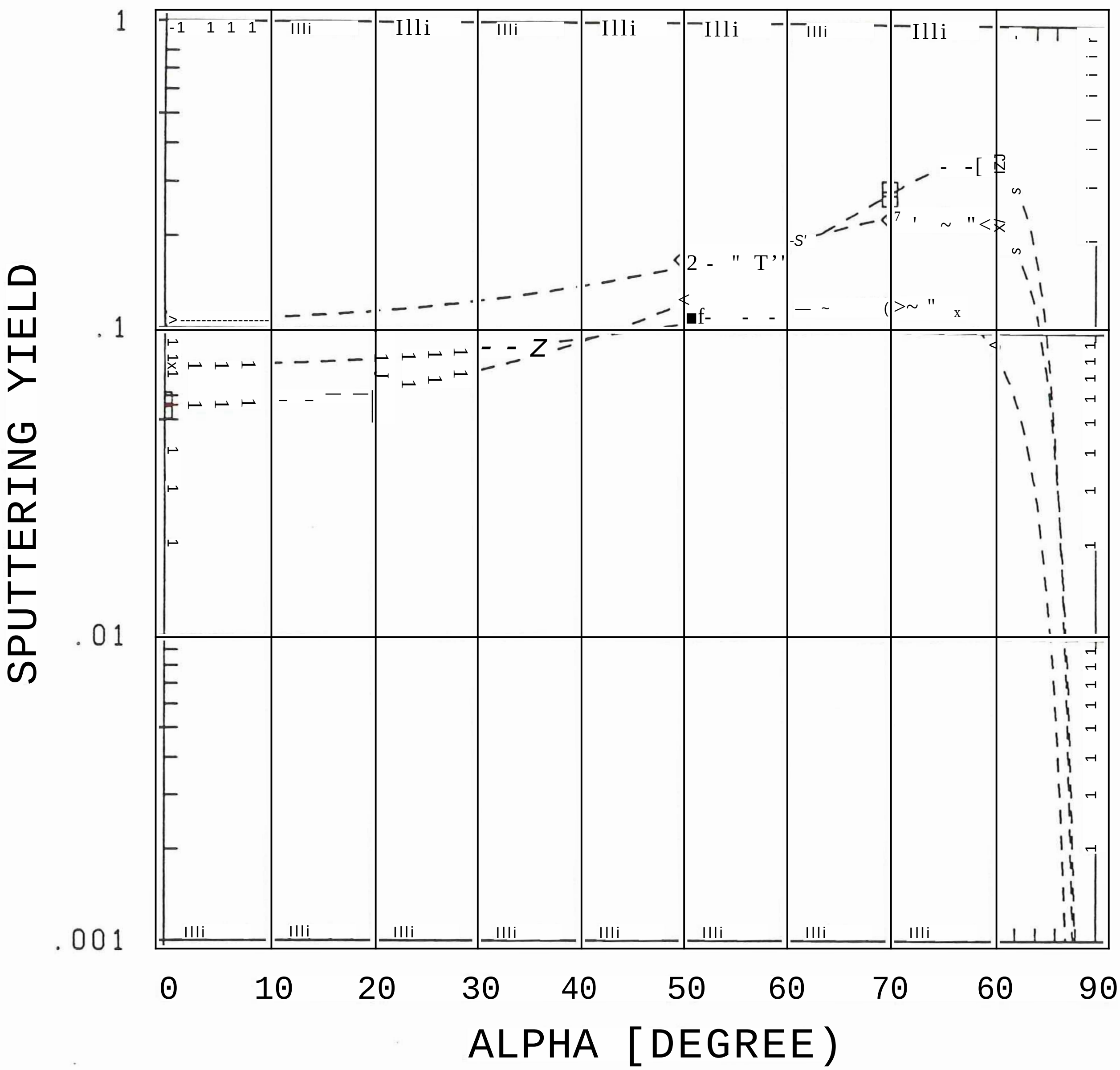


Fig. 139: Angular dependence of the sputtering yield of TiC with different degrees of surface roughness for 6 keV He ions. The roughness increases from TiC-sheet to sintered TiC to plasma sprayed TiC. The data are unpublished.

Experimental Data

Target ■	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
TiC sheet	He	6.000	0	0.05820	240	1	V	161	06.05.1982
TiC sheet	He	6.000	0	0.05330	220	1	V	163	07.05.1982
TiC sheet	He	6.000	70	0.29400	130	1	V	160	06.05.1982
TiC sheet	He	6.000	70	0.27200	130	1	V	167	12.05.1982
TiC sheet	He	6.000	80	0.35200	110	1	V	167	12.05.1982

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
TiC sint.	He	6.000	0	0.10700	240	1	V	153	30.04.1982
TiC sint.	He	6.000	50	0.17000	20	1	V	153	30.04.1982
TiC sint.	He	6.000	70	0.23300	145	1	V	152	30.04.1982
TiC sint.	He	6.000	80	0.22500	130	1	V	152	30.04.1982

Target	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
TiC pl.spr.	He	6.000	0	0.07550	20	1	V	146	26.04.1982
TiC pl.spr.	He	6.000	50	0.12300	20	1	V	145	26.04.1982
TiC pl.spr.	He	6.000	70	0.11900	20	1	V	144	26.04.1982
TiC pl.spr.	He	6.000	80	0.09040	20	1	V	145	26.04.1982

Experimental Data

Target	Projectile	Energy	Symbol	y(0)	a	f
C/USB15	D	LOGO	Ö	0.01880	7E4	273

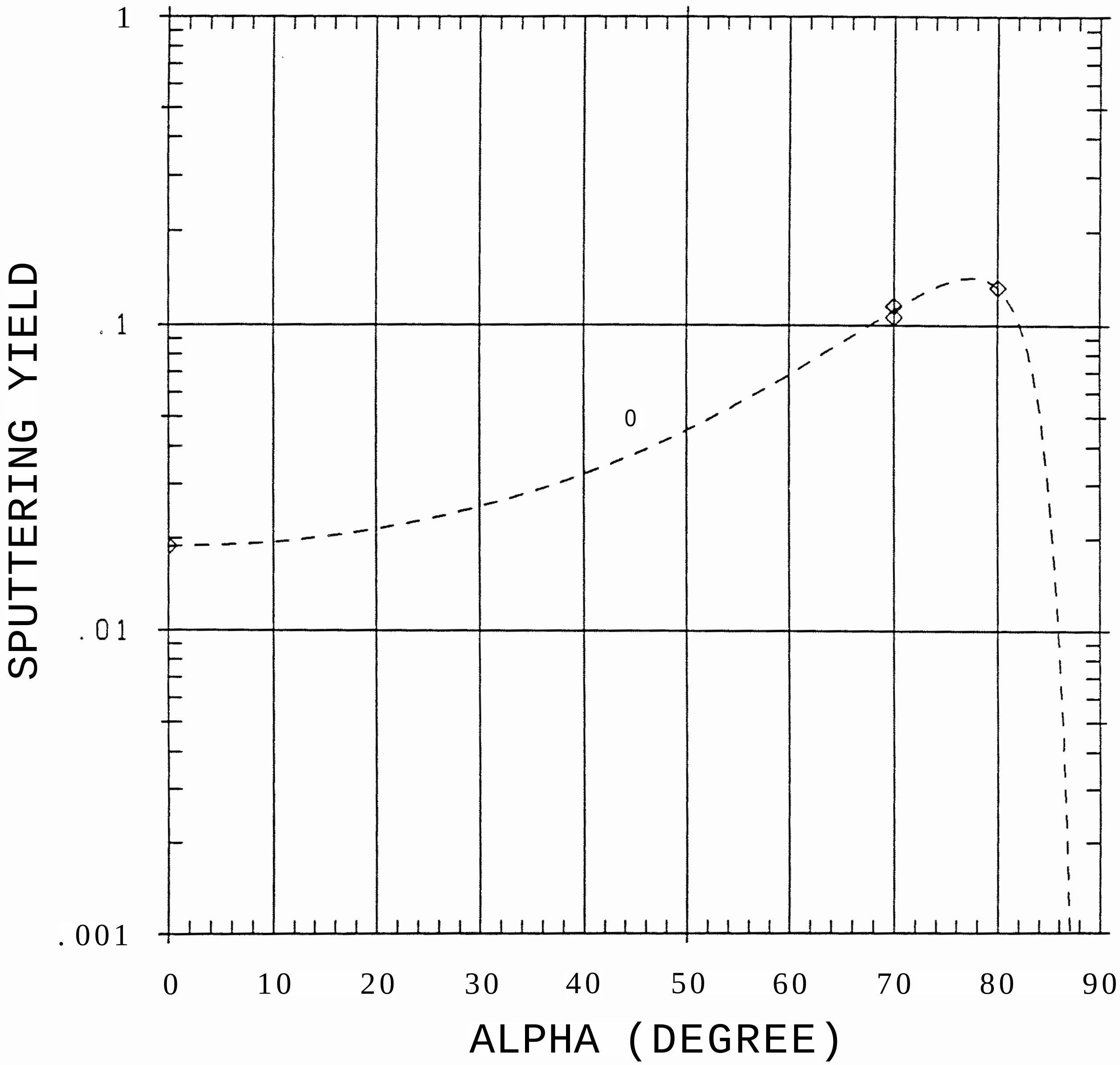


Fig. 140: Angular dependence of the sputtering yield of boron doped graphite USB15 (15 % B) with 1 keV D ions. The data are unpublished.

Experimental Data

Target •	Proj.	Energy	Angle	Yield	Temp.	N	Book	Page	Date
C/USB15	α	1.000	0	0.01880	20	3	X	119	30.10.1989
C/USB15	α	1.000	45	0.04980	20	3	X	120	31.10.1989
C/USB15	α	1.000	70	0.11500	20	3	X	119	30.10.1989
C/USB15	α	1.000	70	0.10600	20	3	X	123	07.11.1989
C/USB15	α	1.000	80	0.13200	20	3	X	120	31.10.1989

6. Discussion

The revised *Bohdansky* formula (10) gives good agreement with experimental and calculated data in the low keV range but deviations occur at higher energies as well as in the threshold regime, as already mentioned above. In many cases the accuracy of the formula is better than 30% but in special cases differences of more than 50% axe possible.

The experimental data have an accuracy of about ±30%, but the reproducibility is sometimes not better than a factor of two.

Discrepances between calculated and experimental data may originate from different effects. On one hand surface structure influences the sputtering of surface atoms. Sputtering at normal incidence is enhanced by surface roughness whereas at large angles of incidence the yield is reduced [70]. Additionally, the calculated data as well as the fitting formulae do not treat cases where the projectiles build up large concentrations in the target material and where strong chemical interactions between ions and target atoms exist, as in the case of bombardment of carbon with hydrogen or oxygen ions (figs. 17, 18). In some cases, surface oxidation of the targets in the experiments leads to higher threshold energies due to the higher binding energies of oxides which reduces the sputtering yield compared to pure metals, as in the case of Al (fig. 8) or Be sputtering (fig. 14) at room temperature. He bombardment of some bulk oxides like A/2O3 (fig. 50), *BeO* (fig. 54) and *SiOi* (fig. 57) shows higher threshold energies as expected, possibly due to charging effects at the target surface despite charge compensation.

In order to obtain an analytic scaling of the resulting value Q with the projectile/target parameters, we start from *Sigmund's* formula [72] for the sputtering yield Y

$$Y = \backslash F_d \quad . \qquad (15)$$

Assuming power potentials of the form [73]

$$V(r) \propto r^{\sim TM} \quad , \qquad m < 1 \quad , \qquad (16)$$

the values of A and F_d can be written

$$A = \frac{\Gamma_m}{8(1-2m)} \frac{1}{N C_m E^{1-2m}} \quad ,$$

$$F_d = a_s N S_n(E_0) \qquad (17)$$

$$= a_s N \quad a_L Z_1 Z_2 e^2 \frac{M_1}{M_1 + M_2} s_n(\epsilon) \quad .$$

N is the atomic density of the solid and a_s is a dimensionless function of the angle of incidence and the mass ratio M2/M1 [2,72]. $S_n(Eo)$ is the nuclear stopping cross section and 5_n(e) an universal stopping cross section function, where e is the reduced energy given in (5). The other values appearing in (17) are given by the following formulae

$$rm = (1) - 7(1 - m) \tag{18}$$

$$C_m = \frac{tt}{2} \wedge_m a_L^2 \left(\frac{ZM_1}{M_2} \right)^m \left(\frac{2Z_1Z_2e^2}{a_L} \right)^{2m} \quad . \tag{19}$$

X_m is a dimensionless function of the parameter m which varies slowly from $m = 1$ at high energies down to m « 0 at very low energies [72]. is given in (6). (r) is the digamma function which is defined by

$$\psi(x) = \frac{d \ln \Gamma(x)}{dx} = r'M/rw \quad . \tag{20}$$

Introducing (16,18) into (14) leads to

$$y_m = \frac{p^{-2(1-2m)} \left(9 \; 1128; \right)^{1/3(-1+2m)}}{2^{2m}(1-2m)A_m} \frac{a_B^{1+2m}}{a_s} E_s^{2m-L}$$

$$\left(7 \; 7 \right)^{l-2m} \left(f_7^{2/3} \; 7^{2/3} \right)^{2-m} \frac{M_1^{1-m} M_2^m}{M_1 + M_2} s_n(\epsilon)$$

$$= q_m E_3^{2m-1} f_m(Z_1, Z_2, M_1, M_2 y_n(e) \quad . \tag{21}$$

One can try to compare Y_m with the yield Y of the *Bohdansky* formula (10) neglecting the threshold terms, i.e. $Y_m = Qs_n(e)$ and one obtains

$$qmE^{2m-1} f_m = Q \quad . \tag{22}$$

A linear relation between $QEl^{\sim 2m}$ and f_m (q_m is a constant) could best be achieved by using $m = 1/6$ which was shown earlier [15,74] to give the best agreement with data from simulations. The value $m = 0$, which corresponds to hard spheres, gives no reasonable fit. Therefore, in fig. 141 the comparison is done for $m = 1/6$ with the expression (21)

$$QE_s^{2/3} = ?i/6/i/«(Zi, Z_2, Mi, Af_2) \quad \text{where} \tag{23}$$

$$81/6 \; « \; \frac{r_{1/6} (e^2)^{2/3} \, 0.8853 \text{-} V > aä^{2/3} a,}{2V3p_{1/6}} \quad , \tag{24}$$

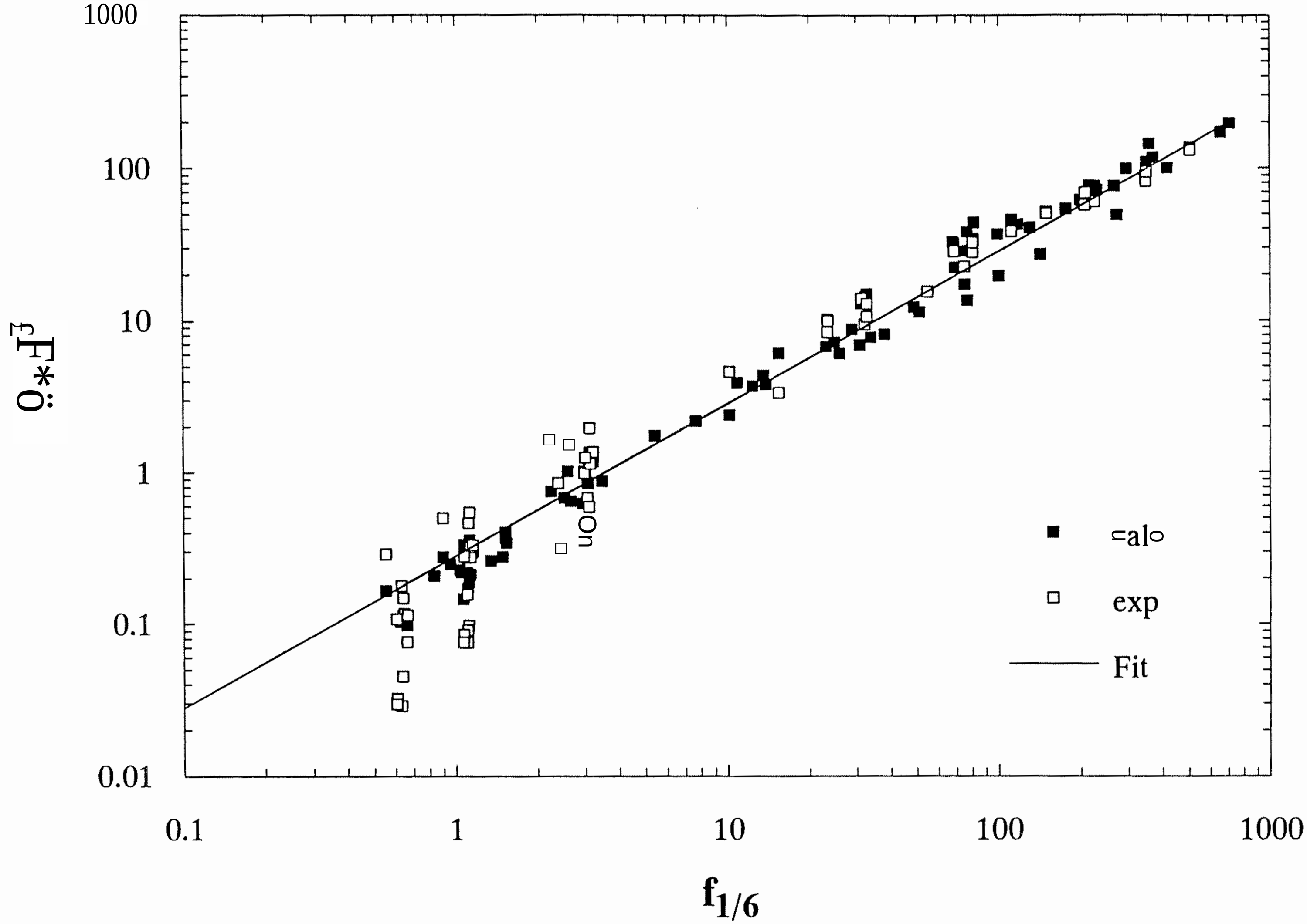


Fig. 141: The value $QE_t^{\ ...}$ versus /i/ß, see (23-25). Solid squares represent calculated data, open squares experimental data. The solid line is given by the theoretical formula (23).

$$A_{1/6} - \quad 7\,{}_1^{2}{}^{/3}\, z\, {}_2^{2/3} \, |^{*}{}_1^{Z}{}^{2/3} + z_2^{2/3}Y/^{3}\; M_{M1+}^{6}\; M_2^{176} \quad ■ \qquad (25)$$

<2ß is the Bohr radius, and X- is determined by interpolation of known values for several m [72]

$$a\ss = 0.529\text{Ä} \quad , \quad r_{1/6} = 0.531 \quad , \quad \text{and} \quad \text{Ai/g} = 3.8 \quad . \qquad (26)$$

The best fit shown in fig. 141 can be achieved with a value $a_a = 0.17$ leading to a value of 91/6 = 0.278 . Formula (23) can, therefore, be written

$$QE\mathfrak{J}^{2}{}^{3} = 0.278Zf^{/3} Z_2^{2/3} (z?^{/8} + Z^{2/3})^{1/3} \frac{M_1^{5/6} M_2^{1/6}}{M_1 + M_2} \quad . \qquad (27)$$

The factor a_a is a function of the mass ratio, as already mentioned above. The dependence of a_a on the mass ratio is shown in fig. 142 for different targets. The points result from equation (23) using the fitted values of Q. This dependence leads to deviations of $QE\mathfrak{J}^{2}{}^{3}$ from the linearity in fig. 141 up to a factor of 5, especially for experimental data at low values of $/_{1y}l_6$ corresponding to H, D and He bombardment and Af_2/Afi > 2. The product $a_a S_n(Eo)$ in (17) is proportional to the deposited energy during the slowing down of ions and energetic recoil atoms [2,72], *Sigmund's* equation (15) includes in the solution of the transport equation multiple scattering events of the primaries through the surface, which is a large correction especially for light ions [72]. This multiple scattering leads to an overestimate of the deposited energy for light ion sputtering which is expressed in the dependence of on the mass ratio M_2/Mi. The choice of a_a — 0.17 is a good mean value, as can be seen in fig. 142. The solid line in fig. 142 shows *Sigmund's* theoretically predicted a_a. Bohdansky [2] gave an analytic approximation of a_s which results from dividing *Sigmund's* a_a by the avarage number of surface crossings by pure elastic collisions in order to get the deposited energy for a real surface. This approximation is also shown in fig. 142 (dashed line) and gives a reasonable agreement to the data for M_2/Afi < 10. The scale of the ordinate is chosen as in [2] for comparison. The measured values of a_a given by Bohdansky in [2] show a stronger spreading as the values given here (fig. 142). This is due to the fact that Bohdansky's is calculated for $m = 0$ in equation (21); it should also be mentioned that Bohdansky used the Born-Mayer screening length *übm* = 0.219Ä [75] independent of Z for the calculation of q_0 in eq. (21) (while for $S_n(E)$ *aß* was used), leading

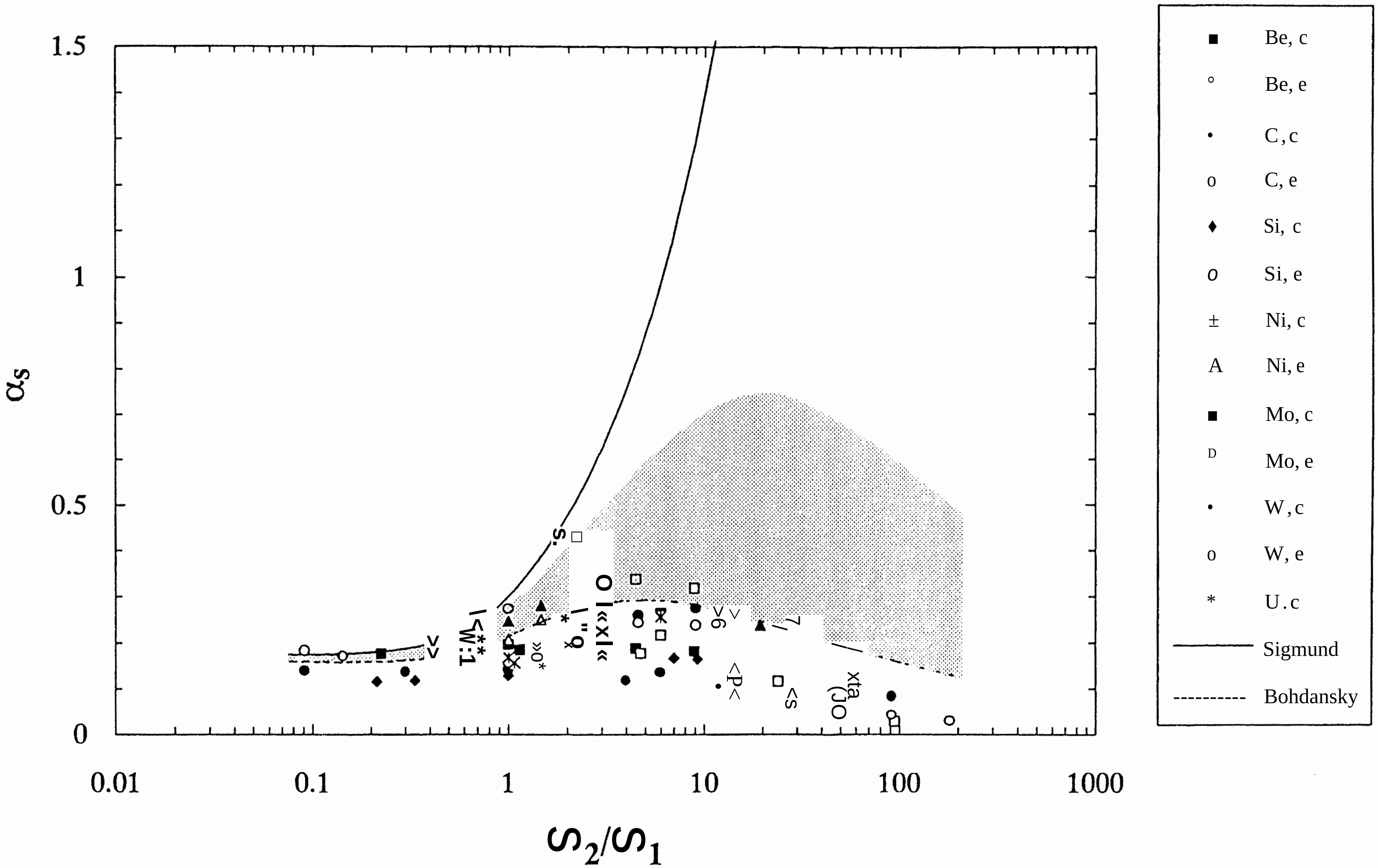


Fig. 142: The value α_s (see text) versus the ratio of target to projectile mass. Solid symbols represent calculated data (c), open symbols experimental data (e). The solid line is Sigmund's theoretical curve [72], the dashed curve is given by Bohdansky [2] for pure elastic collisions. The shaded area shows the spreading of the α_s-values given by Bohdansky.

to a stronger variation of a_a with Z. The shaded area in fig. 142 shows the spreading of the values of Bohdansky's a_a in [2].

The large number of fitted values of the threshold energy $E_t h$ give the possibility to introduce a better fit of the threshold energy versus the mass ratio. The best fit is achieved with the formula

$$\frac{E_{th}}{E_s} = b_1 \left(\frac{M_2}{M_1}\right)^{b_2} + bs \left(\frac{M_2}{M_1}\right)^{b_4} \text{ with}$$

$$bi\ —7.0 \quad , \quad b_2 \sim —0.54 \quad , \quad 63 = 0.15 \qquad 64 = 1.12 \quad , \qquad (28)$$

see fig. 143. Earlier fits vary somewhat but give similar results. It should be remembered that these data are only valid for normal incidence, and that the fit values Q and Eth depend on the analytic formula (10) for the enrgy dependence chosen for the fitting procedure, and that calculated values at very low energies had to be omited for the fitting procedure (see page 7).

Yamamura's procedure given in (12,13,14) is based on the assumption that the angular dependence can be described by a factor to the yield at normal incidence. As can be seen in some figures, *Yamamuras's* assumption is not correct for selfsputtering and heavy ions at ion energies near the threshold, but for not too low energies *Yamamura's* procedure is acceptable. *Yamamura's* proposed fit for f, see (13), shows a linear relation between $f/\backslash fE_{\sim 3}$ and the mass ratio M2/M1. Our collected data agree with (13) for large mass ratios but at low mass ratios we observe strong deviations which scale with the ion energy. Therefore we prefer to plot f as a function of the ion energy for different ion/target combinations in order to facilitate reading off the value of f for a given mass ratio and a given energy. This plot is shown in fig. 144. The shaded area gives the range of /-values due to *Yamamura's* fit formula (13) for the plotted ion/target combinations.

Yamamura's formula for a_{opt} (14) fits our data well only for light projectiles (M_2/Mi :> 3) and not too low energies, but for heavy projectiles and selfsputtering as well as for ion energies near the threshold we observe systematic deviations. Fig. 145 and 146 show a_{opt} as a function of the ion energy for light projectiles (M_2/Mi > 3) and selfsputtering, respectively. For high mass ratios a_{opt} agrees with *Yamamura's* formula (14) at high ion

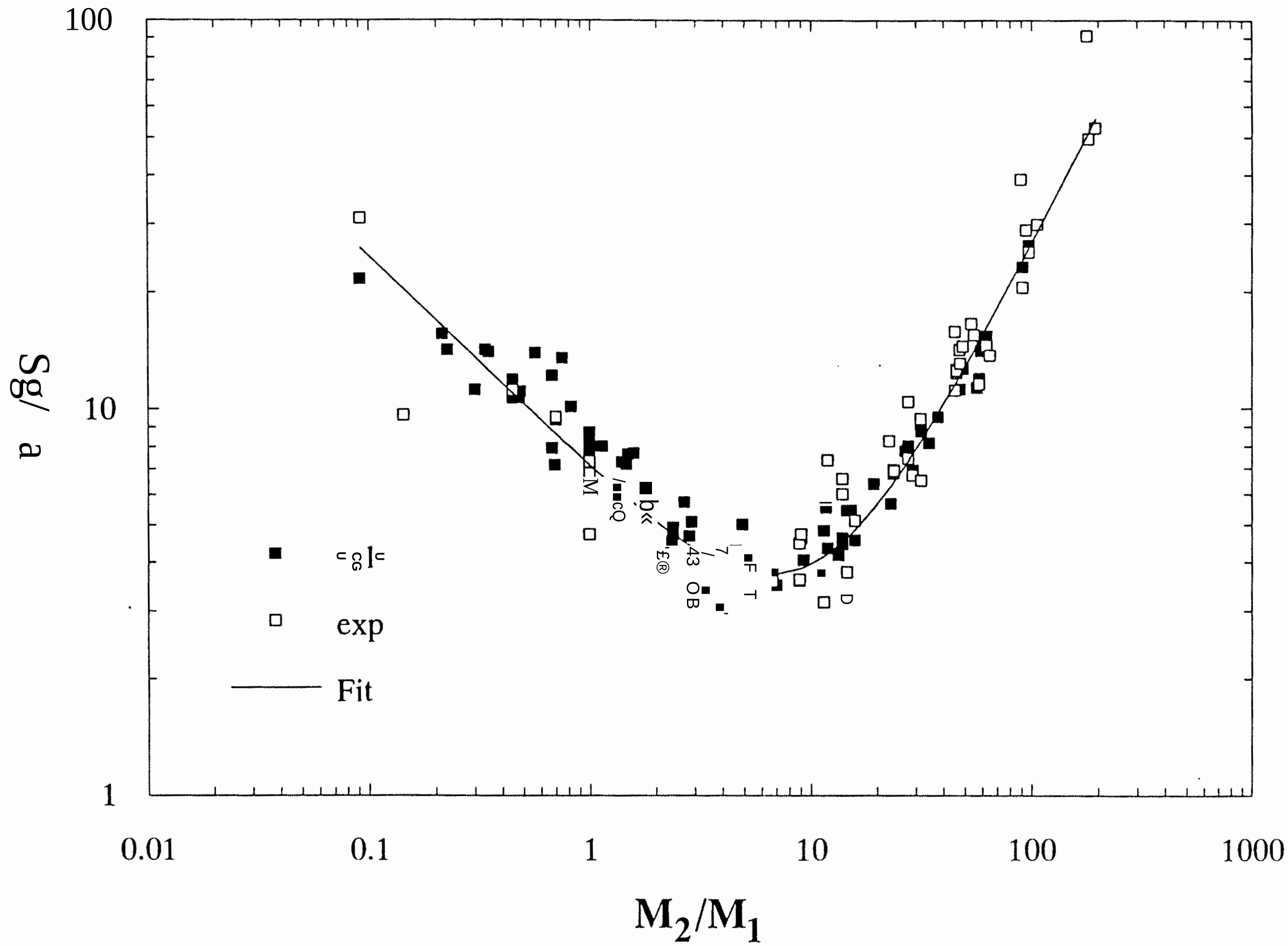


Fig. 143: The relative threshold energy, E_{th}/E_s, versus the ratio of target to projectile mass. Solid squares represent calculated data, open squares experimental data. The solid line, given by (28), is a fit to all available data.

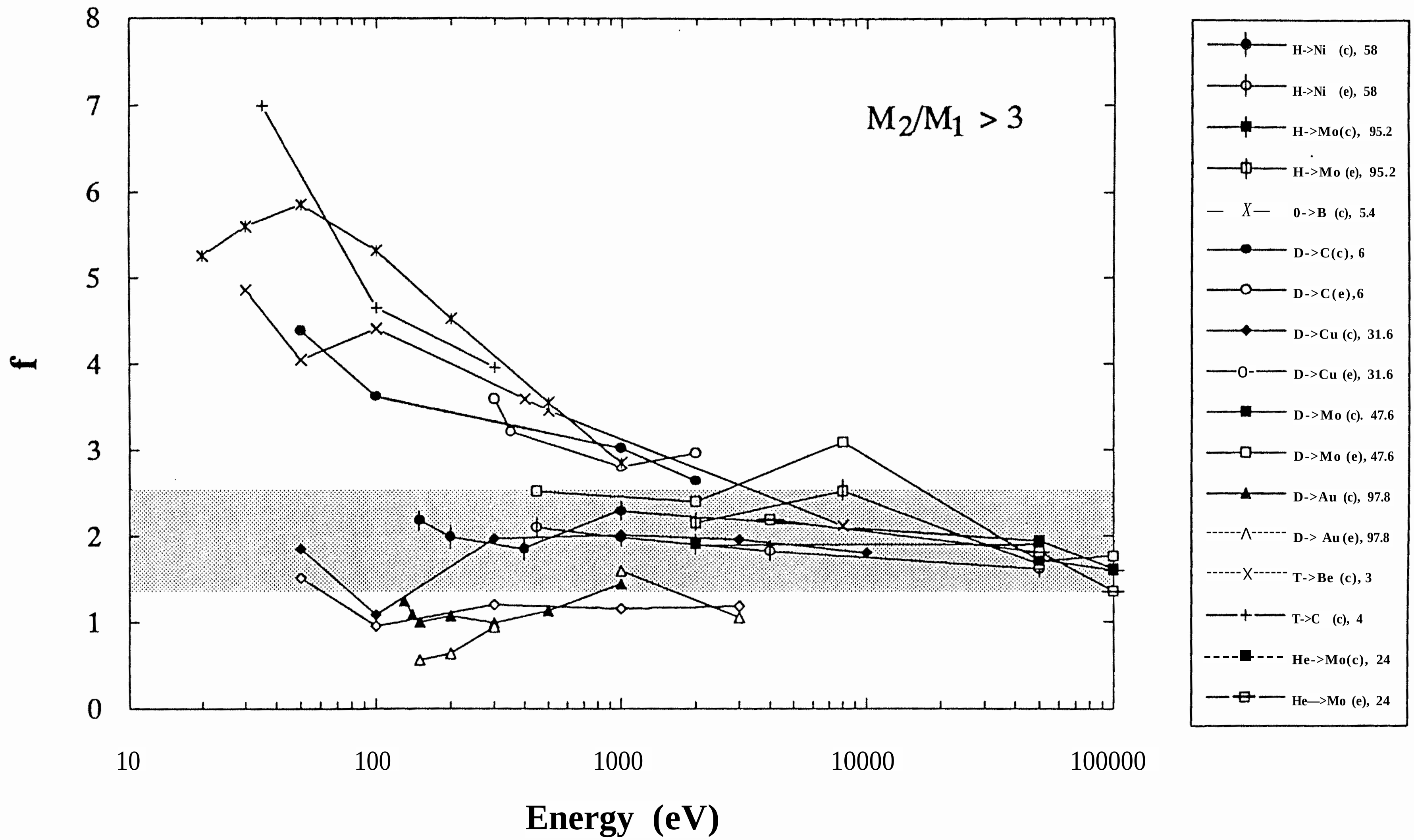


Fig. 144: Fit-values for the value f versus the projectile energy for target to projectile mass ratios larger than 3. Solid symbols represent calculated data (c), open symbols experimental data (e). Points for the same projectile-target combination are connected by straight lines. The shaded area gives the range of /-values due to formula (13) for the projectile-target combinations shown to the right of the figure.

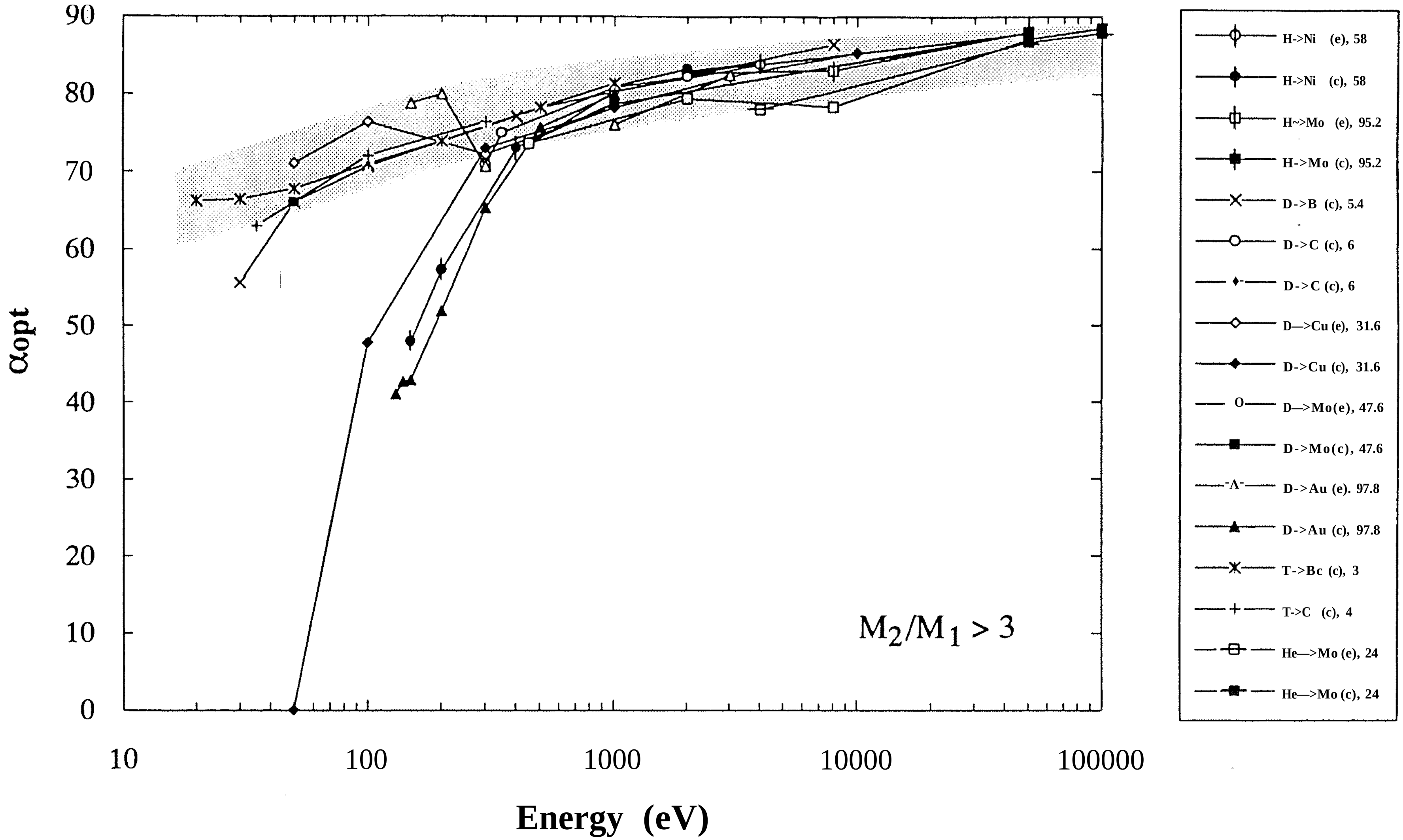


Fig. 145: Fit-values for the value a_{opt} versus the projectile energy for target to projectile mass ratios larger than 3. Solid symbols represent calculated data (c), open symbols experimental data (e). Points for the same projectile-target combination are connected by straight lines. The shaded area gives the range of $a_{op(}$-values due to formula (14) for the projectile-target combinations shown to the right of the figure.

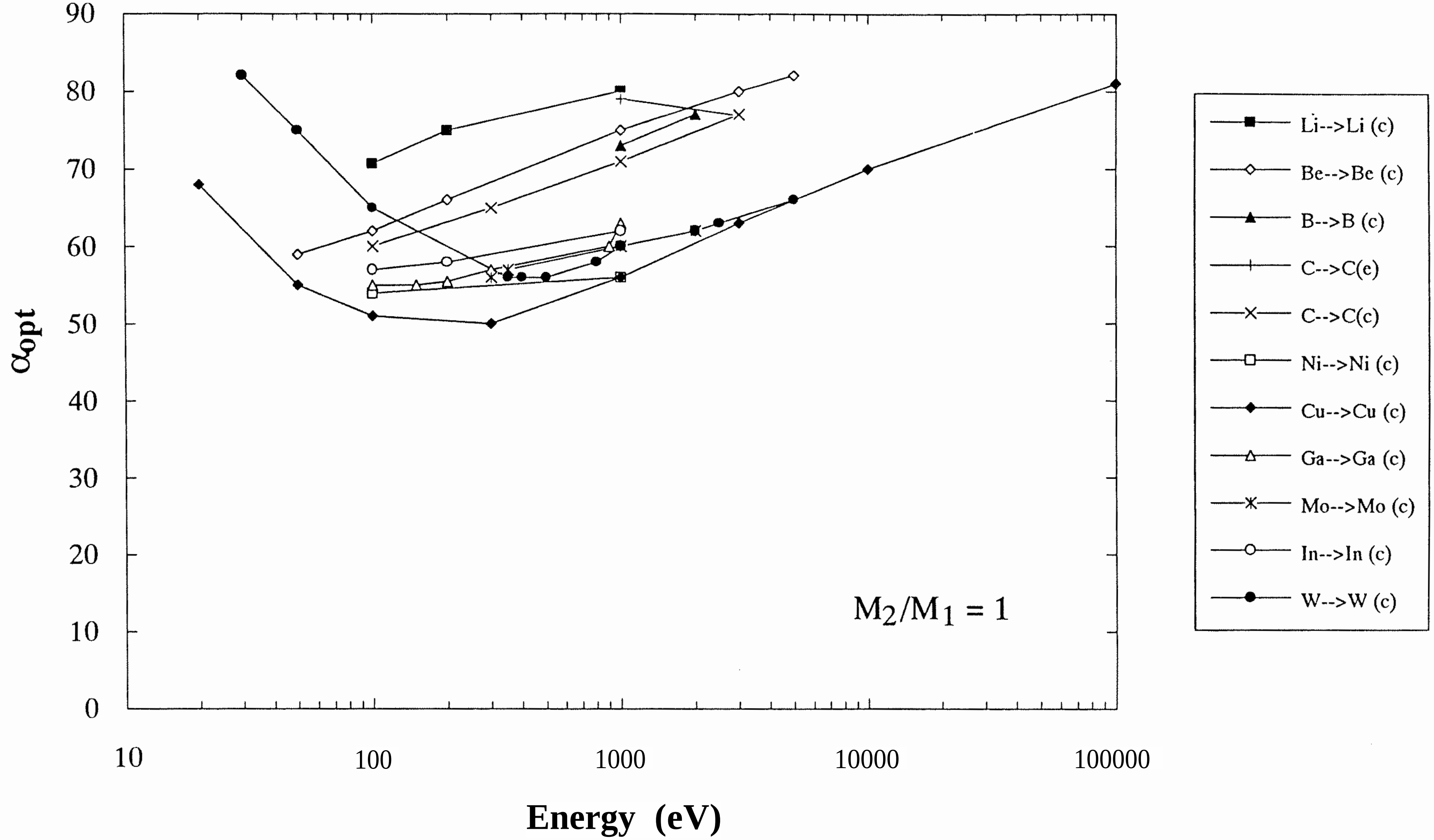


Fig. 146: Fit-values for the value a_{opt} versus the projectile energy for self-ion bombardment (mass ratio equal to 1). Solid symbols represent calculated data (c), open symbols experimental data (e). Points for the same projectile-target combination are connected by straight lines. The shaded area gives the range of a-values due to formula (14) for the projectile-target combinations shown to the right of the figure.

energies, as can be seen in fig. 145. The shaded area gives the range of a_{op}t-values due to formula (14) for the plotted ion/target combinations. At ion energies near the threshold a_{opt} becomes smaller and it may even reach zero. For low mass ratios and selfsputtering (fig. 146), on the contrary, the values of a_{opt} at energies near the threshold have a tendency to become larger. This behaviour can be understood considering that, especially for selfsputtering, chemical binding forces at the surface cause an acceleration and a refraction for projectiles leading to a change in the angle of incidence [76]. This effect is negligible for ion energies much higher than the binding forces but it will be of importance in the threshold regime. The values of a_{opt} for selfsputtering and low energies were read off from the curve given by the data points and not by fitting.

In table I of ref. [23] (page 52) the parameters E_{th} and Q were given for the most important materials involved in plasma-wall interaction. These parameters resulted from fitting of the energy dependence of experimental sputtering yield data at normal incidence with the *Bohdansky* formula (4). The parameters f and ??(= tt/2 —$a_{op(}$), which resulted from fitting of the angular dependence of exerimental yield data with *Yamamura's* formulae (13) and (14), were also given in this table but only for light projectiles, because formula (13) does not apply to heavy projectiles. Best fit values for E_{th} and Q for individual target/projectile combinations are found in this report above all figures representing data and fitting curves. Parameters E_{th} and Q (as well as E_a, *Mi/M* and *Etf')* are given here again in table 3 for a more extended fist of target materials and projectiles. Here these parameters results from the deduced empirical formulae (28) and (27) and they can be calculated for target/projectile combinations where no experimental or calculated data exist. The empirical formulae (28) and (27) are based on the fit parameters of the revised *Bohdansky* formula (10) and result from a large amount of measured and calculated sputtering yield data, which are all given in this work. The parameters f and a_{opt} for the angular dependence of the sputtering yield can be taken from figs. 144 - 146 for given target/projectile combinations and incident energy.

Table 3. Parameters for the energy dependence of the sputtering yield at normal incidence

Target	H	D	T	He	C	O	self-sput.	Ne	Ar	Kr	Xe
Lithium											
Es = 1.67 eV											
M2/M1	6.88	3.45	2.30	1.73	0.58	0.43	1	0.34	0.17	0.08	0.05
ETF(eV)	185	209	232	557	3506	6014	1129	9345	33553	156426	401359
Eth (eV)	6.22	6.92	8.03	9.10	15.94	18.61	11.94	21.11	30.65	46.03	58.91
Q (atoms/ion)	0.10	0.16	0.21	0.40	1.37	1.82	0.69	2.24	3.72	6.41	8.66
Beryllium											
Es - 3.38 eV											
M2/M1	8.94	4.47	2.99	2.25	0.75	0.56	1	0.45	0.23	0.11	0.07
ETF(eV)	256	282	308	720	4153	6971	2208	10660	36842	167016	423799
Eth (eV)	12.99	13.09	14.69	16.40	28.08	32.71	24.17	37.07	53.76	80.70	103.28
Q (atoms/ion)	0.07	0.11	0.14	0.28	1.00	1.35	0.67	1.68	2.86	5.01	6.81
Bor											
Es - 5.73 eV											
M2/M1	10.73	5.37	3.59	2.70	0.90	0.68	1	0.54	0.27	0.13	0.08
ETF(eV)	333	361	389	894	4856	8021	3717	12115	40627	179955	452343
Eth (eV)	23.14	21.56	23.46	25.83	43.25	50.30	40.97	56.95	82.48	123.75	158.37
Q (atoms/ion)	0.05	0.08	0.11	0.21	0.80	1.08	0.67	1.36	2.36	4.18	5.70
Graphite											
Es - 7.42 eV											
M2/M1	11.92	5.96	3.98	3.00	1.00	0.75	1	0.60	0.30	0.14	0.09
ETF(eV)	415	447	479	1087	5688	9298	5688	13933	45800	199619	498376
Eth (eV)	31.11	27.64	29.48	32.15	52.98	61.54	52.98	69.63	100.74	151.11	193.36
Q (atoms/ion)	0.05	0.08	0.10	0.20	0.75	1.02	0.75	1.28	2.26	4.03	5.51
Aluminium											
Es = 3.36 eV											
M2/M1	26.77	13.40	8.94	6.74	2.25	1.69	1	1.34	0.68	0.32	0.21
ETF(eV)	1059	1097	1135	2448	10297	15720	34550	22277	62825	239436	563516
Eth (eV)	23.87	14.86	12.91	12.51	16.32	18.55	24.02	20.75	29.51	44.01	56.24
Q (atoms/ion)	0.08	0.14	0.19	0.37	1.65	2.36	4.21	3.09	6.08	11.87	16.85
Silizium											
Es = 4.70 eV											
M2/M1	27.86	13.95	9.31	7.02	2.34	1.76	1	1.39	0.70	0.34	0.21
ETF(eV)	1163	1203	1244	2674	11127	16925	41072	23910	66811	252306	591200
Eth (eV)	34.56	21.21	18.22	17.52	22.45	25.47	33.61	28.45	40.41	60.23	76.96
Q (atoms/ion)	0.07	0.11	0.15	0.31	1.37	1.96	3.78	2.58	5.10	10.00	14.22
Titanium											
Es = 4.89 eV											
M2/M1	47.52	23.78	15.88	11.97	3.99	2.99	1	2.37	1.20	0.57	0.36
ETF(eV)	2054	2097	2139	4503	16949	24846	117915	33975	85653	289886	642824
Eth (eV)	59.49	31.51	23.71	20.56	19.45	21.23	34.96	23.21	31.88	46.95	59.84
Q (atoms/ion)	0.06	0.11	0.15	0.30	1.41	2.07	7.44	2.79	5.97	12.70	18.79
Vanadium											
Es = 5.33 eV											
M2/M1	50.54	25.29	16.88	12.73	4.24	3.18	1	2.52	1.28	0.61	0.39
ETF(eV)	2174	2216	2258	4744	17692	25841	130802	35219	87811	293378	646058
Eth (eV)	69.01	36.11	26.83	23.02	20.89	22.66	38.11	24.68	33.69	49.52	63.08
Q (atoms/ion)	0.06	0.10	0.14	0.28	1.33	1.96	7.52	2.64	5.70	12.25	18.22

Table 3. (continue)

Target	H	D	T	He	C	O	self-sput.	Ne	Ar	Kr	Xe
Chromium											
Es = 4.12 eV											
M2/M1	51.58	25.82	17.23	12.99	4.33	3.25	1	2.58	1.30	0.62	0.40
ETF(eV)	2296	2340	2383	5002	18577	27091	144458	36871	91517	304121	667748
Eth (eV)	54.47	28.39	21.01	17.96	16.07	17.40	29.46	18.92	25.78	37.86	48.22
Q (atoms/ion)	0.07	0.12	0.17	0.34	1.61	2.38	9.54	3.21	6.94	14.96	22.28
Manganese											
Es = 2.92 eV											
M2/M1	54.50	27.28	18.21	13.73	4.57	3.43	1	2.72	1.38	0.66	0.42
ETF(eV)	2418	2462	2505	5250	19345	28123	158895	38166	93813	308147	672276
Eth (eV)	40.84	21.08	15.44	13.07	11.26	12.11	20.88	13.13	17.78	26.06	33.17
Q (atoms/ion)	0.09	0.15	0.21	0.42	2.02	2.99	12.79	4.04	8.82	19.18	28.71
Iron											
Es = 4.34 eV											
M2/M1	55.11	27.58	18.41	13.88	4.62	3.47	1	2.75	1.39	0.66	0.42
ETF(eV)	2544	2590	2635	5517	20270	29437	174122	39914	97826	320199	697195
Eth (eV)	61.39	31.63	23.12	19.54	16.70	17.95	31.03	19.43	26.28	38.50	49.01
Q (atoms/ion)	0.07	0.12	0.16	0.33	1.59	2.36	10.44	3.19	6.95	15.13	22.67
Cobalt											
Es =4.43 eV											
M2/M1	58.47	29.26	19.53	14.72	4.91	3.68	1	2.92	1.48	0.70	0.45
ETF(eV)	2670	2714	2759	5768	21026	30440	190151	41153	99852	322843	698137
Eth (eV)	66.61	34.00	24.59	20.58	16.88	18.00	31.67	19.41	26.07	38.08	48.45
Q (atoms/ion)	0.07	0.12	0.16	0.32	1.56	2.31	10.92	3.13	6.89	15.15	22.82
Nickel											
Es = 4.46 eV											
M2/M1	58.25	29.15	19.46	14.67	4.89	3.67	1	2.91	1.47	0.70	0.45
ETF(eV)	2799	2846	2893	6045	22014	31860	206991	43063	104429	337404	729328
Eth (eV)	66.80	34.12	24.69	20.67	17.00	18.14	31.89	19.57	26.29	38.42	48.88
Q (atoms/ion)	0.07	0.12	0.16	0.33	1.60	2.38	11.51	3.22	7.07	15.52	23.36
Copper											
Es = 3.52											
M2/M1	63.04	31.55	21.06	15.87	5.29	3.97	1	3.15	1.59	0.76	0.48
ETF(eV)	2926	2972	3017	6293	22701	32727	224652	44077	105538	335640	719012
Eth (eV)	57.25	28.90	20.64	17.07	13.27	14.01	25.17	15.02	19.98	29.08	36.96
Q (atoms/ion)	0.08	0.14	0.19	0.38	1.83	2.73	14.23	3.70	8.22	18.30	27.76
Gallium											
Es = 2.82 eV											
M2/M1	69.17	34.62	23.11	17.42	5.80	4.36	1	3.45	1.75	0.83	0.53
ETF (eV)	3187	3232	3278	6821	24324	34905	262478	46807	110381	344274	729195
Eth (eV)	50.57	25.22	17.76	14.48	10.54	10.98	20.16	11.68	15.32	22.19	28.17
Q (atoms/ion)	0.09	0.15	0.21	0.43	2.11	3.15	18.30	4.29	9.64	21.77	33.31
Germanium											
Es = 3.88 eV											
M2/M1	72.02	36.04	24.06	18.14	6.04	4.54	1	3.60	1.82	0.87	0.55
ETF (eV)	3320	3365	3410	7090	25163	36036	282661	48235	113007	349472	736476
Eth (eV)	72.61	36.03	25.23	20.46	14.46	14.99	27.74	15.87	20.69	29.89	37.93
Q (atoms/ion)	0.07	0.12	0.17	0.35	1.70	2.54	15.54	3.47	7.84	17.83	27.38

Table 3. (continue)

Target	H	D	T	He	C	O	self-sput.	Ne	Ar	Kr	Xe
Zirconium											
Es = 6.33 eV											
M2/M1	90.50	45.29	30.24	22.79	7.59	5.70	1	4.52	2.28	1.09	0.69
ETF(eV)	4430	4478	4526	9356	32333	45807	475761	60697	137124	403744	825617
Eth (eV)	151.27	73.40	50.01	39.43	23.73	23.68	45.26	24.47	30.53	43.33	54.77
Q (atoms/ion)	0.05	0.09	0.13	0.25	1.26	1.90	15.87	2.60	6.03	14.20	22.29
Niobium											
Es = 7.59 eV											
M2/M1	92.17	46.13	30.79	23.21	7.73	5.81	1	4.60	2.33	1.11	0.71
ETF(eV)	4574	4623	4672	9653	33285	47114	503978	62377	140504	412001	840317
Eth (eV)	185.00	89.63	60.96	47.96	28.50	28.36	54.27	29.24	36.33	51.48	65.04
Q (atoms/ion)	0.05	0.08	0.11	0.23	1.13	1.69	14.61	2.33	5.40	12.75	20.04
Molybdenum											
Es = 6.83 eV											
M2/M1	95.18	47.64	31.80	23.97	7.99	6.00	1	4.75	2.40	1.14	0.73
ETF(eV)	4719	4768	4817	9945	34188	48329	533127	63907	143293	417472	847973
Eth (eV)	172.36	83.30	56.47	44.28	25.75	25.47	48.83	26.16	32.26	45.57	57.54
Q (atoms/ion)	0.05	0.09	0.12	0.24	1.20	1.81	16.27	2.49	5.80	13.77	21.73
Paladium											
Es = 3.91 eV											
M2/M1	105.56	52.83	35.27	26.58	8.86	6.65	1	5.27	2.66	1.27	0.81
ETF(eV)	5310	5360	5409	11145	37933	53400	659200	70334	155412	443386	888437
Eth (eV)	110.40	52.96	35.58	27.62	15.00	14.55	27.96	14.74	17.73	24.77	31.19
Q (atoms/ion)	0.07	0.12	0.17	0.35	1.75	2.64	27.19	3.64	8.56	20.63	32.87
Silver											
Es = 2.97 eV											
M2/M1	107.02	53.56	35.75	26.95	8.98	6.74	1	5.34	2.70	1.29	0.82
ETF(eV)	5461	5511	5562	11455	38926	54762	693123	72086	158942	452060	903991
Eth (eV)	85.12	40.80	27.37	21.22	11.42	11.05	21.24	11.18	13.39	18.69	23.52
Q (atoms/ion)	0.09	0.15	0.21	0.42	2.12	3.20	33.77	4.41	10.38	25.07	39.99
Indium											
Es = 2.49 eV											
M2/M1	114.01	57.06	38.09	28.71	9.57	7.18	1	5.69	2.88	1.37	0.88
ETF(eV)	5764	5814	5864	12065	40783	57247	763906	75196	164454	462159	916815
Eth (eV)	76.46	36.51	24.37	18.79	9.72	9.29	17.80	9.32	10.97	15.18	19.08
Q (atoms/ion)	0.09	0.17	0.23	0.47	2.35	3.56	40.53	4.92	11.65	28.40	45.60
Tantalum											
Es = 8.1 eV											
M2/M1	177.08	88.62	59.16	44.59	14.86	11.16	1	8.84	4.47	2.13	1.36
ETF(eV)	9698	9752	9806	20030	65489	90632	1936432	117444	243854	632301	1185140
Eth (eV)	403.72	189.25	123.30	92.48	37.81	33.15	57.92	31.05	31.39	40.24	49.60
Q (atoms/ion)	0.04	0.07	0.10	0.21	1.08	1.64	34.32	2.29	5.62	14.49	24.26
Tungsten											
Es = 8.68 eV											
M2/M1	182.40	91.29	60.94	45.93	15.31	11.49	1	9.11	4.60	2.19	1.40
ETF(eV)	9871	9925	9978	20376	66517	91993	1998893	119127	246680	636771	1189500
Eth (eV)	447.02	209.37	136.26	102.07	41.20	35.92	62.06	33.49	33.44	42.58	52.39
Q (atoms/ion)	0.04	0.07	0.10	0.20	1.02	1.55	33.47	2.16	5.32	13.77	23.13

Table 3. (continue)

Target	H	D	T	He	C	O	self-sput.	Ne	Ar	Kr	Xe
Platinum											
Es = 5.86 eV											
M2/M1	193.55	96.87	64.66	48.74	16.24	12.19	1	9.67	4.88	2.33	1.49
ETF(eV)	10576	10630	10684	21800	70908	97913	2260145	126603	260626	666316	1235713
Eth (eV)	322.30	150.72	97.88	73.14	28.80	24.84	41.90	22.93	22.34	28.04	34.36
Q (atoms/ion)	0.05	0.09	0.13	0.26	1.32	2.02	47.21	2.81	6.94	18.10	30.56
Gold											
Es = 3.8 eV											
M2/M1	195.41	97.80	65.29	49.21	16.40	12.31	1	9.76	4.93	2.35	1.50
ETF(eV)	10754	10809	10863	22161	72036	99443	2328335	128546	264355	674720	1249737
Eth (eV)	211.23	98.75	64.11	47.89	18.79	16.17	27.17	14.91	14.46	18.11	22.18
Q (atoms/ion)	0.07	0.12	0.17	0.34	1.77	2.70	64.27	3.77	9.31	24.28	41.03
Lead											
Es = 2.03 eV											
M2/M1	205.55	102.87	68.67	51.76	17.25	12.95	1	10.27	5.19	2.47	1.58
ETF(eV)	11292	11347	11401	23245	75351	103894	2539888	134144	274593	695459	1280570
Eth (eV)	119.35	55.73	36.13	26.93	10.36	8.84	14.51	8.08	7.67	9.48	11.56
Q (atoms/ion)	0.10	0.18	0.26	0.52	2.67	4.08	103.45	5.69	14.09	36.98	62.78
Uranium											
Es = 5.42											
M2/M1	236.15	118.19	78.90	59.47	19.82	14.88	1	11.79	5.96	2.84	1.81
ETF(eV)	13132	13187	13242	26956	86741	119219	3322159	153458	310319	769905	1395148
Eth (eV)	371.76	173.11	111.77	82.95	30.40	25.32	38.75	22.66	20.22	23.98	28.94
Q (atoms/ion)	0.05	0.09	0.13	0.27	1.37	2.10	64.29	2.94	7.33	19.52	33.53

7. Acknowledgements

We like to thank the students T.Grebner, G.Hadwich, T.Hirschmann, and M.Langhoff for the data handling, which includes the data transfer into the computer, writing programs to fit the data and to produce plot output. For the help with some of the figures we express our thanks to Mrs. Sombach and Mrs. Treske.

8. References

1 J.Roth, J.Bohdansky, W.Ottenberger: *Data on Low Energy Light Ion Sputtering, Max-Planck-Institut für Plasmaphysik, Report IPP 9/26* (1979)

2 J.Bohdansky: Nucl. Instrum. Methods B 2, 587 (1984)

3 Y.Yamamura, Y.Itikawa, N.Itoh: IPPJ-AM-26, Nagoya (1983)

4 G.Schilling: Kerntechnik **16,** 309 (1974)

5 P.Sigmund: Appl. Phys. Lett. **27,** 52 (1975)

6 H.H.Andersen, H.L.Bay: J. Appl. Phys. 46, 2416 (1975)

7 C.E.Kenknight, G.K.Wehner: J. Appl. Phys. 35, 322 (1964)

8 H.L.Bay, J.Roth, W.Eckstein: J. Appl. Phys. 48, 4722 (1977)

9 G.Staudenmaier, J.Roth, R.Behrisch, J.Bohdansky, Ph.Staib, S.Matteson, S.K.Erents: J. Nucl. Mater. **84,** 149 (1979)

10 J.Roth, J.Bohdansky, W.Ottenberger: J. Nucl. Mater. 165, 193 (1989)

11 E.Gauthier, W.Eckstein, J.Läszlo, J.Roth: J. Nucl. Mater. 176&177, 438 (1991)

12 H.Liebl, J.Bohdansky, J.Roth, V.Dose: Rev. Sei. Instrum. **58,** 1830 (1987)

13 H.L.Bay, J.Bohdansky, W.O.Hofer, J.Roth: Appl. Phys. 21, 327 (1980)

14 R.Behrisch: Vakuum Technik **10,** 250 (1967)

15 J.P.Biersack, W.Eckstein: Appl. Phys. A 34, 73 (1984)

16 W.D.Wilson, L.G.Haggmark, J.P.Biersack: Phys. Rev. B 15, 2458 (1977)

17 J.Lindhard, M.Scharff: Phys. Rev. **124,** 128 (1961)

18 O.S.Oen, M.T.Robinson: Nucl. Instrum. Methods 132, 647 (1976)

19 H.H.Andersen, J.F.Ziegler: *Hydrogen Stopping Powers and Ranges in All Elements, The Stopping and Ranges of Ions in Matter* (Vol.3, ed. by J.F.Ziegler (Pergamon, New York 1977) p. 35)

20 J.F.Ziegler: *Helium Stopping Powers and Ranges in All Elements, The Stopping and Ranges of Ions in Matter* (Vol.4, ed. by J.F.Ziegler (Pergamon, New York 1977))

21 R.Hultgren, J.P.Desai, D.T.Hawkins, M.Gleiser, K.K.Kelley, D.D.Wagman: *Selected Values of the Thermodynamic Properties of the Elements* (Am. Soc. Metals, Metals Park, OH 1973)

22 W.Eckstein: *Computer Simulation of Ion-Solid Interaction,* Springer Series in Materials Science, Vol.10 (Springer, Berlin, Heidelberg 1991)

23 W.Eckstein, J.Bohdansky, J.Roth: Nuclear Fusion Supplement **1,** 51 (1991)

24 L.H.Thomas: Proc Cambridge Philos. Soc. 23 (1927) 542

25 E.Fermi: Z.Phys. **48,** 73 (1928)

26 J.Bohdansky, H.Lindner, E.Hechtl, A.P.Martinelli, J.Roth: Nucl. Instrum. Methods B **18,** 509 (1987)

27 J.Bohdansky, J.Roth, F.Brossa: J. Nucl. Mater. **85&86,** 1145 (1979)

28 H.L.Bay, J.Roth, J.Bohdansky: J.Appl. Phys. **48,** 4722 (1977)

29 E.Gauthier, W.Eckstein, J.Läszlo, J.Roth: J. Nucl. Mater. **176&177,** 438 (1990)

30 E.Hechtl, A.Mazanec, W.Eckstein, J.Roth, C.Garcia-Rosales: J. Nucl. Mater. **196 —198,** 713 (1992)

31 J.Bohdansky, J.Roth, W.Ottenberger: *Sputtering Measurements of Beryllium, Max-Planck-Institut für Plasmaphysik, Report IPP-JET No. S1* (1985)

32 J.Roth: J. Nucl. Mater. **145 —147,** 87 (1987)

33 J.Roth, W.Eckstein, J.Bohdansky: J. Nucl. Mater. 165, 199 (1989)

34 J.Roth, J.Bohdansky, R.S.Biewer, W.Ottenberger: J. Nucl. Mater. 85&86, 1077 (1979)

35 C.H.Wu, E.Hechtl, H.R.Yang, W.Eckstein: J. Nucl. Mater. **176&177,** 845 (1990)

36 W.Eckstein, J.Roth, E.Gauthier, J.Läszlo: Fusion Technol. **19,** 2076 (1991)

37 W.Eckstein, A.Sagara, K.Kamada: J. Nucl. Mater. 150, 266 (1987)

38 W.Eckstein, J.P.Biersack: Z.Phys. B **63,** 109 (1986)

39 J.Roth, J.Bohdansky, W.Poschenrieder,M.K. Sinha: J. Nucl. Mater. 63, 222 (1976)

40 J.Roth, J.Bohdansky, K.L.Wilson: J. Nucl. Mater. 111&112, 775 (1982)

41 J.Roth, J.Bohdansky, A.P.Martinelli: Radiat.Eff. 48, 213 (1980)

42 J.Bohdansky, H.L.Bay, W.Ottenberger: J. Nucl. Mater. **76&77,** 163 (1978)

43 J.Bohdansky, J.Roth: Nucl. Instrum. Methods B 23, 518 (1987)

44 J.Roth, E.Vietzke, A.A.Haasz: *Atomic and Plasma-Material Interaction Data for Fusion, Suppl. to Nuclear Fusion* **1,** *63* (1991)

45 E.Hechtl, J.Bohdansky, J.Roth: J. Nucl. Mater. **103&104,** 333 (1981)

46 E.Hechtl, J.Bohdansky: J. Nucl. Mater. **122&123,** 1431 (1984)

47 J.Roth: Proc. Symp. on Sputtering, ed. P.Varga, G.Betz, F.P Vieböck (Inst, für Allg. Physik, Techn. University Vienna, 1980) 773

48 J.Bohdansky, G.L.Chen, W.Eckstein, J.Roth, B.M.V.Scherzer, R.Behrisch: J. Nucl. Mater. **111&112,** 717 (1982)

49 R.Weissmann, R.Behrisch: Radiat.Eff. 19, 69 (1973)

50 O.C.Yonts, C.E.Normand, D.E.Harrison: J.Appl. Phys. 31, 447 (1969)

51 E.Hintz, D.Rusbüldt, B.Schweer, J.Bohdansky, J.Roth, A.P.Martinelli: J. Nucl. Mater. **93&94,** 656 (1986)

52 J.Läszlo, W.Eckstein: J. Nucl. Mater. 184, 22 (1991)

53 W.Eckstein, J.Läszlo: J. Nucl. Mater. **183,** 19 (1991)

54 M.Saidoh, H.L.Bay, J.Bohdansky, J.Roth: Nucl. Instrum. Methods B 13, 403 (1986)

55 J.P.Biersack, W.Eckstein: Appl. Phys. A **34,** 73 (1984)

56 E.Hechtl, H.L.Bay, J.Bohdansky: Appl. Phys. 16, 147 (1978)

57 J.Bohdansky, H.L.Bay, J.Roth: Proc. 7^{th} Int. Vacuum Congress and $3^{Z/1}$ Int. Conf, on Solid Surfaces, Vienna, (1977) 1509

58 W.Eckstein: Surface and Interface Analysis 14, 799 (1989)

59 H.L.Bay, J.Bohdansky, E.Hechtl: Radiat.Eff. 41, 77 (1979)

60 E.Hechtl, J.Bohdansky, J.Roth: Proc. Symp. on Sputtering, ed. P.Varga, G.Betz, F. P Vieböck (Inst, für Allg. Physik, Techn. University Vienna, 1980) 834

61 A.Santaniello, J.Appelt, J.Bohdansky, J.Roth: J. Nucl. Mater. **162 —164,** 951 (1989)

62 W.Eckstein, J.Roth: Nucl. Instrum. Methods B 53, 279 (1991)

63 E.Hechtl, H.R.Yang, C.H.Wu, W.Eckstein: J. Nucl. Mater. **176&177,** 874 (1990)

64 E.Hechtl, W.Eckstein, J.Roth, J.Läszlo: J. Nucl. Mater. **179 —181,** 290 (1991)

65 M.K.Sinha, J.Roth, J.Bohdansky: Proc $9^{t/l}$ Symp. on Fusion Technology (Pergamon Press, Oxford 1976) 41

66 R.Behrisch, J.Bohdansky, G.H.Oetjen, J.Roth, G.Schilling, H.Verbeeck: J. Nucl. Mater. 60, 321 (1976)

67 C.Garcia-Rosales, J. Roth: J. Nucl. Mater. **196 —198,** 573 (1992)

68 H.L.Bay, J.Bohdansky: Appl. Phys. **19,** 421 (1979)

69 J.Roth, Physical sputtering of solids at ion bombardment, in: Physics of Plasma-Wall Interactions in Controlled Fusion, eds. D.E.Post, R.Behrisch, (Plenum 1986), p.351

70 J.Roth, W.Eckstein, E.Gauthier, J.Läszlo: J. Nucl. Mater. **179 —181,** 34 (1991)

71 J.Bohdansky, G.L.Chen, W.Eckstein, J.Roth: J. Nucl. Mater. **103&104,** 717 (1982)

72 P.Sigmund: *Sputtering by Particle Bombardment* J,Topics in Applied Physics, Vol. 47 (Springer, Berlin, Heidelberg 1981)

73 J.Lindhard, V.Nielsen, M.Scharff: Mat.-Fys. Medd. K. Dan. Vidensk. Selsk. 36, 10 (1968)

74 M.T.Robinson: J.Appl.Phys. 54, 2650 (1983)

75 H.H.Andersen, P.Sigmund: Nucl. Instrum. Methods **38,** 238 (1965)

76 W.Eckstein, C.Garcia-Rosales, J.Roth: Nucl. Instrum. Methods, B to be published