United States Department of Commerce
National Institute of Standards and Technology

NIST Technical Note 1289

The NIST X-Ray Photoelectron Spectroscopy (XPS) Database

Charles D. Wagner

NIST Technical Note 1289

The NIST X-Ray Photoelectron Spectroscopy (XPS) Database

Charles D. Wagner

Surfex Company
29 Starview Drive
Oakland, CA 94618

October 1991

U.S. Department of Commerce
Robert A. Mosbacher, Secretary

National Institute of Standards and Technology
John W. Lyons, Director

National Institute of Standards
and Technology
Technical Note 1289
Natl. Inst. Stand. Technol.
Tech. Note 1289
69 pages (Oct. 1991)
CODEN: NTNOEF

U.S. Government Printing Office
Washington: 1991

For sale by the Superintendent
of Documents
U.S. Government Printing Office
Washington, DC 20402

The NIST X-Ray Photoelectron Spectroscopy (XPS) Database

Charles D. Wagner
Surfex Company, 29 Starview Drive, Oakland, CA 94618

The technique known as XPS (X-Ray Photoelectron Spectroscopy) involves x-ray irradiation of surface samples under high vacuum. Electrons escaping from the samples are sorted and arranged to form a spectrum. A compilation of data for binding energy and kinetic energy of sample electrons from all elements has been collected. Depending on the nature of the chemical bond, the chemical shift can be as much as 10 eV. Over the past 6 years the author has indexed articles related to this subject area. The data bank contains a total of 13,200 records, from a total of 800 papers.

Key words: Auger electron; Auger parameter; binding energy; chemical shift; core level; doublet separation; photoelectron; XPS; X-Ray generation.

Contents

THE NIST X–RAY PHOTOELECTRON SPECTROSCOPY (XPS) DATABASE

I. Introduction

The technique of XPS was pioneered by Siegbahn and co-workers. In 1954 Siegbahn's group developed a high resolution electron spectrometer and in 1958 his group discovered that chemical shifts between copper and its oxides could readily be resolved(SNS58). Since that time there has been great interest in chemical surface analysis, encouraged by a written monograph by the Siegbahn's group (SNFN67) stating the principles of the technique. The technique is essentially nondestructive, sensitive to all elements except hydrogen and helium, and samples a shallow surface region a few nanometers thick. It is restricted to low vapor pressure compounds and can even be used to study organic materials nondestructively.

By 1973 the technique, widely known as Electron Spectroscopy for Chemical Analysis (ESCA), became widely used through the development of high-quality commercial instruments. Since that time work in the field has grown explosively. For example, by the end of 1985 over 780 papers had been written which reported measurements of photoelectron and Auger line energies.

Because of the sheer volume of this work, the number of compounds studied, and the variability of the quality of the data, it was clear that a critical compilation of available data was needed. In 1982, the author began work under the sponsorship of the then National Bureau of Standards on a data base that was to include all data on inorganic and organic compounds from refereed journals. These data were eventually to be made available for computerized retrieval.

This paper describes the structure of the resulting data bank, known as the NIST X-Ray Photoelectron Spectroscopy (XPS) Database, and the nature of the data compiled for each compound or element. At the time this paper was drafted, the author intended to include a listing of the data ordered by element through 1985 – about 13,200 records in all. However, the volume of these data was too large to make this practical. Even this compilation is not entirely complete; some references include a large number of similar compounds, and, in the interest of brevity, only representative ones were selected. Because of its size, a printed copy of the data base will be made available to interested parties upon request to Standard Reference Data, National Institute of Standards and Technology, A323 Physics Bldg., Gaithersburg, MD 20899.

II. Structure of the NIST X-Ray Photoelectron Spectroscopy (XPS) Database

The data are organized into 13 fields.

1. *Atomic number*
   This needs no elaboration.

2. *Elemental symbol*
   The elements are presented in order of atomic number.

3. *Spectral line*
   Included are not only photoelectron and Auger lines, but also various useful line energy differences. The following describes the different designations shown:

   Photoelectron lines – Self-explanatory. In Figure 1 is shown a photoelectron line at 0-1070 binding energy in the reverse direction.

   Doublet separation in photoelectron lines – This is indicated by Figure 2, simply by a Δ followed by the line, e.g., Δ2p, Δ3p, Δ3d, Δ4p, Δ4d, Δ4f. Included also is the multiplet splitting of 3s, as in Δ3s.

   Auger lines – The common Auger lines shown will be $KL_{23}L_{23}(^1D)$, $L_3M_{45}M_{45}(^1G)$, $M_4N_{45}N_{45}$, $M_5N_{67}N_{67}$, and sometimes, $N_6O_{45}O_{45}$. This in the case of $KL_{23}L_{23}$ is exemplified by Figure 1, on the kinetic energy direction. Valence type Auger lines, sometimes designated CVV, with final vacancies in valence levels, will ordinarily not be included; if they are, the notation will have V standing for

the final vacancy, as in KVV. Other Auger lines will ordinarily be cited only as energy difference values from the above principal lines of each series (see below).

Separation from the sharpest Auger line — This category (Fig. 4) will be used for all Auger line energies other than KVV or $KL_{23}L_{23}(^1D)$, LVV or $L_3M_{45}M_{45}(^1G)$, $M4N_{45}N_{45}$, $M5N_{67}N_{67}$, and $N_6O_{45}O_{45}$. The kinetic energy of the minor line cited will be subtracted from the standard line in its series, and the energy value will have a "+" or "−." Examples of the line designations are:

$KL_{23}L_{23}(^1S)$
$L_3M_{23}M_{45}(^3P)$
$M_{45}N_1N_{45}$
$M_4N_{67}N_{67}$

Auger parameter — In the modified form, used here in Figure 1, is the kinetic energy of the sharpest Auger line (one of those above) plus the binding energy of the most intense photoelectron line.

$\alpha 3d_5,M_4N_{45}N_{45}$

If the Auger line and the photoelectron line are supplied but not the Auger parameter, the Auger parameter was derived by the reviewer from the data. The connotation (AP derived) is indicated in the column (see Sec. 9 — *Method of compensation for steady state charge*). With charge references of photoelectron and Auger lines of doubtful value, both are omitted but the Auger parameter is retained.

Chemical shift from the elemental form — This is shown in Figure 3 when publications present both peaks in the same spectrum, or when the elemental peak is not in the same spectrum but in the same article. The absolute scale is not necessary because the chemical shifts are based on zero. Also the alloys constitute a special case because the chemical shifts are so minimal (a fraction of a volt in most cases). Lines cited will be strong photoelectron lines, the standard Auger lines, and Auger parameters, and there will be a "+" or "−" on the chemical shift energy.

$\gamma 2p_3$
$\gamma L_3M_{45}M_{45}(^1G)$
$\gamma\alpha 2p_3,L_3M_{45}M_{45}(^1G)$

4. *Compound*

Ordinarily the simple chemical formula is used, but with complex molecules the common name can be substituted. Abbreviations commonly used in Chemical Abstracts will be used for naming the compounds.

Data are supplied for bulk condensed states believed to be pure. Gas phase data are not included. In relatively rare instances, implanted atoms or well-defined monolayers will be included, with the requirement that evidence be supplied that all of the atoms have the same environment.

If not all of the published line energy data for a compound are included in this tabulation, the compound name will be followed by a "+."

If a compound has atoms of an element in more than one chemical state, the position of an asterisk in the structural formula will indicate the atom for which data are presented. For the special case of carbon, it is usually assumed in this data set that aliphatic or aromatic carbon bound only to carbon and hydrogen has the binding energy 284.8 eV, and so these are not usually included in the data.

If space does not permit, an abbreviation will contain an asterisk which will refer to an asterisk with a more complete explanation such as:

With abbreviation	More complete explanation
$FeCl_3$ 2DMSO*	*DMSO = di(Me)sulfoxide

If a footnote is appropriate such as an alternative common name, it will be written out and indicated by an asterisk.

C_6H_6* benzene	
$(COONa)_2$*	Na oxalate
$(CH_2)_6N_4$*	hexamethylenetetramine

Some compounds which are not obviously ionic are noted by (ionic cmpd) following the formula or in several cases by a plus or minus sign ending the expression. Ionic compounds such as ammonium or phosphonium are not specially indicated because they are expected to be obvious. Some abbreviations are the following:

M ox	=	thin metal oxide layers formed by passive oxidation, e.g., Al ox
MY_x	=	non-stoichiometric binary compound (rare), such as SiN
poly(-XXXX-)	=	polymer with repeat group (-XXXX-)
poly(RCH=CHX)	=	vinyl polymer
p-XXXX	=	para orientation on benzene ring
Am	=	the element americium, or the amyl group in an organic compound
acac	=	acetylacetonate
bzac or bzbz	=	benzoyl substitution for acetyl in acac

5. *Empirical formula*

In the case of organic compounds, the compound name is so complicated that it can be written in a multitude of ways, so that the empirical formula is the simple way out and is used.

6. *Physical state*

When supplied in the article, some information about the physical state of the compound or element, or its method of preparation is conveyed by a code of one to three digits, as follows:

A	annealed
Ads	adsorbed
Am	amorphous
Arc	arc method
Br2	Br2-ethanol
C	cooled
CE	chemically etched
Cl	cleaved crystal
Co	co-condensed with a charge reference material
Cr	crystal
Cru	crushed
CVD	chemical vapor deposition
EO	electrolytic oxidation
ER	electrolytic reduction
Ex	exchangable
H	heated
H2	hydrogen pressure

H&C	heated and cooled
Imp	implanted
Ind	induction heater
IR	reaction by bombarding ions
L	liquid
MBE	molecular beam epitaxy
Ml	multilayer
O2	oxygen pressure
Oxi	oxidizing atmosphere
Pc	polycrystalline
PO	passive oxide
Pwd	powder (when a special point is made in the article)
R	reacted
RF	reacted film
Red	reducing atmosphere
Sc	scraped
ScH	scraped and heated
SD	sputter deposited
Sp	sputtered
Sp*	this is an artifact made because there is no way of differentiation from Al K and Mg K. All the primary keys are identical. Therefore the Phys. St. was used as Sp*.
SpA	sputtered in argon
SpH	sputtered and heated
TF	thin film
TL	thin layer
TO	thick oxide
VC	vacuum cleaved
VD	vapor deposited
VDH	vapor deposited and heated

7. *Energy*

All energies are referred to the Fermi level. Ordinarily, values are shown to tenths of an eV, with some quoted to hundredths of an eV. Values are binding energies for photoelectrons and kinetic energies for Auger electrons. The data have been standardized for a voltage scale that assumes with Fermi level referencing that $Au4f_7 = 84.0$, $Ag3d_5 = 368.2$, $Cu2p_3 = 932.6$, and C1s for hydrocarbon or hydrocarbon groups equals 284.8 eV (cf below under instrument calibration and charge referencing). Data will not ordinarily be included unless correspondence with at least one point on this voltage scale can be determined, and corrections made accordingly. Energy data corrected for this are indicated by the designation "c" under the quality column.

Ordinarily there are no adequate data furnished to be assured of an energy scale of correct magnitude. When data are furnished for two widely-spaced photoelectron lines of an element corresponding to initial and final states of accurately determined x-ray transitions, the accuracy of the energy scale magnitude can be checked, and data corrected when necessary. A similar operation can be conducted if calibration lines for $Cu2p_3$ plus either $Au4f_7$ or $Ag3d_5$ are furnished. Data corrected in this way for energy scale magnitude are designated by "a" in the quality column. Data from a few references performed carefully for energy scale calibration purposes have not been changed, and are designated by "A" (see Sec. 8).

All line designations beginning with Δ, or γ, are difference values, and the energy values should be plus or minus except for Δ applied to spin doublet separations or multiplet splitting (cf "Line" above). Auger parameter values (line designations beginning with α) are inherently difference values but are always positive.

8. *Quality of the datum*

The uses of "c" and "a" have already been described in the paragraphs above. When the line energy is within 300 eV of a reference point on the energy scale, such as $Au4f_7$ when a conductive material is examined, or C1s for adventitious hydrocarbon when charge referencing is done on an insulator, a "G" is included, indicating a reasonable degree of reliability. A few studies have been done very carefully and data from them are indicated by the letter "A", representing calibration grade.

9. *Method of compensation for steady state charge*

Data on insulators are not included unless a technique for charge referencing is used that is believed to be valid. Some abbreviations are the following:

a. "Cond" indicates the material is sufficiently conducting, either because of its nature, or because it is sufficiently thin not to require charge correction.

b. "Au" indicates the gold vapor deposition method, with $Au4f_7$ assumed to be 84.0.

c. "AC" indicates use of the C1s line of adventitious hydrocarbon, assumed to be 284.8 eV.

d. "IC" indicates use of an internal hydrocarbon group of the compound, with the same assumed energy.

e. "CC" indicates that a hydrocarbon was co-condensed with the vapor-deposited specimen and used as the charge reference, with value 284.8.

If use of other charge referencing values in a paper requires changes in the energy data for this set, this is indicated by the letter "c" in the Quality column.

Occasionally all energy values are referenced to a single element present in all the materials. While this does not presume to give absolute line energies, it can furnish useful data, and this method is indicated in the Charge Reference column by a phrase such as "F1s = 684.6". A charge reference is not needed for difference values, such as those beginning with Δ, γ or α.

10. *Instrument calibration*

The symbol FL means the instrument was calibrated to set zero binding energy at the Fermi edge of a metal with high density of states at the conduction band. The symbol ON indicates the scale was set at zero kinetic energy at the onset of electron emission. The symbol DVM indicates that voltages on the energy scale were calibrated directly with the aid of an accurate digital voltmeter.

In most studies, however, natural strong lines of conductors were used to establish the scale. For this data set it is assumed that gold, silver, and copper as calibrants have their most intense spectral lines at the following binding energies: $Au4f_7$ = 84.0, $Ag3d_5$ = 368.2, and $Cu2p_3$ = 932.6 eV. If these lines were used in the instrument calibration, the symbols Au, Ag, or Cu indicate it, and if the values used in the article were not the above, energy values for conducting species were corrected to correspond (see Energy and Quality paragraphs).

Determinations of line energies of elemental gold, silver, and copper with none of them cited as an energy scale reference are printed without change, but companion data from the same article on other materials may be corrected for deviation of these standards from the values adopted here.

If data are furnished from which the magnitude of the voltage scale can be checked (such as widely separated calibration lines, or lines for elements that represent initial and final states of x-ray transitions), these difference values are included. If the values are not those adopted for the x-ray transitions or for widely separated calibration lines, a correction of the voltage scale magnitude may be needed. When this has been done, the new and correct difference value is shown,

energy values are corrected, and those corrected are indicated by an "a" symbol in the Quality column. It should be understood that elemental states are used for instrument calibration unless otherwise indicated.

11. *Compound type*
This has been used, not entirely consistently, to classify the compounds.

12. *Reference*
With multiple authors the first letter of each author's last name is used:
XXXX
XXX

In the case of two authors, the first two letters are used, capital and lower case:
XxXx

In the case of one author, capital and three lower case letters are used:
Xxxx

This is followed by two digits, representing the last two digits of the year of publication. This may be followed by a small letter, to distinguish between two otherwise identical reference notations.

In many cases the reference may end with a plus sign. This indicates that the reference includes a large number of similar compounds, and, in the interest of brevity, only representative ones were selected. The reader is encouraged to look for the simpler of a class of compounds, and if the reference for it contains a plus sign, to consult the reference to obtain data on similar materials. A complete list of references is given in Appendices A and B. Appendix A contains the so-called "long references" which have been separated out because of their length. Appendix B continas the majority of the references.

13. *Registry number*
Space is provided to enter the Chemical Abstracts Service Registry Number if it is needed in the future.

III. Elemental Data Summary

Below (Table 2) is a summary table of the most reliable elemental photoelectron energy values through 1985. These records are about ten percent of the total bank of elemental XPS data.

IV. Complete XPS Data

The NIST X-Ray Photoelectron Spectroscopy (XPS) Database is available from the NIST Standard Reference Data Program, National Institute of Standards and Technology, A323 Physics Bldg., Gaithersburg, MD 20899, (301) 975-2208, Joan Sauerwein. The database is complete for XPS data through 1985. It is lengthy and is not printed here, but will be sent to users on request. As an illustration, a subset for Tin (Sn) is duplicated in Table 3 and Table 4. Also a division of the records into organic and inorganic is shown. The criterion is based as a first approximation on the empirical formula for hydrogen content for organic compounds.

Also a different type of subset is shown in Table 5. In this Table are shown 800 chemical states of 84 elements, with the main photoelectron and Auger lines in detail.

The records for the data bank include six types of spectral lines listed in Table 1 below.

TABLE 1. Distribution of Spectral lines

Type of Line	Records
Photoelectron lines	9810
Doublet separation	950
Auger lines	784
Separation from the sharpest Auger lines	168
Auger parameter	910
Chemical shifts	578

V. Acknowledgement

This work was supported by the Department of Energy and the National Science Foundation through the Program on Critical Evaluation of Physical and Chemical Data through the Standard Refernce Data Program of the National Institute of Standards and Technology.

VI. Reference

An additional discussion of the NIST X-Ray Photoelectron Spectroscopy (XPS) Database is given below.

C. J. Powell, "Formal Databases for Surface Analysis: The current Situation and Future Trends" in *Quantitative Surface Analysis* (London, Nov. 13–16, 1990).

TABLE 2. The best values of elemental photoelectric energies as of 1985

		1s			
3	Li	54.8	G[x]	KLMP	73
4	Be	111.8	G	WRDM	79
5	B	(186.5)[y]	G	SMS	80
6	C	284.45	G	WVB	80
11	Na	1071.8	G	BaSt	75
12	Mg	1303.2	G	Fugg	77
13	Al				
14	Si				
15	P				
16	S				

		$2p_3$			
18	Ar	(241.8)	G	KiWi	75
19	K	294.7	G	PeKa	77
20	Ca	345.9	G	VaVe	80
21	Sc	(398.3)	G	MFA	85
22	Ti	453.89	A[z]	LANM	81
		453.73	A	ALMP	82
23	V	512.14	A	LANM	81
24	Cr	574.26	A	LANM	81
25	Mn	638.78	A	LANM	81
26	Fe	706.74	A	LANM	81
		706.82	A	Asam	86
27	Co	778.32	A	LANM	81
28	Ni	852.68	A	LANM	81
		852.8	A	PEJ	82
		852.73	A	ALMP	82
29	Cu	932.57	A	LANM	81
		932.7	A	PEJ	82
		932.67	A	AnSe	84
		932.55	A	ALMP	82
		932.62	A	BiSw	80
		932.70	A	BiSw	80
30	Zn	1021.82	A	LANM	81
		1021.70	A	Evan	85
		1021.96	A	LKMP	73
31	Ga	1116.67	A	Evan	85
32	Ge	1217.28	A	Evan	85
		1217.38	A	Evan	85
		1217.2	A	McWe	76
33	As				

		$3d_5$			
34	Se	55.1	A	BWI	80
37	Rb	112.0	G	EbSi	79
38	Sr	134.4	G	VaVe	80
39	Y	155.8	A	NyMa	80
40	Zr	178.79	A	NyMa	80
41	Nb	202.26	A	NyMa	80
42	Mo	227.94	A	NyMa	80
44	Ru	280.02	A	NyMa	80
45	Rh	307.18	A	NyMa	80
46	Pd	335.08	A	NyMa	80
		335.18	A	VaTr	79
		335.20	A	Asam	86
		335.2	A	JHBK	73

		2p		
30.8	G	BaSt	75	
30.52	G	Citr	73	
49.6	G	Fugg	77	
49.6	G	VaTr	79a	
72.85	G	Tayl	82	
72.92	G	WPHK	82	
(99.44)	G	WPHK	82	
(130.00)	G	NSDU	75	
164.1	G	Brio	80	
164.15	G	WRDM	79	
164.25	G	RiVe	83	

	3p		
32.5	A[z]	LANM	81
37.2	A	LANM	81
42.3	A	LANM	81
47.2	A	LANM	81

	3p3		
52.5	A	LANM	81
58.9	A	LANM	81
66.1	A	LANM	81
66.5	A	PEJ	82
75.13	A	LANM	81
75.20	A	PEJ	82

	3d		
10.00	A	LANM	81
9.78	A	Evan	85
10.18	A	LKMP	73
18.69	A	Evan	85
29.45	A	Evan	85
29.65	A	Evan	85
29.3	A	McWe	76
29.0	A	SFS 77	
41.5	G	BWWI	76

	$4p_3$		
27.1	A	NyMa	80
30.8	A	NyMa	80
35.5	A	NyMa	80
43.4	A	NyMa	80
47.3	A	NyMa	80

TABLE 2. The best values of elemental photoelectric energies as of 1985 – Continued

		$3d_5$			
		335.20	A	BiSw	80
		335.47	A	BiSw	80
47	Ag	368.2	A	JHBK	73
		368.22	A	NyMa	80
		368.23	A	Asam	86
		368.28	A	AnSe	84
		368.10	A	BiSw	80
		368.16	A	BiSw	80
		368.21	A	BiSw	80
48	Cd	405.15	A	NyMa	81
49	In	443.86	A	NyMa	81
50	Sn	484.8	A	VaTr	79
		484.92	A	NyMa	80
51	Sb	528.2	A	VaTr	79
52	Te	572.98	A	NyMa	80
		573.0	A	SFS	77
53	I	(619.9)		DMKK	84
		(619.9)		Sher	76
55	Cs	726.0	G	KDR	77
56	Ba	780.6	G	KoGr	85
57	La	(835.9)		SOS	82
		(835.9)		ScSc	82
58	Ce	(883.2)		PKHL	80
		(883.9)		SOS	82
		(883.9)		ScOs	82
59	Pr	(932.0)		FuOs	84
62	Sm	(1081.2)		DKMB	76

		$4d_5$			
70	Yb	(181.4)	G	HHL	70
		(181.4)	G	KEML	74
		(182.7)	G	LPWF	75
		(183.0)	G	PLNW	77
71	Lu	(196.1)	G	KEML	74
		(196.3)	G	LPWF	75
		(196.6)	G	PLNW	77
72	Hf	211.5	A	NBM	80
73	Ta	226.4	A	NBM	80
74	W	243.5	A	NBM	80
75	Re	260.5	A	BNMN	79
76	Os	278.5	A	BNMN	79
77	Ir	296.3	A	NMB	80
78	Pt	314.6	A	NMB	80
		314.6	A	KNNH	68

$4d_5$			
10.2	A	PLJL	73
10.47	A	PKLS	72
16.74	A	PKLS	72
24.04	A	VaTr	79
23.95	A	NyMa	80
23.68	A	PKLS	72
24.1	A	SFS	77
32.3	A	VaTr	79
32.07	A	NyMa	80
32.1	A	SFS	77
32.14	A	PKLS	72
40.44	A	NyMa	80
40.5	A	SFS	77
40.31	A	PKLS	72
77.3	A	SLCO	83
90.2	G	KoGr	85
90.4	G	VaVe	80
103.7	G	KEML	74
(111.2)		NIS	72
128.4	G	NNBF	68
141.7	G	TeLe	79

$4f_7$			
14.23	A	NBM	80
21.61	A	NBM	80
21.64	A	VHE	82
31.32	A	NBM	80
40.46	A	BNMN	79
50.7	A	BNMN	79
60.75	A	NMB	80
71.07	A	NMB	80
71.0	A	JHBK	73
71.07	A	VaTr	79

TABLE 2. The best values of elemental photoelectric energies as of 1985 — Continued

		$4d_5$				$4f_7$			
79	Au	334.7	A	VaTr	79	83.97	A	VaTr	79
		335.2	A	NBM	80	84.00	A	NBM	80
		335.1	A	PEJ	82	84.0	A	MKLP	73
						84.00	A	AnSe	84
						84.07	A	Asam	86
						84.1	A	PEJ	82
						84.15	A	ALMP	82
						83.86	A	BiSw	80
						83.98	A	BiSw	80
80	Hg	359.3	G	SMBM	76	99.9	G	SMBM	76
81	Tl	385.0	G	MBN	80	117.73	G	MBN	80
82	Pb	412.0	A	NBM	80	136.78	A	NBM	80
		412.0	A	SFS	77	136.8	A	SFS	77
83	Bi	440.1	A	NBM	80	156.85	A	NBM	80
		440.3	A	VaTr	79	156.88	A	VaTr	79
		440.4	A	SFS	77	156.9	A	SFS	77
						157.0	A	LKMP	73
90	Th	(675.2)		FBWF	74	333.1	G	ScLa	81
		(675.2)		ScLa	81	333.25	G	WRDM	79
92	U	(736.0)		FBWF	74	376.9	G	VRPC	74
		(736.4)		ScLa	81	377.1	G	ACCT	74
		(736.8)		ACCT	74	377.1	G	Chad	73
						377.4	G	ScLa	81
						377.4	G	WRDM	79

[x]When the data are within 300 eV of a point of reference, they are indicated by a "G".
[y]When the data are enclosed by a parenthesis, it is indicated that the data are not within bounds of 300 eV, or if they are within "G", they are still so scattered that several competing data must be supplied.
[z]A few data have been done very carefully, and all of these data are indicated by the letter "A", representing calibration grade.

TABLE 3. Inorganic compounds for which Sn was being observed by photoelectron or Auger spectroscopy.

Spectral Line	Compound	Physical State	Energy (eV)	Quality	Charge Reference	Calibration Method	Reference	
Binding Energy								
3s	Sn	Sc	885.3	A	Au	Au	NyMa	80
3p3	K2SnF6		717.2	c	AC		MoVa	73
3p3	Sn	Sc	714.6	A	Cond	Au4f7 = 83.97 Pd3d5 = 335.18	VaTr	79
3p3	Sn	Sc	714.7	A	Au	Au	NyMa	80
3p3	Sn	Sc	714.7	A	Cond	Au, Na1s-2p = 1041.1	SFS	77
3p3	SnF2		716.3	c	AC		MoVa	73
3p3	SnO		716.2	c	AC		MoVa	73
3p3	SnO2		716	c	AC		MoVa	73
3d5	(NH4)2SnCl6		486.7	c	Au		GZF	73+
3d5	Ag95Sn5		485.6	G	Cond	Au,Ag,Cu	HSBS	81
3d5	Ba(SnCl3)2		486.8	Gc	AC	FL	WVV	79+
3d5	BaSnCl4		486.8	Gc	AC	FL	WVV	79+
3d5	Cd2SnO4		486	Gc	AC	Au	GHMH	83
3d5	Cd996Sn4		485.3	G	Cond	Au,Ag,Cu	HSBS	81
3d5	CdSnO3		486.1	Gc	AC	Au	GHMH	83
3d5	Co20Sn80	Sp	484.7		Cond	Au	ThSh	78
3d5	K2SnF6		487.6	Gc	AC		MoVa	73
3d5	KSnF3		486.7	c	Au		GZF	73+
3d5	Na2SnO3		486.2	Gc	AC		MoVa	73
3d5	Na2SnO3		486.7	Gc	AC	Au,Cu	Wagn	75
3d5	Na2SnO3		486.8	Gc	AC		Shut	80
3d5	Na2SnO3		487.2	Gc	AC		ADPS	77
3d5	NaSnF3		487.4	Gc	AC	Au,Cu	Wagn	75
3d5	Pb98Sn2		486.4	G	Cond	Au,Ag,Cu	HSBS	81
3d5	Sb95Sn5		485.2	G	Cond	Au,Ag,Cu	HSBS	81
3d5	Sn		484.4		Cond	FL	WVV	79+
3d5	Sn		484.7	Gc	AC		FaGo	77
3d5	Sn		484.8		Cond	ON	PWA	79
3d5	Sn		484.8	Gc	AC		Shut	80
3d5	Sn		484.87	G	Cond	Vacuum Ne1s = 870.27 (Ne2s = 48.47)	VeCa	85
3d5	Sn		484.9		Cond	Au	TLR	78
3d5	Sn		484.9	G	AC		LAK	77
3d5	Sn		485.2	Gc	AC		OCH	79
3d5	Sn	Sc	484.8	A	Cond	Au4f7 = 83.97 Pd3d5 = 335.18	VaTr	79
3d5	Sn	Sc	484.92	A	Au	Au	NyMa	80
3d5	Sn	Sc	485	Gc	Cond	Au,Cu	Wagn	75
3d5	Sn	Sc	485.1	A	Cond	Au, Na1s-2p = 1041.1	SFS	77
3d5	Sn	Sp	484.3	c	Cond	Au	ADPS	77
3d5	Sn	Sp	484.7		Cond	Au	ThSh	78
3d5	Sn	Sp	484.85	Gc	Cond	Au,Cu	WRDM	79
3d5	Sn	SpA	485		Cond		SHR	82
3d5	Sn	VD	484.8		Cond		BVWW	80
3d5	Sn	VD	484.87	G	Cond	Ag	PVVA	79
3d5	Sn,alpha		486.72		Au		WaHu	74
3d5	Sn,alpha	SpA	485	G	Cond	AuCu	Hegd	82
3d5	Sn,beta		484.6	G	Cond	Au,Ag,Cu	HSBS	81
3d5	Sn,beta		486.1		Au		WaHu	74
3d5	Sn,beta	SpA	484.6	G	Cond	AuCu	Hegd	82

TABLE 3. Inorganic compounds for which Sn was being observed by photoelectron or Auger spectroscopy – Continued

Spectral Line	Compound	Physical State	Energy (eV)	Quality	Charge Reference	Calibration Method	Reference	
Binding Energy								
3d5	SnBr2		486.9	c	Au		GZF	73+
3d5	SnCl2		486.5	c	Au		GZF	73+
3d5	SnCl2		486.7	Gc	AC	FL	WVV	79+
3d5	SnF2		487	Gc	AC		MoVa	73
3d5	SnF2		487.1	c	Au		GZF	73+
3d5	SnF2		487.4	Gc	AC		Shut	80
3d5	SnF4		487.9	c	Au		GZF	73+
3d5	SnF4		488.2	Gc	AC		Shut	80
3d5	SnMo6S8		486.2	Gc	AC		MAS	85
3d5	SnO		485.6	Gc	AC		Shut	80
3d5	SnO		486	Gc	AC		ADPS	77
3d5	SnO		486.6	c	Au		GZF	73+
3d5	SnO		486.9	Gc	AC	FL	WVV	79+
3d5	SnO		487	Gc	AC		MoVa	73
3d5	SnO	Sc	487	Gc	AC		FaGo	77
3d5	SnO2		486.1	Gc	AC		Shut	80
3d5	SnO2		486.2	Gc	AC	Au	GHMH	83
3d5	SnO2		486.5	Gc	AC		ADPS	77
3d5	SnO2		486.6	Gc	AC		MoVa	73
3d5	SnO2		486.6	Gc	AC	Au,Cu	WRDM	79
3d5	SnO2		486.7	Gc	AC		NGDS	75
3d5	SnO2		486.7	Gc	AC	FL	WVV	79+
3d5	SnO2		486.7	c	Au		GZF	73+
3d5	SnO2		486.8	Gc	AC	Au	TLR	78
3d5	SnO2	PO	486.6	G	AC		LAK	77
3d5	SnO2	Sc	486.5	Gc	AC		FaGo	77
3d5	SnS		485.6	Gc	AC	Au,Cu	Wagn	75
3d5	SnS		486.4	Gc	AC		MoVa	73
3d5	SnS	Cl	485.7	G	Cond	Au, Na1s-2p = 1041.1	SFS	77
3d5	SnS2		486.8	Gc	AC		MoVa	73
3d5	SnSe	Cl	485.7	G	Cond	Au, Na1s-2p = 1041.1	SFS	77
3d5	SnTe	Sc	485.6	G	Cond	Au, Na1s-2p = 1041.1	SFS	77
4s	Sn	Sc	136.8	A	Cond	Au4f7 = 83.97 Pd3d5 = 335.18	VaTr	79
4s	Sn	Sc	137.2	A	Au	Au	NyMa	80
4p	Sn	Sc	85.2	A	Cond	Au4f7 = 83.97 Pd3d5 = 335.18	VaTr	79
4d	Sn		24.5		Cond	ON	PWA	79
4d	Sn	SpA	24.2		Cond		SHR	82
4d5	Sn		23.68	G	Cond	Vacuum Ne1s = 870.27 (Nc2s = 48.47)	VeCa	85
4d5	Sn	Cr	23.68	A	Cond	Au FL	PKLS	72
4d5	Sn	Sc	23.95	A	Au	Au	NyMa	80
4d5	Sn	Sc	24.04	A	Cond	Au4f7 = 83.97 Pd3d5 = 335.18	VaTr	79
4d5	Sn	Sc	24.1	A	Cond	Au, Na1s-2p = 1041.1	SFS	77
4d5	Sn	VD	23.68		Cond	Ag	PVVA	79
4d5	SnS	Cl	24.8	G	Cond	Au, Na1s-2p = 1041.1	SFS	77
4d5	SnSe	Cl	24.7	G	Cond	Au, Na1s-2p = 1041.1	SFS	77
4d5	SnTe	Sc	24.5	G	Cond	Au, Na1s-2p = 1041.1	SFS	77

TABLE 3. Inorganic compounds for which Sn was being observed by photoelectron or Auger spectroscopy – Continued

Spectral Line	Compound	Physical State	Energy (eV)	Quality	Charge Reference	Calibration Method	Reference	
Auger								
M455	Na2SnO3		431.7	Gc	AC	Au,Cu	Wagn	75
M455	NaSnF3		430.8	Gc	AC	Au,Cu	Wagn	75
M455	Sn		437.27	G	Cond	Vacuum Ne1s = 870.27 (Ne2s = 48.47)	VeCa	85
M455	Sn		437.5		AC		LAK	77
M455	Sn	Sc	437.4	Gc	Cond	Au,Cu	Wagn	75
M455	Sn	Sc	437.5	A	Cond	Au4f7 = 83.97 Pd3d5 = 335.18	VaTr	79
M455	Sn	Sp	437.6	Gc	Cond	Au,Cu	WRDM	79
M455	Sn	VD	437.27		Cond	Ag	PVVA	79
M455	SnO2	PO	432.6		AC		LAK	77
M455	SnS		435.7	Gc	AC	Au,Cu	Wagn	75
M555	Sn		428.85	G	Cond	Vacuum Ne1s = 870.27 (Ne2s = 48.47)	VeCa	85
M555	Sn		428.9		Cond	ON	PWA	79
M555	Sn	Sc	429	A	Cond	Au4f7 = 83.97 Pd3d5 = 335.18	VaTr	79
Auger Parameter								
3d5-M4	Na2SnO3		918.4	G		Au,Cu	Wagn	75
3d5-M4	NaSnF3		918.2	G		Au,Cu	Wagn	75
3d5-M4	Sn		922.14			Vacuum Ne1s = 870.27 (Ne2s = 48.47)	VeCa	85
3d5-M4	Sn		922.4				LAK	77
3d5-M4	Sn	Sc	922.4	G		Au,Cu	Wagn	75
3d5-M4	Sn	Sp	922.45	G		Au,Cu	WRDM	79
3d5-M4	Sn	VD	922.14			Ag	PVVA	79
3d5-M4	SnO2	PO	919.2				LAK	77
3d5-M4	SnS		921.3	G		Au,Cu	Wagn	75
3d5-M5	Sn		913.7			ON	PWA	79
3d5-M5	Sn		913.72			Vacuum Ne1s = 870.27 (Nc2s = 48.47)	VeCa	85
4d5-M4	Sn		460.95			Vacuum Ne1s = 870.27 (Ne2s = 48.47)	VeCa	85
4d5-M5	Sn		452.53			Vacuum Ne1s = 870.27 (Ne2s = 48.47)	VeCa	85
Chemical Shift								
3p3	AuSn	Sc	+0.2	A	Cond	Au4f7 = 83.97 Pd3d5 = 335.18	VaTr	79
3d5	Ag95Sn5		+1		Cond	Au,Ag,Cu	HSBS	81
3d5	Ag95Sn5	SpA	+1	G	Cond	AuCu	Hegd	82
3d5	AuSn		+0.4			Au	FHPW	73
3d5	AuSn	Sc	+0.3	A	Cond	Au4f7 = 83.97 Pd3d5 = 335.18	VaTr	79
3d5	AuSn4		+0.1			Au	FHPW	73
3d5	Cd99.5Sn5	SpA	+0.7	G	Cond	AuCu	Hegd	82
3d5	Cd996Sn4		+0.7		Cond	Au,Ag,Cu	HSBS	81
3d5	CsSn	RF	+0.0				BVWW	80
3d5	Cu95Sn5	SpA	+1	G	Cond	AuCu	Hegd	82
3d5	In95Sn5	SpA	+0.6	G	Cond	AuCu	Hegd	82
3d5	Pb95Sn5	SpA	+1.8	G	Cond	AuCu	Hegd	82
3d5	Pb98Sn2		+1.6		Cond	Au,Ag,Cu	HSBS	81
3d5	Sb95Sn5		+0.6			Au,Ag,Cu	HSBS	81
3d5	Sb95Sn5	SpA	+0.6	G	Cond	AuCu	Hegd	82
3d5	Sn ox	RF	+1.5				WaBi	73
3d5	Sn5Cu95		+1			Au	HeSi	83
4d	Sn ox	RF	+1.2				WaBi	73

TABLE 3. Inorganic compounds for which Sn was being observed by photoelectron or Auger spectroscopy — Continued

Spectral Line	Compound	Physical State	Energy (eV)	Quality	Charge Reference	Calibration Method	Reference	
Auger Parameter								
d5	AuSn	Sc	+0.3	A	Cond	Au4f7 = 83.97 Pd3d5 = 335.18	VaTr	79
M455	AuSn	Sc	−0.3	A	Cond	Au4f7 = 83.97 Pd3d5 = 335.18	VaTr	79
M455	Sn ox	PO	−3.4				SHR	82
M455	Sn ox	RF	−3.9				WaBi	73
M455	Sn ox	RF	−4.1	G			BBG	79
M555	AuSn	Sc	+0.3	A	Cond	Au4f7 = 83.97 Pd3d5 = 335.18	VaTr	79
3d5-M4	AuSn	Sc	+0.0	A	Cond (AP derived)	Au4f7 = 83.97 Pd3d5 = 335.18	VaTr	79
3d5-M4	Sn ox	RF	−2.4				WaBi	73
Doublet Separation								
3p	Sn	Sc	41.9			Au, Na1s-2p = 1041.1	SFS	77
3p	Sn	Sc	41.9	A		Au	NyMa	80
3p	Sn	Sc	41.9	A	Cond	Au4f7 = 83.97 Pd3d5 = 335.18	VaTr	79
3d	Sn		8.4				FaGo	77
3d	Sn		8.45			Vacuum Ne1s = 870.27 (Ne2s = 48.47)	VeCa	85
3d	Sn	Sc	8.3			Au, Na1s-2p = 1041.1	SFS	77
3d	Sn	Sc	8.4	A	Cond	Au4f7 = 83.97 Pd3d5 = 335.18	VaTr	79
3d	Sn	Sc	8.41	A		Au	NyMa	80
3d	Sn	Sp	8.5			Au,Cu	WRDM	79
3d	Sn	VD	8.45			Ag	PVVA	79
3d	SnMo6S8		8.5				MAS	85
3d	SnO		8.5				FaGo	77
3d	SnO2		8.5				FaGo	77
4d	Sn		1.08			Vacuum Ne1s = 870.27 (Ne2s = 48.47)	VeCa	85
4d	Sn	Cr	1.08			Au FL	PKLS	72
4d	Sn	Sc	0.98	A	Cond	Au4f7 = 83.97 Pd3d5 = 335.18	VaTr	79
4d	Sn	Sc	1.05	A		Au	NyMa	80
4d	Sn	VD	1.08			Ag	PVVA	79
Separation from Strongest Auger Line								
M555	Sn	VD	−8.5	G			BBG	79

TABLE 4. Organic compounds for which Sn was being observed by photoelectron or Auger cpectroscopy.

Spectral Line	Compound	Physical State	Energy (eV)	Quality	Charge Reference	Calibration Method	Reference
Binding Energy							
3p3	Ph4Sn		716	c	IC		MoVa 73
3d5	(Et4N)2SnBr6		487	Gc	IC	FL	WVV 79+
3d5	(Et4N)3Pt(SnCl3)5		486.9	Gc	IC		Rigg 72+
3d5	(Me4N)2<Pt(SnCl3)2Cl2>		486.7	Gc	IC		AKSK 82+
3d5	(Me4N)2<Pt(SnCl3)5>		486.8	Gc	IC		AKSK 82+
3d5	(Me4N)2SnCl6		486.7	Gc	IC		AKSK 82+
3d5	(Me4N)SnCl3		485.3	Gc	IC		AKSK 82+
3d5	(PhCH2)2SnCl2		487.6	Gc	IC		MoVa 73
3d5	(PhCH2)3SnCl		486.9	Gc	IC		MoVa 73
3d5	AgSnCl3(Ph3P)3		487	Gc	IC		GZF 73+
3d5	Br4Sn(pyrazine)		487.4	Gc	IC		FMPB 81
3d5	Bu2SnO		485.6	Gc	IC	FL	WVV 79+
3d5	Cl2Ph2Sn(pyrazine)		487.5	Gc	IC		FMPB 81
3d5	Cl3BuSn(pyrazine)		487.6	Gc	IC		FMPB 81
3d5	Cl3MeSn(pyrazine)		487.5	Gc	IC		FMPB 81
3d5	Cl3OctSn(pyrazine)		487.6	Gc	IC		FMPB 81
3d5	Cl3PhSn(pyrazine)		487.9	Gc	IC		FMPB 81
3d5	Cl3SnCo(CO)3AsPh3		487.2	Gc	IC		WVV 79+
3d5	Cl3SnMo(CO)3(C5H5)		487.1	Gc	IC		WVV 79+
3d5	Cl3SnMo(CO)3(C5H5)		487.3	Gc	IC		WWVV 77
3d5	Cl3SnW(CO)3(C5 H5)		487	Gc	IC		WVV 79+
3d5	Cl3SnW(CO)3(C5H5)		487	Gc	IC		WWVV 77
3d5	Cl4Sn(pyrazine)		487.8	Gc	IC		FMPB 81
3d5	Cl4Sn(pyrazine)2		488.1	Gc	IC		FMPB 81
3d5	Et2Sn(5-Ac-8-quinolinol)2		487.4	Gc	IC		UBS 83+
3d5	EtSnCl3(pyridine)2		487.2	Gc	IC	FL	WVV 79+
3d5	I4Sn(pyrazine)		487.6	Gc	IC		FMPB 81
3d5	Mc2ClSnMo(CO)3(C5H5)		486.3	Gc	IC		WWVV 77
3d5	Me2ClSnW(CO)3(C5H5)		486	Gc	IC		WWVV 77
3d5	Me2Sn(MeCOCHCOMe)2	VD	486.81		Cond	Pt4f7 = 71.2	BALS 76+
3d5	Me2Sn(8-quinolinol)2		486.96	Gc	IC		UBS 83+
3d5	Mc2Sn(PhCOCHCOPh)2	VD	486.87		Cond	Pt4f7 = 71.2	BALS 76+
3d5	Mc2SnCl2(DMSO)2		487	Gc	IC		WVV 79+
3d5	Me2SnF2		487.1	Gc	IC	FL	WVV 79+
3d5	Me2SnI2(bipyridyl)		486.3	Gc	IC		WVV 79+
3d5	Me2SnSO4		487	Gc	IC	FL	WVV 79+
3d5	Me3SnF		486.7	Gc	IC	FL	WVV 79+
3d5	Me3SnMo(CO)3(C5H5)		485.3	c	Au		GrMa 75+
3d5	Me3SnW(CO)3(C5H5)		485.8	Gc	IC		WWVV 77
3d5	Me4NSnCl3		486.1	Gc	IC		GZF 73+
3d5	McCl2SnW(CO)3(C5H5)		486.3	Gc	IC		WWVV 77
3d5	Ph2Sn(PhCOCHCOPh)2	VD	486.64		Cond	Pt4f7 = 71.2	BALS 76+
3d5	Ph3Sn(8-quinolinol)		487	Gc	IC		UBS 83+
3d5	Ph3Sn(PhCOCHCOPh)	VD	486.55		Cond	Pt4f7 = 71.2	BALS 76+
3d5	Ph3SnBr		487.5	Gc	IC		HWVV 74
3d5	Ph3SnCl		486.3	Gc	IC	FL	WVV 79+
3d5	Ph3SnCl		487	Gc	IC		MoVa 73
3d5	Ph3SnCl		487.6	Gc	IC		HWVV 74
3d5	Ph3SnF		486.2	Gc	IC	FL	WVV 79+
3d5	Ph3SnF		487.3	Gc	IC		HWVV 74
3d5	Ph3SnFc(CO)2(C5H5)		485.4	Gc	IC		WVV 79+

TABLE 4. Organic compounds for which Sn was being observed by photoelectron or Auger spectroscopy – Continued

Spectral Line	Compound	Physical State	Energy (eV)	Quality	Charge Reference	Calibration Method	Reference
Binding Energy							
3d5	Ph3SnGePh3		485.1	Gc	IC	FL	WVV 79+
3d5	Ph3SnI		486.3	Gc	IC	FL	WVV 79+
3d5	Ph3SnI		487.5	Gc	IC		HWVV 74
3d5	Ph3SnMo(CO)3(C5H5)		486	Gc	IC		WWVV 77
3d5	Ph3SnOH		485.6	Gc	IC	FL	WVV 79+
3d5	Ph3SnOSnPh3		485.6	Gc	IC	FL	WVV 79+
3d5	Ph3SnSSnPh3		485.3	Gc	IC	FL	WVV 79+
3d5	Ph3SnW(CO)3(C5H5)		485.8	Gc	IC		WVV 79+
3d5	Ph3SnW(CO)3(C5H5)		486.1	Gc	IC		WWVV 77
3d5	Ph4Sn		485.1	Gc	IC	FL	WVV 79+
3d5	Ph4Sn		486.3	Gc	IC		MoVa 73
3d5	Ph4Sn		487.1	Gc	IC		HWVV 74
3d5	Ph4Sn	VD	485.85		Cond	Pt4f7 = 71.2	BALS 76+
3d5	PhClSn(PhCOCHCOPh)2	VD	487.18		Cond	Pt4f7 = 71.2	BALS 76+
3d5	PhSnCl3(pyridine)2		487.2	Gc	IC	FL	WVV 79+
3d5	Sn(5,7-Cl2-8-quinolinol)2		487.18	Gc	IC		UBS 83+
3d5	Sn(8-quinolinol)2		488.1	Gc	IC		UBS 83+
3d5	SnCl4(Me2SO)2		487.1	Gc	IC		GZF 73+
3d5	SnCl4(dimethylsulfone)2		486.9	Gc	IC		WVV 79+
3d5	SnCl4(pyridine)2		487.3	Gc	IC		WVV 79+
4d	Ph3SnBr		26.6	Gc	IC		HWVV 74
4d	Ph3SnCl		26.9	Gc	IC		HWVV 74
4d	Ph3SnF		26.4	Gc	IC		HWVV 74
4d	Ph3SnI		26.6	Gc	IC		HWVV 74
4d	Ph4Sn		26.5	Gc	IC		HWVV 74
Doublet Separation							
3d	Ph4Sn	VD	8.39			Pt4f7 = 71.2	BALS 76+

TABLE 5. A subset of values of photoelectron binding energies and Auger kinetic energies for all the elements.

	Values in Chemical State Values in Error (0.5 eV)		1s	Ref. (median)	
LITHIUM					
Li	3		54.8	KLMP	73
LiO			55.6	CSFG	79
LiOH			54.9	CSFG	79
LiCl	3		56.1	MVS	73
LiF	3	1	55.7	MVS	73
Li2CO3	2		55.2	CSFG	79
BERYLLIUM					
Be	3		111.8	WRDM	79
BeO	4		113.7	NFS	82
BeF2	2	1	115.3	NKBP	73
NaBeF3			115.3	NKBP	73
BORON					
B	2	1	186.5	SMS	80
TiB2			187.5	MECC	73
BN	4		190.5	WRDM	79
B2O3	4		193.1	SMS	80
H3BO3	2		193.0	SMS	80
Na2B4O7			191.8	SMS	80
NaBF4	2		194.9	RNS	73
CARBON					
C,graphite	5		284.5	SmBl	84
TiC	3		281.5	IKIM	73
C6H6	3		284.9	CKAM	72
Na2CO3	2		289.4	HHDD	81
CO2			291.9	GHHL	70
CCl4			292.4	GHHL	70
CF2CF2	2	1	292.6	Tayl	78
NITROGEN					
CrN			396.8	STAB	76
Si3N4	3	1	397.7	TLR	78
BN	4	1	398.1	WRDM	79
NH3	3	1	398.8	LaLu	79
NH4Cl	4	1	401.7	BTE	77
NH4NO3	4	2	401.9	BCM	78
NaNO2	5	2	403.8	DML	84
NaNO3	5	2	407.3	DML	84
OXYGEN					
CdO	4		529.2	NFS	82
NiO	10		529.5	LoSt	84
Ni(OH)2	9		531.2	LoSt	84
CuO	9	1	529.6	MSSS	81
Cu2O	7	1	530.4	MSSS	81
CoO	7		530.2	NGDS	75
Co3O4	6		530.2	NGDS	75
MoO3	11	2	530.62	BFCB	83
Al2O3	17	4	531.0	StHe	84
KClO3	3		531.87	TCCW	85
KClO4	3		532.92	TCCW	85
poly(CH2CHOH)	3		532.6	PRCV	77
H2O	3		533.1	WZR	80
Co(CO)6	5	1	533.9	KTWY	76

TABLE 5. A subset of values of photoelectron binding energies and Auger kinetic energies for all the elements – Continued

	Values in Chemical State / Values in Error (0.5 eV)						
		1s				Ref. (median)	
FLUORINE							
CaF2	4	684.8				WRDM	79
LiF	5 1	685.0				NBK	74
NaF	5 1	684.5				NBK	74
KF	4	683.9				NBK	74
MgF2	4	685.52				MuTh	80
UF4	4 1	684.8				Chad	73
K2NbF7	2	685.2				NBK	74
Ni(OOCCF3)2		688.4				WRDM	79
poly(CF2CF2)	3 1	690.0				CFKM	73
C6F6		690.9				CKAM	72
NF4BF4		694.2				RNS	73
		1s	$KL_{23}L_{23}$	α			
NEON							
Ne(implanted in Fe)		863.4	818.0	1681.4		Wagn	75
Ne(implanted in diamond)		863.1	818.7	1681.8		Evan	80
Ne(implanted in Ag)		862.4				CiHa	74
SODIUM							
Na	4	1071.8	994.3	2066.1		BaSt	75
Na3Sb				2064.8		BaGa	80
Na2O		1072.5	989.8	2062.3		BaSt	75
NaNO2		1071.6	989.8	2061.4		Wagn	75
NaNO3		1071.4	989.4	2060.8		WGR	79
Na3PO4	3	1071.1	990.2	2061.3		Swif	82
NaPO3	3	1071.6	989.4	2061.0		Swif	82
Na2SO3	3 1	1071.4	990.2	2061.6		WGR	75
Na2SO4	3 1	1071.2	989.8	2061.0		Wagn	75
Na2CrO4	2	1071.2	990.9	2062.1		WGR	79
Na2MoO4	2 1	1070.9	991.0	2061.9		WGR	79
NaBiO3		1071.3	990.9	2062.2		WGR	79
NaI	2	1071.6	991.2	2062.8		Wagn	75
NaBr	3 1	1071.7	990.6	2062.3		Wagn	75
NaCl	8 5	1071.6	990.3	2061.9		Wagn	75
NaOOCH		1071.1	989.8	2060.9		WGR	79
NaOAc	2 1	1071.1	989.9	2061.0		Wagn	75
natrolite(Na2Al2Si3O10)		1072.4	988.5	2060.9		WPHK	82
Na zeolite A (NaAlSiO4)	2	1071.7	988.9	2060.6		WPHK	82
Na2ZrF6		1071.5	988.7	2060.2		Wagn	75
NaF	4 1	1071.2	988.6	2059.8		Wagn	75
NaBF4		1072.7	987.1	2059.8		Wagn	75
Na2SiF6	2	1071.7	987.7	2059.4		Wagn	75
		2p	$KL_{23}L_{23}$	α	1s		
MAGNESIUM							
Mg	9	49.6	1185.6	1235.2	1303.2	Fugg	77
Mg2Cu		49.5	1186.0	1235.5	1302.6	FWPF	75
Mg3Bi		50.3	1184.9	1235.2	1303.6	FWPF	75
MgO		50.4	1180.4	1230.8	1304.0	WRDM	79
Mg(OH)2		49.5	1302.7			HKNU	78
MgAl2O4		50.4	1304.0			HNUW	78
MgF2	2	50.95	1178.15	1229.1	1305.0	Wagn	80
Mg acetylacetonate		50.1	1180.5	1230.6	1304.0	WGR	79
Mg erucate		50.7	1180.2	1230.9	1304.4	WGR	79

TABLE 5. A Subset of values of photoelectron binding energies and Auger kinetic energies for all the elements – Continued

	Values in Chemical State / Values in Error (0.5 eV)		2p	$KL_{23}L_{23}$	α	Ref. (median)	
ALUMINIUM							
Al	9	1	72.85	1393.29	1466.14	Tayl	82
AlAs			73.6	1391.2	1464.8	Tayl	82
AlN	2		74.0	1388.9	1462.9	TaRa	81
Al2O3,alpha	3	1	73.85	1388.24	1462.09	WSJT	81
Al2O3,gamma	6		73.72	1377.83	1461.55	WSJT	81
Al2O3,sapphire	2		74.10	1387.87	1461.97	WPHK	82
Al(OH)3	2		74.3	1387.7	1462.0	Tayl	82
CuAl2O4	2		74.2			SLFH	85
natrolite			74.25	1386.53	1460.78	WPHK	82
sillimanite			74.58	1386.86	1461.44	WPHK	82
molecular sieve type A	2		73.66	1386.90	1460.56	WPHK	82
SILICON							
Si	11	1	99.44	1616.68	1716.12	WSJT	81
MoSi2			99.56	1617.2	1716.76	WSJT	81
PtSi			100.5			GMM	82
SiC			100.4			SmBl	84
Si3N4	5		101.9	1612.2	1714.1	Tayl	81
Ph4Si			101.2			GCH	76
SiO2	12		103.4	1608.8	1712.2	KBHN	74
SiO2 α-quartz			103.65	1608.6	1712.25	WPHK	82
SiO2 Vycor			103.5	1608.5	1712.0	Wagn	78
SiO2 gel			103.59	1607.87	1711.46	WPHK	82
methylsilicone resin			102.92	1608.80	1711.72	WPHK	82
poly-dimcthylsilicone			102.40	1609.38	1711.78	WPHK	82
pyrophyllite			102.88	1609.20	1712.08	WPHK	82
spodumene			102.46	1609.59	1712.05	WPHK	82
albite			102.63	1609.26	1711.89	WPHK	82
natrolite			102.22	1609.62	1711.84	WPHK	82
hydroxysodalite			101.65	1610.7	1712.35	WPHK	82
molecular sicve type A	2		101.65	1610.09	1711.52	Tayl	81
Na2SiF6			104.3			NSLS	77
PHOSPHORUS							
P (red)	7	1	(130.2)	1857.0	1987.2	ScBr	81
BP			130.3			PHHJ	70
CrP			129.6			PHHJ	70
GaP			128.7	1858.9	1987.6	WaTa	80
InP	5	1	129.7			Bert	81
P2O5	6		135.2			CFRS	80
Ph3P	18	3	130.9			BMPN	85
Ph3PO	9	1	132.5			Wagn	75
Ph3PS	5		132.5			Wagn	75
NaPO3	5	2	134.7	1848.3	1983.0	Wagn	78
Na2HPO4	4		133.1	1850.8	1983.9	WaTa	80
Na3PO4	5		132.3			Swif	82
SULFUR							
S	7	1	164.25			RiVe	83
ZnS	4	1	161.7	2114.4	2276.1	Wagn	78
NiS	4		162.8	2116.1	2278.9	WaTa	80
WS2	5	2	162.8	2115.6	2278.4	Wagn	78
Na2SO3	5	1	166.6	2108.5	2275.1	WaTa	82
Na2S2O3 (ccntral S)	3	1	168.6	2107.8	2276.4	Wagn	78
Na2S2O3 (periphcral S)			162.5	2112.5	2275.0	Wagn	78
CuSO4	3	1	169.1	2108.0	2277.1	WaTa	80
Na2SO4	5	1	169.1	2105.9	2275.0	Wagn	78
SF6			174.4	2100.45	2274.85	WaTa	82
CS2			163.6	2111.65	2275.25	WaTa	82
SO	2		167.4	2106.2	2273.6	WaTa	82

TABLE 5. A subset of values for photoelectron binding energies and Auger kinetic energies for all the elements – Continued

	Values in Chemical State / Values in Error (0.5 eV)						
		2p	$KL_{23}L_{23}$	α		Ref. (median)	
CHLORINE							
NaCl	5	198.6				NSLS	77
KCl	4	198.4				NSLS	77
KClO3	2	206.16				TCCW	85
KClO4	2	208.33				TCCW	85
K2PtCl4	4 1	198.7				NSBM	80
K2PtCl6	5 1	198.9				NSBM	80
NiCl2	2	199.4				KlHe	83
RhCl3	3 1	198.6				NSBM	80
poly-(vinyl chloridc)		200.1				WRDM	79
		$2p_3$					
ARGON							
Ar(implanted in Fe)		241.7				Wagn	75
Ar(implanted in graphite)		241.5				Wagn	78
		$2p_3$	$L_3M_2M_3$	$L_2M_2M_3$	α		
POTASSIUM							
K		294.7				PeKa	77
KI		292.8			543.6*	Wagn	75
KBr	3	293.1	248.3	250.7	542.6	WRDM	79
KCl	4	292.8				NSLS	77
KF		292.8				Wagn	75
K2OsCl6	3	293.0				LZML	83
KSbF6		293.7				Wagn	75

*Peaks composed mainly of $L_3M_{23}M_{23}$ and $L_2M_{23}M_{23}$ respectively.

		$2p_3$	$L_3M_2M_3$,$L_2M_2M_3$	α		
CALCIUM						
Ca		345.9	298.2	644.1	VaVe	80
CaS		346.45			KMUK	77
CaO	4	347.3	292.5	639.8	VaVe	80
CaCl2	3	348.3	291.9	640.2	Wagn	77
CaF2	3 1	347.9	288.9	636.8	Wagn	77
CaCO3	4	347.0	291.8	638.5	WRDM	79
CaSO4		348.0			CLSW	83
CaHPO4		347.6			LaMa	84
SCANDIUM						
Sc		398.3			MFA	85
ScP		399.4			MFA	85
ScN		400.7			STAB	76
ScS		402.9			FUMT	76
Sc2O3	4	401.9	334.9	736.8	WRDM	79
ScF3		405.0	329.8	734.8	AWH	81
		$2p_3$	$L_3M_{23}V$	α		
TITANIUM						
Ti	6	453.89			LANM	81
TiP		454.8			MFA	85
TiN		455.8			STAB	76
TiC		454.6	418.2	872.8	WGR	79
TiO2	10 2	458.7			WRDM	79
TiCl4		458.5			MRV	83
BaTiO3	2	458.55			MWI	75
Na2TiF6		462.6	409.8	872.4	WGR	79
K2TiF6		462.1	409.4	871.5	WGR	79

TABLE 5. A subset of values for photoelectron binding energies and Auger kinetic energies for all the elements – Continued

	Values in Chemical State / Values in Error (0.5 eV)		$2p_3$	$L_3M_{23}V$	α	Ref. (median)	
VANADIUM							
V	10	2	512.15	472.0	984.15	WRDM	79
VN	2		514.3			STAB	76
VS			513.9			FUMT	76
V2O3	4	2	515.8			HSGH	81
V2O5	16	6	517.65			WRDM	79
Na3VO4			517.3			NFS	82
V(C5H5)2	2		512.9			GSMJ	74
V(acac)3			514.2			LFS	73
CHROMIUM							
Cr	10	1	574.3	527.2	1101.5	WRDM	79
ZrCr2			573.9			RKOS	84
Cr2O3	16	3	576.6			BDFP	81
CrO3	4	2	580.1			Shut	80
Na2Cr2O7	4		579.8			NSSP	80
Cr(C5H5)2	3		574.8			GSMJ	74
CrCl3	2		577.8			AlTu	76
CrF3	3	1	579.4			MMP	82
MANGANESE							
Mn			638.78			LANM	81
MnP			639.0			MFA	85
MnN			641.3			CSC	72
Mn2O3	9	1	641.6			StHe	84
Mn3O4	6		641.4			INZI	82
MnO2	7	2	642.6			INZI	82
MnBr2	2		642.1			Aoki	76
MnCl2	2		642.0			Aoki	76
KMnO4			647.0			UmRe	78
			$2p_3$	L_3VV	α		
IRON							
Fe	19	3	706.95	702.4	1409.35	WRDM	79
FeP	2		707.1			MFA	85
FeB	2		707.4			JJH	80
Fe3Si			707.5			ShTr	75
Fe3C			708.1			ShTr	75
FeS2	5	1	706.7			VHVH	80
FeO	6	2	709.6			NDKS	83
Fe2O3	14	3	710.9			WRDM	79
FeF2	2		711.4			KaUr	79
Fe(C5H5)2	4		707.8			Nefe	78
COBALT							
Co	6		778.2	773.0	1551.2	HaWi	77
CoS2	2		778.1			VHVH	80
CoO	13	1	780.4			NFS	82
CoOOH	2		780.3			SDM	83
Co(OH)2	2		781.3			SDM	83
CoAl2O4	3		780.8			OkHi	76
CoMoO4	2		781.3			KGBP	83
K3Co(CN)6	3	1	781.9	766.8	1548.7	WGR	79
Co(NH3)6Cl3	4	1	781.7	768.6	1550.3	WGR	79

TABLE 5. A subset of values for photoelectron binding energies and Auger kinetic energies for all the elements – Continued

	Values in Chemical State / Values in Error (0.5 eV)						
			$2p_3$	L_3VV	α	Ref. (median)	
NICKEL							
Ni	18	1	852.7	846.2	1698.9	PEJ	82
Al3Ni			853.75			HFBZ	82
AuNi			852.15			HFBZ	82
NiB			853.2			SMS	80
Ni2Si	3		853.0			GGM	82
NiS	2		852.8			ShRe	79
NiO	18	7	854.4			GGM	82
Ni2O3	2		856.0			SMSB	81
Ni(OH)2	9	2	855.9			SMSB	81
Ni(CO)4	2		854.4			KMI	81
NiCl2	4		856.7			KlHe	83
NiAl2O4	6	2	856.2			SMSB	81
NiSO4	4		856.8			ShRe	79
Ni(dimethylglyoxime)2	4		854.8	842.4	1697.2	WGR	79
NiF2	3	1	857.4	842.4	1699.8	WGR	79
			$2p_3$	$L_3M_{45}M_{45}$	α		
COPPER							
Cu	26	3	932.67	918.65	1851.32	AnSe	84
Al2Cu			933.9	918.0	1851.9	FKWF	77
CuP2			932.4			NSDU	75
Cu2S	7	1	932.4			NSSP	80
CuS	6	1	932.3			Brio	80
CuFeS2	2		932.0			Brio	80
CuAl2O4	2		934.7			SLFH	85
Cu2O	14		932.4	916.8	1849.4	THC	83
CuO	16	1	933.8	917.9	1851.7	WRDM	79
CuCl	5		932.4	915.6	1848.0	GaWi	77
CuCl2	7	3	934.4	915.5	1849.9	GaWi	77
CuF2	5	2	936.1	916.0	1852.1	GaWi	77
ZINC							
Zn	13	2	1021.70	992.10	2013.80	Evan	85
ZnP2			1020.9			NSDU	75
ZnTe			1021.6	991.3	2012.9	HFV	77
ZnSe			1022.0	989.5	2011.5	HFV	77
ZnS	3		1021.6	989.7	2011.3	GaWi	77
ZnO	11	2	1022.1	987.7	2009.8	GaWi	77
ZnI2	2		1022.5	988.7	2011.2	GaWi	77
ZnBr2	2		1023.4	987.3	2010.7	Wagn	75
ZnSO4	2		1023.0	986.2	2009.2	StHe8	4a
ZnF2	2		1021.8	986.2	2008.0	GaWi	77
			3d	$L_3M_{45}M_{45}$	α		
GALLIUM							
Ga	7		18.7	1068.1	1086.8	WRDM	79
GaAs	14	1	19.3	1066.3	1085.6	MINN	78
GaP	7		19.3	1065.6	1084.9	NIMN	78
GaN			19.54	1064.5	1084.05	HeMa	80
AlGaAs			19.0			TAYL	82
Ga2Se3	2		19.7	1065.6	1085.3	ITI	82
Ga2O3	6		20.5	1062.4	1082.9	ITI	82
GERMANIUM							
Ge	9		29.15	1145.2	1174.35	WRDM	79
GeAs2			29.7			HKMP	74
GeTe	2		30.0	1144.8	1174.8	SFS	77
GeSe3			31.2	1141.7	1172.9	Ueno	83
GeSe	2		31.7	1142.9	1173.6	Ueno	83
GeS			30.5	1143.7	1174.2	SFS	77
GeO2			32.7	1137.7	1170.4	Wagn	82
Ph4Ge			31.2			HWVV	74
Na2GeF6			33.3	1135.7	1169.0	Wagn	82

TABLE 5. A subset of values for photoelectron binding energies and Auger kinetic energies for all the elements – Continued

	Values in Chemical State / Values in Error (0.5 eV)		3d	$L_3M_{45}M_{45}$	α	Ref. (median)	
ARSENIC							
As	12		41.5	1225.0	1266.5	BWWI	76
NbAs			40.8	1226.0	1266.8	BWWI	76
AlAs	2		41.0			Tayl	82
AlGaAs			41.0			Tayl	82
GaAs	16		41.2	1225.0	1266.2	Tayl	82
As2Se3	6	1	43.0	1223.3	1266.3	BWWI	76
As2S3			43.4	1222.0	1265.5	BWWI	76
As2O3	9	3	44.9	1218.7	1263.6	Tayl	82
As2O5	4		46.1	1217.4	1263.6	BWWI	76
NaAsO2	2		44.3	1219.6	1263.9	Tayl	82
AsI3			43.5	1222.9	1266.4	BWWI	76
AsBr3			45.3	1218.1	1263.4	BWWI	76
Ph3AsS	2		44.1	1220.0	1264.1	BWWI	76
Ph3As	4		42.76			HVV	79
KAsF6			47.8	1213.8	1261.6	WGR	79
SELENIUM							
Se	18	4	55.2			CIKT	85
As2Se3	6		54.9			UeOd	82
GeSe2	3		54.5			UeOd	82
Ga2Se3	3		54.6			ITI	82
CuInSe2	2		53.8			CIKT	85
PbSe	2		53.4			SFS	77
H2SeO3			59.0	1301.0	1360.0	BWI	81
H2SeO4			61.0	1298.1	1359.1	BWI	81
SeO2	4		58.8	1301.6	1360.4	BWI	81
Ph2Se			55.8	1304.0	1359.8	BWI	81
Ph2Se2			55.8	1304.3	1360.1	BWI	81
Ph2SeO			57.6	1301.9	1359.5	BWI	81
BROMINE							
CsBr	4	1	68.3			NSBM	80
RbBr			68.4			MVS	73
KBr	3		68.7			WaTa	80
NaBr	2		68.8			ShIg	78
LiBr			68.9	1389.1	1458.1	Wagn	78
KBrO3			74.8	1384.4	1459.2	Wagn	78
PbBr2	2		68.7			Nefe	82
K2PtBr4	3		69.3			NSBM	80
K2PtBr6	2		69.2			NSBM	80
Ni(NH3)6Br2			68.7			NZB	78
			3p3				
KRYPTON							
Kr in Ag			207.6			CiHa	74
Kr in Cu			207.3			CiHa	74
			3d5				
RUBIDIUM							
Rb			112.0			EbSi	79
RbCl			110.1			NSMN	74
STRONTIUM							
Sr			134.4			VaVe	80
SrO			135.3			VaVe	80
SrMoO4			133.5			NFS	82
SrRh2O4			133.0			NFS	82
SrF2			133.75			WRDM	79

TABLE 5. A subset of values for photoelectron binding energies and Auger kinetic energies for all the elements – Continued

	Values in Chemical State / Values in Error (0.5 eV)	3d	$L_3M_{45}M_{45}$	α	Ref. (median)
YTTRIUM					
Y		155.8			NyMa 80
YH3		157.7			FuSc 84
Y2O3	4 1	157.0			UIY 84
Y2(C2O4)3		159.7			UIY 84
Y2(SO4)3		160.0			UIY 84
ZIRCONIUM					
Zr	5	178.79			NyMa 80
ZrCr2		178.4			RKOS 84
ZrCr2H4		179.5			RKOS 84
ZrH2		178.8			CoMa 75
ZrO2	4 1	182.2			NGDS 75
ZrF4		185.3			NKBP 73
K2ZrF6		184.2			NKBP 73
NIOBIUM					
Nb	10 2	202.26			NyMa 80
NbN		203.8			Bahl 75
NbSe4		203.4			Bahl 75
NbO	4 2	203.7			Bahl 75
NbO2	5 2	205.7			Bahl 75
Nb2O5	12 4	207.6			NFS 82
NbI5		207.1			GSS 84
NbBr5		207.1			MSC 73
NbCl5		208.0			MSC 73
KNbO3		206.5			MSC 73
K2NbF7		209.4			MSC 73
		$3d_5$	M_5VV	α	
MOLYBDENUM					
Mo	14 3	227.9	222.8	450.7	WaTa 80
MoB2		227.9			MECC 73
Mo2C		227.8			BrWh 78
MoS2	8 2	229.0			ZMTB 80
MoO2	12 4	229.6			FlMa 82
MoO3	17 2	232.8			FlMa 82
Al2(MoO4)3	3	232.7			ZMTB 80
CoMoO4	5 3	233.1			PCLH 76
InMo6S8		227.9			MAS 85
Na2MoO4	4	232.0			NFS 82
MoCl5	2	231.0			GrMa 75
RUTHENIUM					
Ru	8 1	280.02			NyMa 80
RuO2	5 2	280.9			McGi 82
RuO3		282.5			KiWi 74
RuO4		283.3			KiWi 74
RuCl3		281.8			Folk 73
BaRuO4		284.2			OGB 80

TABLE 5. A subset of values for photoelectron binding energies and Auger kinetic energies for all the elements – Continued

	Values in Chemical State Values in Error (0.5 eV)	$3d_5$	M_5VV	α	Ref. (median)
RHODIUM					
Rh	8 2	307.2	301.3	608.5	WRDM 79
Rh2S3		308.8			GiDi 84
Rh2O3	3	308.7			NFS 82
RhCl3	2	310.2			AnSc 81
RhI3	2	308.6			Nefe 78
Na3RhCl6		310.0	297.7	607.7	WGR 79
KRhO2		308.5			NFS 82
Rh2MoO6		309.2			NFS 82
RhCl3.3H2O	6	310.0			FMPS 85
Rh6(CO)16		308.8			AWH 81
K3Rh(N02)6		310.5			SNMK 78
K3Rh(NO3)6	3	311.1			SNMK 78
ClRh(PPh3)3	4 1	307.6			OIIT 79
K3RhCl6	3	309.8			SNMK 78
K3RhF6		312.2			SNMK 78
		$3d_5$	$M_4M_{45}M_{45}$	α	
PALLADIUM					
Pd	21 3	335.1	327.8	662.9	WRDM 79
Al3Pd		337.7			HFBZ 82
LaPd		336.4			HFBZ 82
Pd2Si		336.8			GGM 82
PdO		336.3			KGW 74
PdO2		337.9			KGW 74
PdCl2	4	337.8			CKJT 85
K2Pd(NO2)4	2	338.8			NZMP 73
K2PdBr4	2	337.7			NZMP 73
K2PdCl4	3	337.9	323.1	661.0	WGR 79
K2PdCl6	3	340.3			Nefe 78
Pd(NH3)4Cl2		338.4	323.8	662.2	WGR 79
Pd(PPh3)4		335.1	324.4	659.5	WGR 79
		$3d_5$	$M_4M_{45}M_{45}$	α	
SILVER					
Ag	16	368.28	357.84	726.12	AnSe 84
AlAg2		368.7	357.7	726.4	FKWF 77
CuAgSe		367.8	357.3*	725.1	RRD 78
Ag2Se		367.8	357.4*	725.2	RRD 78
Ag2S		367.1	357.2*	725.3	RRD 78
Ag2O	4 1	367.8	356.7*	724.5	GaWi 77
AgO	4 1	367.4	356.6*	724.0	GaWi 77
AgI		368.0	356.1*	724.1	GaWi 77
AgF		367.7	355.3*	723.0	GaWi 77
AgF2		367.3	355.6*	722.9	GaWi 77

*6.0 eV added to value for $M_5N_{45}N_{45}$ to give value for $M_4N_{45}N_{45}$.

		$3d_5$	$M_4N_{45}N_{45}$	α	
CADMIUM					
Cd	8 2	405.0	384.0*	789.0	GaWi 77
CdTe	9	405.2	382.4	787.6	Pola 82
CdSe	2	405.0	381.7	786.7	Pola 82
CdS	7	405.3	381.3*	786.6	GaWi 77
CdO	7	404.2	382.4*	786.6	GaWi 77
Cd(OH)2	2	405.1	380.0	785.1	WGR 79
CdSO4		405.4			RVJK 85
CdCO3		405.1			HGW 75
CdI2	3	405.4	381.2*	786.6	GaWi
CdCl2		406.1			SATD 73
CdF2	5	405.9	379.0*	784.9	GaWi 77

*6.8 eV added to value for $M_5N_{45}N_{45}$ to give value for $M_4N_{45}N_{45}$.

TABLE 5. A subset of values for photoeleetron binding energies and Auger kinetic energies for all the elements — Continued

	Values in Chemical State / Values in Error (0.5 eV)	$3d_5$	$M_4N_{45}N_{45}$	α	$4d_5$	Ref. (median)	
INDIUM							
In	17 4	443.84	410.41	854.25	16.76	PVVA	79
InSb	2	444.3				VaGr	81
InP	6 1	444.6	408.0	852.6		Bert	81
In2Se3	3 1	444.5	408.0	852.5		CIKT	85
CuInSe2	2	444.1	408.6	852.7		CIKT	85
In2S3	2	444.7	407.3	852.0		WGR	79
InMo6S8		444.4				MAS	85
In2O3	10 4	444.4	406.4	850.8		Bert	81
InI3	3 1	445.8	405.8	851.6		Wagn	77
InBr3	3 1	446.0	404.8	850.8		Wagn	77
InCl3	3 1	445.9				FHT	77
InF3	2	446.2	403.7	849.9		Wagn	75
(NH4)3InF6		445.6	404.1	849.7		Wagn	77

*7.6 eV added to value for $M_5N_{45}N_{45}$ to give value for $M_4N_{45}N_{45}$.

		$3d_5$	$M_4N_{45}N_{45}$	α			
TIN							
Sn	17	484.87	437.27	922.7		PVVA	79
SnTe		485.6				SFS	77
SnSe		485.7				SFS	77
SnS	3 1	485.6	435.7	921.3		Wagn	75
SnO	6 2	486.9				WVV	79
SnO2	11	486.6	432.6	919.2		LAK	77
Me3SnF		486.7				WVV	79
Ph4Sn	4	486.3				MoVa	73
SnBr2		486.9				GZF	73
SnCl2	2	486.7				WVV	79
SnF2	3	487.4				Shut	80
SnF4	2	488.2				Shut	80
NaSnF3		487.4	430.8	918.2		Wagn	75
ANTIMONY							
Sb	8 1	528.2	464.5	992.7		VaTr	79
Na3Sb				990.6		BaGa	80
AlSb		528.6				MSV	73
InSb		528.0				VaGr	81
Sb2S3	4 1	529.5	462.1	991.6		Wagn	75
Sb2S5	2	529.3	462.2	991.5		Wagn	75
Sb2O3	2	530.0	459.7	989.7		Wagn	75
SbI3		530.4				MSV	73
SbCl5		530.9				MSV	73
Ph3Sb		528.9				BCH	75
Ph3SbS		528.7				BCH	75
SbF3		531.7				MSV	73
KSbF6		532.9	454.4	987.3		WGR	75

TABLE 5. A subset of values for photoelectron binding energies and Auger kinetic energies for all the elements – Continued

Values in Chemical State
Values in Error (0.5 eV)

		$3d_5$	$M_4N_{45}N_{45}$	α	$4d_5$	Ref. (median)	
TELLURIUM							
Te	17 4	572.85	492.13	1064.98	40.26	PVVA	79
SnTe		572.3				SFS	77
PbTe		572.0				SFS	77
CdTe	8	572.7	490.8	1063.5		Pola	82
Ga2Te3		572.4	40.3			TIWB	72
GeTe		572.7	40.2			SFS	77
GeTe3As		572.5				HKMP	74
TeO2	6	576.1	487.1	1063.2	43.4	BWI	77
TeO3	2 1	577.3	485.5	1062.8	44.6	BWI	77
Te(OH)6		577.1	485.1	1062.2	45.0	BWI	77
Na2TeO4		576.8	485.5	1062.3		Wagn	75
TeI4		575.8	43.8			BWI	77
TeBr4		576.7	487.3	1064.0	44.0	BWI	77
TeCl4		576.9	486.1	1063.0	44.3	BWI	77
(NH4)2TeCl6		576.9	486.4	1063.3	45.3	BWI	77
Ph2Te2		573.9	488.5	1062.4	42.8	BWI	77
Ph2TeCl2		576.2	486.3	1062.5	43.8	BWI	77
		$3d_5$	$M_4N_{45}N_{45}$	α			
IODINE							
I2	2	619.9	519.0	1138.9		DMKK	84
UI3		620.3	517.3	1137.6		DMKK	84
LiI	2 1	619.7	517.0	1136.7		WRDM	79
NaI	2	618.4				Sher	76
NiI2		619.0	518.8*	1137.8		GaWi	77
AgI		619.4	518.3*	1137.7		GaWi	77
NbI4			620.0			GSS	84
HIO3		623.1				Sher	76
NaIO3		623.5				Sher	76
NaIO4		624.0				Sher	76
ICl		621.5				Sher	76
ICl3		622.5				Sher	76
I2O5		623.3				Sher	76

*11.5 eV added to value for $M_5N_{45}N_{45}$ to provide value for $M_4N_{45}N_{45}$.

XENON							
Xe (implanted in graphite)		669.65	545.2	1214.85		WRDM	79
Xe (implanted in Ag)		669.6				CiHa	74
Na4XeO6		674.1	541.4	1215.5		Wagn	77
		3d5	M4N45N45	α	4d5		
CESIUM							
Cs	2	726.3			77.5	EbSi	79
CsN3		723.6				SGRS	72
Cs2O	2 1				77.6	EbSi	79
CsOH		724.15	568.7	1292.85		WRDM	79
Cs2SO4		723.9	568.4	1292.3		Wagn	77
Cs3PO4		723.9				MVS	73
CsI		723.9				MVS	73
CsCl	2	724.0				NSMN	74
CsClO4		724.2				MVS	73
CsF		724.0				MVS	73

TABLE 5. A subset of values for photoelectron binding energies and Auger kinetic energies for all the elements – Continued

	Values in Chemical State Values in Error (0.5 eV)	$3d_5$	$M_4N_{45}N_{45}$	α	$4d_5$	Ref. (median)	
BARIUM							
Ba	4 1	780.6	601.0	1381.6	90.2	KoGr	85
BaH2		782.0				FMUK	77
BaS		779.8				SiWo	80
BaO	4 1	779.9	598.0	1377.9	89.8	KoGr	85
BaCO3		779.9				CLSW	83
Ba(NO3)2		780.7				CLSW	83
BaSO4	4 1	780.8	596.1	1376.9		Wagn	77
BaCrO4		778.9				ACHT	73
BaF2		781.7	594.9	1376.6		SeSo	84
		3d5			**4d5**		
LANTHANUM							
La	2	835.9				SOS	82
LaH2		837.2				SOS	82
LaH3	2	838.8				SOS	82
La2O3	4 2	834.8			102.1	UIY	84
La2(SO4)3		837.4			104.4	UIY	84
La2(C2O4)3		837.2			104.6	UIY	84
LaCrO3		833.0			101.7	HoTh	80
CERIUM							
Ce	3 1	883.9				SOS	82
CeAl2		883.5			109.1	LFBC	80
CePd3		884.3				LFBC	80
CeH2		885.8				SOS	82
CeH3	2	886.0				SOS	82
CeSe		884.3				LFBC	80
CeO2	4 1	881.93				BFCB	83
PRASEODYMIUM							
Pr		932.0				FuOs	84
PrH2		933.2				FuOs	84
PrH3		934.2				FuOs	84
Pr2O3	2	933.6			116.1	SaRa	80
PrO2		935.3			116.2	SaRa	80
Pr2(SO4)3		936.1			116.8	UIY	84
Pr2(C2O4)3		935.8			116.8	UIY	84
NEODYMIUM							
Nd2(SO4)3		984.9			122.5	UIY	84
Nd2(C2O4)3		984.7			122.1	UIY	84
PROMETHIUM							
PmCl3		1033.5			128.3	MNTB	70
SAMARIUM							
Sm		1081.2				DKMB	76
Sm2O3		1084.3			131.0	UIY	84
Sm2(SO4)3		1085.6			132.9	UIY	84
Sm2(C2O4)3		1085.5			132.8	UIY	84
EUROPIUM							
Eu					128.4	NNBF	68
Eu2O3		1135.6			135.6	UIY	84
Eu2(SO4)3		1137.9			137.5	UIY	84
Eu2(C2O4)3		1136.4			135.1	UIY	84
GADOLINIUM							
Gd					141.7	TeLe	79
Gd2(SO4)3		1190.0			143.8	UIY	84
Gd2(C2O4)3		1189.8			144.4	UIY	84

TABLE 5. A subset of values for photoelectron binding energies and Auger kinetic energies for all the elements — Continued

Values in Chemical State
Values in Error (0.5 eV)

		$3d_5$			$4d_5$		Ref. (median)	
TERBIUM								
Tb2O3		1241.5			148.7		SaRa	80
TbO2		1241.4			149.2		SaRa	80
Tb2(SO4)3					150.5		UIY	84
Tb2(C2O4)3					150.9		UIY	84
DYSPROSIUM								
Dy2O3		1298.9					SaRa	80
Dy2O3					155.8		UIY	84
Dy2(SO4)3					156.5		UIY	84
Dy2(C2O4)3					156.0		UIY	84
HOLMIUM								
Ho2(SO4)3					162.8		UIY	84
Ho2(C2O4)3					163.3		UIY	84
ERBIUM								
Er2O3					168.8		UIY	84
Er2(C2O4)3					170.7		UIY	84
THULIUM								
Tm2O3					176.6		UIY	84
Tm2(SO4)3					178.3		UIY	84
Tm2(C2O4)3					178.3		UIY	84
YTTERBIUM								
Yb	4 2				183.0		PLNW	77
Yb2O3					185.2		UIY	84
Yb2(SO4)3					187.3		UIY	84
Yb2(C2O4)3					187.3		UIY	84
LUTETIUM								
Lu	3				196.6		PLNW	77
Lu2O3	4 1				196.5		UIY	84
Lu2(SO4)3					198.5		UIY	84
Lu2(C2O4)3					198.7		UIY	84

		$4f$			$4d_5$		
HAFNIUM							
Hf	2	14.23			211.5	NBM	80
HfO2		16.7			213.0	SaRa	80

		$4f_7$	$M_5N_{67}N_{67}$	α	$4d_5$		
TANTALUM							
Ta	4	21.9	1674.65	1696.6		WaTa	80
TaSi2		27.0			231.1	MSC	73
TaS2		26.7			230.8	MSC	73
Ta2O5	4	26.5			230.4	SaRa	80
KTaO3		25.9			229.8	MSC	73
TaBr5		26.9			231.2	MSC	73
TaCl5		27.3			231.0	MSC	73
TaF5		27.8			231.6	MSC	73
K2TaF7		29.4			234.9	NKSP	73

TABLE 5. A subset of values for photoelectron binding energies and Auger kinetic energies for all the elements — Continued

Values in Chemical State
Values in Error (0.5 eV)

			$4f_7$	$M_5N_{67}N_{67}$	α	$4d_5$	Ref. (median)	
TUNGSTEN								
W	9		31.32			243.5	NBM	80
WC			31.5				CoRa	76
WS2			33.2	1727.8	1761.0		Wagn	75
WO2	8	3	32.7				CoRa	76
WO3	12	2	35.7				CoRa	76
Al2(WO4)3	4	1	36.3				SMSB	81
Na2WO4			36.3	1722.0	1758.3		Wagn	75
H2WO4			36.1	1723.9	1760.0		Wagn	78
Li2WO4	2		36.0			247.6	MSC	73
CuWO4			36.1	1725.3	1761.4		Wagn	78
WBr5			36.3			247.6	MSC	73
WBr6			35.9			247.7	MSC	73
WCl4			34.9				GMW	85
WCl6			36.6				GMW	85
			$4f_7$			$4d_5$		
RHENIUM								
Re	8	1	40.46			260.5	BMNN	79
ReO2	3	1	43.2				KOAG	83
Re2O7			46.7				CDGV	80
K2ReO4			46.07				TCCW	85
NH4ReO4			46.2				KOAG	83
K2ReBr6			43.5				NSSK	80
K2ReCl6	3		44.0				NSSK	80
OSMIUM								
Os	4		50.7			278.5	BNMN	79
OsO2	2	1	52.0			280.1	SaRa	80
K2OsO4						283.6	SaRa	80
K2OsI6			51.9				Nefe	78
K2OsCl6	5	1	53.2				LZML	83
OsCl3			53.1				Nefe	78
K2OsO2(OH)4			55.2				Nefe	78
O6Os(C5H5N)4			53.8				LZML	83
Os(NH3)5N2I2			50.9				Folk	73
IRIDIUM								
Ir	6		60.75			296.3	NBM	80
IrO2	2		62.0				Peuc	84
IrCl3			62.7				Folk	73
IrCl4(PEt3)2			63.6				LeBr	72
IrClN2(PPh3)2			60.7				Folk	73
K2IrBr6			62.6				Nefe	78
K2IrCl6	4	1	63.5				KSPB	76
K3IrBr6			61.8				Nefe	78
K3IrCl6			62.5				NBSN	77
K3Ir(CN)6			61.8				InFl	84

TABLE 5. A subset of values for photoelectron binding energies and Auger kinetic energies for all the elements -- Continued

	Values in Chemical State / Values in Error (0.5 eV)							
		$4f_7$				$4d_5$	Ref. (median)	
PLATINUM								
Pt	2	71.07				314.6	NBM	80
Pt	13	71.2					Wagn	75
PtSi		73.0					GGM	82
Pt2Si		72.5					GGM	82
PtO	3 1	74.2				317.3	EPCC	75
PtO2	4 2	75.0				318.1	EPCC	75
Pt(OH)2		72.6					HaWi	77
Pt(OH)4		74.6					PCB	84
Pt(OAc)2		73.8					RCMS	80
PtCl2		73.6				316.7	EPCC	75
PtCl4		75.5				318.6	EPCC	75
K2PtI6	2	73.4					NSBM	80
K2PtCl4	6 1	73.0				316.1	Wagn	75
K2PtCl6	6	75.5				318.6	NSBM	80
K2PtF6	2	77.6					NSBM	80
K2Pt(OH)6	2	75.1					NSBM	80
K2Pt(NO2)6	2	75.9					NSBM	80
Pt(NH3)6Cl4	2	76.3					NSBM	80
Pt(PPh3)3	2	71.4					Rigg	72
		$4f_7$	$M_5N_{67}N_{67}$	α	$M_4N_{67}N_{67}$	$4d_5$		
GOLD								
Au		83.97				334.7	VaTr	79
Au		84.1	2015.8	2099.9	69.8*	335.1	PEJ	82
Au	13	84.0	2015.7	2099.7	2101.6		WaTa	80
Au2O3		85.9					PLTD	84
(PPh3)AuCl	5	85.3					MBSG	80
(PPh3)2AuCl	2	85.2					MBSG	80
(PPh3)AuCl3	2	87.5					MBSG	80
(PPh3)AuI	2	85.4					BMCK	82
(PPh3)8Au9(NO3)3	3	85.0					BMZN	82
(PPh3)AuNO3	2	85.4					BMCK	77
(PPh3)4Au(ClO4)		85.0					MBSG	80

*Line N_7VV.

		$4f_7$	$4d_5$		
MERCURY					
Hg	4	99.9	359.3	SMBM	76
HgS		100.8		NSSP	80
HgO	2	100.8		NSSP	80
Hg3PO4		101.1		NSK	79
Hg2SO4		101.0		NSK	79
Hg2(NO3)2		101.2		NSK	79
Hg2I2		100.9		NSK	79
HgI2		100.7		SATD	73
Hg2Cl2		100.8		NSK	79
HgCl2		101.4		SATD	73
HgF2		101.2		SATD	73
Hg2C2O4		101.1		NSK	79
THALLIUM					
Tl	3	117.73	385.0	MBN	80
TlS		118.7	385.5	MSC	73
TlS3		118.7	385.3	MSC	73
Tl2O3		117.5	384.7	MSC	73
TlI		118.5	385.4	MSC	73
TlBr		119.2	386.1	MSC	73
TlCl		119.0	385.7	MSC	73
TlF		119.2	386.1	MSC	73

TABLE 5. A subset of values for photoelectron binding energies and Auger kinetic energies for all the elements — Continued

	Values in Chemical State / Values in Error (0.5 eV)		$4f_7$	$M_5N_{67}N_{67}$	α	$M_4N_{67}N_{67}$	$4d_5$	Ref. (median)	
LEAD									
Pb			136.78				412.0	NBM	80
Pb			137.0	2180.3	2317.3	2282.1		WaTa	80
			$4f_7$	$N_6O_{45}O_{45}$			$4d_5$		
Pb	12		136.8	96.25	233.05			Pede	82
PbTe	2		137.25	95.45	232.7			Pede	82
PbSe	2		137.6	94.75	232.35			Pede	82
PbS	4		137.5	94.55	232.05			Pede	82
PbO	14		137.25	92.85	230.1			Pede	82
PbO2	6	1	137.4	93.05	230.45			Pede	82
Pb(OH)2	2		137.95	91.95	229.9			Pede	82
Pb(OAc)2	3		138.5	91.45	229.95			Pede	82
Pb(OAc)4			137.2					BeFl	80
PbSO4	4	2	140.0	90.1	230.1			Pede	82
PbSiO3			138.65	91.1	229.75			Pede	82
PbI2			138.35	93.35	231.7			Pede	82
PbCl2			138.9	92.1	231.0			Pede	82
PbF2			138.5	90.6	229.1			Pede	82
Pb(IO4)2			138.2	92.7	230.9			Pede	82
Ph4Pb			138.2				413.3	MoVa	73
			$4f_7$		$5d_5$		$4d_5$		
BISMUTH									
Bi	7		156.88				440.3	VaTr	79
Bi2Sc3					25.0			TSH	84
Bi2S3			158.9					MSV	73
BiOCl			159.9					MSV	73
Bi2MoO6	2	1	159.6					VVS	85
NaBiO3			159.1					MSV	73
BiI3			159.3					MSV	73
BiF3			160.8					MSV	73
Ph3Bi					25.37			HVV	79
THORIUM									
Th	4		333.1		85.4		675.2	ScLa	81
ThO2			334.6		87.0		675.7	VLDH	77
Th(OAc)4					87.3			NMSI	74
Th3(PO4)4					87.5			NMSI	74
ThCl4			335.7					ATT	83
ThCl4					86.2			NMSI	74
ThF4	2		336.9					ATT	83
ThF4					88.1			NMSI	74

TABLE 5. A subset of values for photoelectron binding energies and Auger kinetic energies for all the elements – Continued

	Values in Chemical State Values in Error (0.5 eV)		$4f_7$	$5d_5$	$4d_5$	Ref. (median)	
URANIUM							
U	11	2	377.4	94.0	736.4	ScLa	81
UTe3			381.3			SNRS	76
USe			380.3			SNRS	76
USe3			379.1			SNRS	76
US			380.1			SNRS	76
US3			379.4			SNRS	76
UO2	10	1	380.2	97.0		FSL	85
U3O8	4		380.7	97.3		FSL	85
UO3	6		381.3	97.6		DBLG	83
UOBr2			380.4			TBVL	82
UOCl			380.0			TBVL	82
UOCl2			380.3			TBVL	82
UO2Br			380.5			TBVL	82
UO2Br2			381.1			TBVL	82
UO2F2	2		383.0			TBVL	82
U(SO4)2			381.6			Chad	73
UO2MoO4			381.0	97.5		FSL	85
UI3			379.0			DMKK	84
UBr4			379.9			TBVL	82
UCl3			378.3			TBVL	82
UCl4	2	1	380.2			TBVL	82
UF4	5		382.2			TBVL	82
UF6			384.9			TrRi	82
K2UF6			382.4			PMDS	77
PLUTONIUM							
Pu2O3	2		424.7			CCHB	81
PuO2	2		426.2			CCHB	81
AMERICIUM							
Am(OH)3			449.1	109.2	831.8	KrWu	72

Appendix A. Long References

ACCT74 Allen, G. C., Crofts, J. A., Curtis, M. T., Tueker, P. M., Chadwick, D., Hampson, P. J., J. Chem. Soc. Dalton Trans. 1974, 1296

AKHM84 Asami, K., Kimura, H. M., Hashimoto, K., Masumoto, T., Yokoyama, A., Komiyama, H., Indue, H., J. Non-Cryst. Solids 64, 149 (1984)

BACB75 Baneroft, G. M., Adams, I., Coatsworth, L. L., Bennewitz, C. D., Brown, J. D., Westwood, W. D., Anal. Chem. 47, 586 (1975)

BBFR77+ Best, S. A., Brant, P., Feltham, R. D., Rauehfuss, T. B., Roundhill, D. M., Walton, R. A., Inorg. Chem. 16, 1977 (1977)

BGMN76+ Baranovski, I. B., Golubnichaya, M. A., Mazo, G. Ya., Nefedov, V. I., Salyn, Ya. V., Shehelokov, R. N., Zh. Neorg. Khim. 21, 1085 (1976)

BaGa80 Bates, C. W., and Galan, L. E., Proe. Ninth Imeko Symposium On Photon Deteetors, Budapest, Hungary, 9–12 Sept. (1980), Pages 100–129

CDFM82 Capeee, F. M., Dieastro, V., Furlani, C., Mattogno, G., Fragale, C., Gargano, M., and Rossi, M., J. Eleetron Spectrosc. Relat. Phenom. 27, 119 (1982)

CGGM81 Cheung, N. W., Grunthaner, P. J., Grunthaner, F. J., Mayer, J. W., and Ullrieh, B. M. J. Vae. Sei. Teehnol. 18, 917 (1981)

CSFG79 Contour, J. P., Salesse, A., Froment, M., Garreau, M., Thevenin, J., and Warin, D., J. Mierose. Speetrose. Electron. 4, 483 (1979)

FDBS82 Farrow, R. F. C., Dennis, P. N. J., Bishop, H. E., Smart, N. R., Wotherspoon, J. T. M., Thin Solid Films 88, 87 (1982)

FMPB81 Furlani, C., Mattogno, G., Polzonetti, G., Barbieri, R., Rivarola, E., Silvestri, A., Inorg. Chim. Aeta 52, 23 (1981)

FMUK77 Franzen, H. F., Merriek, J., Umana, M., Khan, A. S., Peterson, D. T., MeCreary, J. R., Thorn, R. J., J. Eleetron Speetrosc. Relat. Phenom. 11, 439 (1977)

GGVL79 Grunthaner, F. J., Grunthaner, P. J., Vasquez, R. P., Lewis, B. F., Maserjian, J., and Madhukar, A. J. Vae. Sei. Technol. 16, 1443 (1979)

GHHL70 Gelius, U., Heden, P. F., Hedman, J., Lindberg, B. J., Manne, R., Nordberg, R., Nordling, C., and Siegbahn, K., Phys. Ser. 2, 70 (1970)

HBBK72 Hedman, J., Baer, Y., Berndtsson, A., Klasson, M., Leonhardt, G., Nilsson, R., and Nordling, C. J. Eleetron Speetrose. Relat. Phenom. 1, 101 (1972)

HKMP74+ Hollinger, G., Kumurdjian, P., Maekowski, J. M., Pertosa, P., Porte, L., Duc, Tran Minh, J. Eleetron Speetrose. Relat. Phenom. 5, 237 (1974)

HKNN71 Hedman, J., Klasson, M., Nilsson, R., Nordling, C., Sorokina, M. F., Kljushnikov, O. I., Nemnonov, S. A., Trapeznikov, V. A., Zyranov, V. G., Phys. Ser. 4, 195 (1971)

HaEd72 Hayes, R. G., Edelstein, N., "Eleetron Speetroseopy", D. A. Shirley, Editor, North-Holland, Publishing Company, London, 1972, P. 771

KBHN74 Klasson, M., Berndtsson, A., Hedman, J., Nilsson, R., Nyholm, R., and Nordling, C., J. Eleetron Speetrose. Relat. Phenom. 3, 427 (1974)

KGBP83 Kasztelan, S., Grimblot, J., Bonnelle, J. P., Payen, E., Toulhoat, H., Jaequin, Y., Appl. Catal. 7, 91 (1983)

KJID81 Kazmerski, L. L., Jamjoum, O., Ireland, P. J., Deb, S. K., Mickelsen, R. A., and Chen, W. J. Vac. Sei. Teehnol. 19, 467 (1981)

KNNH68 Karlsson, S. -E., Norberg, C. H., Nilsson, O., Hogberg, S., El-Farrash, A. H., Nordling, C., Siegbahn, K., Arkiv Fur Fysik 38, 349 (1968)

KrWu72 Krause, M. O., Wuilleumier, F., "Eleetron Speetroscopy", D. A. Shirley, Editor, North-Holland Publishing Company, London, 1972

LHJG70+ Lindberg, B. J., Hamrin, K., Johansson, G., Gelius, U., Fahlmann, A., Nordling, C., Siegbahn, K., Phys. Ser. 1, 286 (1970)

LMSL83 Lindberg, B., Maripuu, R., Siegbahn, K., Larsson, R., Golander, C -G., Erikkson, J. C., J. Coll. Interface Sci. 95, 308 (1983)

MMSB77 Martensson, N., Malmquist, P. A., Svensson, S., Basilier, E., Pireaux, J. J., Gelius, U., Siegbahn, K., Nouveau J. Chim. 1, 191 (1977)

MWLF78+ Moses, P. R., Wier, L. M., Lennox, J. C., Finklea, H. O., Lenhard, F. R., Murray, R. W., Anal. Chem. 50, 576 (1978)

NKBP73 Nefedov, V. I., Kokunov, Y. V., Buslaev, Y. A., Porai-koshits, M. A., Gustyakova, M. P., and Ilín, E. G., Zh. Neorg. Khim. 18, 931 (1973)

NMSI74 Nefedov, V. I., Molodkin, A. K., Salyn, Y. V., Ivanova, O. M., Porai-Koshits, M. A., Balakaeva, T. A., and Belyakova, Z. V., Zh. Neorg. Khim. 19, 2628 (1974)

NNBF68 Nilsson, O., Norberg, C. H., Bergmark, J. E., Fahlman, A., Nordling, C., Siegbahn, K., Helv. Phys. Aeta 41, 1064 (1968)

NPBS74+ Nefedov, V. I., Prokoféva, I. V., Bukanova, A. E., Shuboehkin,, L. K., Salyn, Y. V., Pershin, V. L., Zh. Neorg. Khim. 19, 1578 (1974)

NSKB73+ Nefedov, V. I., Schubochkina, E. F., Kolomnikov, I. S., Baranovskii, I. B., Kukolev, V. P., Golubniehaya, M. A., Schubochkin, L. K., Porai-Koshits, M. A., and Volṕin, M. E., Zh. Neorg. Khim. 18, 845 (1973)

NSMS79 Nefedov, V. I., Salyn, Y. V., Moiseev, I. I., Sadovskii, A. P., Berenbljum, A. S., K Nizhnik, A. G., Mund, S. L., Inorg. Chim. Aeta 35, L343 (1979)

NZMP73+ Nefedov, V. I., Zakharova, I. A., Moiseev, I. I., Porai-koshits, M. A., Vargoftik, M. N., Belov, A. P., Zh. Neorg. Khim. 18, 3264 (1973)

PMDS77 Pireaux, J. J., Martensson, N., Didriksson, R., Siegbahn, K., Riga, J., Verbist, J., Chem. Phys. Lett. 46, 215 (1977)

PRCV77+ Pireaux, J. J., Riga, J., Caudano, R., Verbist, J. J., Delhalle, J., Delhalle, S., Andre, J. M., Gobillon, Y., Phys. Scr. 16, 329 (1977)

PVVA79 Pessa, M., Vuoristo, A., Vulli, M., Aksela, S., Vayrynen, J., Rantala, T., Aksela, H., Phys. Rev. B 20, 3115 (1979)

RSKC82 Rogers, J. D., Sundaram, V. S., Kleiman, G. G., Castro, C. G. C., Douglas, R. A., and Peterlevitz, A. C. J. Phys. F. 12, 2097 (1982)

SBDL83 Schuhl, Y., Baussart, H., Delobel, R., Le Bras, M., Leroy, J., Gengembre, L., G Rimblot, J., J. Chem. Soc. Faraday Trans. I 79, 2055 (1983)

SMBM76 Svensson, S., Martensson, N., Basilier, E., Malmqvist, P. A., Gelius, U., Siegbahn, K., J. Electron Spectrosc. Relat. Phenom. 9, 51 (1976)

SNS 58 Siegbahn, K., Nordling, C., Sokolowski, E., Proc. Rehovoth Conf. Nuel. Struet., Pp. 291, Sept. 8–14, 1957, Lipkin, H. J., Ed, North-Holland Pub. Co., Amsterdam, (1958)

SZNS77+ Salyn, J. V., Zumadilov, E. K., Nefedov, V. I., Seheibe, R., Leonhardt, G., Beyer, L., Hoyer, E., Z. Anorg. Allg. Chem. 432, A275, (1977)

TSSS83 Taniguehi, M., Suga, S., Seki, M., Sakamoto, H., Kanzaki, H., Akahama, Y., Terada, S., Endo, S., Narita, S., Solid State Common. 45, 59 (1983)

VVSW77+ Van De Vondel, D. F., Van Der Kelen, G. P., Sehmidbaur, H., Wolleben, A., Wagner, F. E., Phys. Scr. 16, 364 (1977)

WPHK82+ Wagner, C. D., Passoja, D. E., Hillery, H. F., Kinisky, T. G., Six, H. A., Jansen, W. T., and Taylor, J. A., J. Vac. Sci. Technol. 21, 933 (1982)

WRDM79 Wagner, C. D., Riggs, W. M., Davis, L. E., Moulder, J. F., and Muilenberg, G. E., "Handbook Of X-Ray Photoelectron Speetroseopy", Perkin-Elmer Corporation, Physieal Electronics Division, Eden Prairie, Minn., 55344, 1979

Wagn77 Wagner, C. D., Chapter 7 In "Handbook Of X-Ray and Ultraviolet Photoeleetron Speetroscopy", D. Briggs, Editor, Heyden and Sons, London (1977)

YNAB77 Yatsimirskii, K. B., Nemoshalenko, V. V., Aleshin, V. G., Bratushko, Y. I., Moiseenko, E. P., Chem. Phys. Lett. 52, 481 (1977)

YNNA74+ Yatsimirskii, K. B., Nemoshalenko, V. V., Nazarenko, Y. P., Aleshin, V. G., Zhilinskaya, V. V., Taldenko, Y. D., Dokl. Akad. Nauk SSSR (Phys. Chem.) 217 835 (1974)

YNNA77+ Yatsimirskii, K. B., Nemoshkalenko, V. V., Nazarenko, Y. P., Aleshin, V. G., Zhilinskaya, V. V., Tomashevsky, N. A., J. Electron Spectrosc. Relat. Phenom. 10, 239 (1977)

ZSTM81+ Zakharova, I. A., Salyn, Ya. V., Tatjanenko, L. V., Mashkovsky, Yu. Sh., Ponticelli, G., J. Inorg. Biochem. 15, 89 (1981)

Appendix B. References

ABN 78 Allred, A. L., Bradley, C., and Newman, T. H., J. Am. Chem. Soc. 100, 5081 (1978)

ACHT73+ Allen, G. C., Curtis, M. T., Hooper, A. J., Tucker, P. M., J. Chem. Soc. Dalton Trans. 1973, 1677

ACHT74 Allen, G. C., Curtis, M. T., Hooper, A. J., Tucker, P. M., J. Chem. Soc. Dalton Trans. 1974, 1525

ACW 81 Andrews, P. T., Collins, T., and Weightman, P., J. Phys. C. 14, L957 (1981)

ADPS77 Ansell, R. O., Dickinson, T., Povey, A. F., Sherwood, P. M. A., J. Electron Spectrosc. Relat. Phenom. 11, 301 (1977)

ALMP82 Anderson, C. R., Lee, R. N., Morar, J. F., and Park, R. L., J. Vac. Sci. Technol. 20, 617 (1982)

AMFL74 Armour, A. W., Mitchell, P. C. H., Folkesson, B., Larsson, R., J. Less Common Metals 36, 361 (1974)

AMZG82+ Andreocci, M. V., Mattogno, G., Zanoni, R., Giannoccaro, P., Vasapollo, G., Inorg. Chem. Acta 63, 225 (1982)

ATBB72+ Adams, I., Thomas, J. M., Bancroft, G. M., Butler, K. D., Barber, M., J. Chem. Soc. Chem. Commun. 1972, 751

ATW 78 Allen, G. C., Tucker, P. M., and Wild, R. K., J. Chem. Soc. Faraday Trans. II 74, 1126 (1978)

AWH 81 Andersson, S. L. T., Watters, K. L., and Howe, R. F., J. Catal. 69, 212 (1981)

AWL 80 Atzrodt, V., Wirth, T., and Lange, H., Phys. Status Solidi (A) 62, 531 (1980)

Akse71 Aksela, S., Z. Physik. 244, 268 (1971)

AlTu73 Allen, G. C., Tucker, P. M., J. Chem. Soc. Dalton Trans. 1973, 470

AlTu76+ Allen, G. C., Tucker, P. M., Inorg. Chim. Acta 16, 41 (1976)

AnLa77+ Andersson, C., Larsson, R., Chem. Scr. 11, 140 (1977)

AnSc79 Andersson, S. L. T., Scurrell, M. S., J. Catal. 59, 340 (1979)

AnSc81 Andersson, S. L. T., Scurrell, M. S., J. Catal. 71, 233 (1981)

AnSe84 Anthony, M. T., Seah, M. P., Surf. Interface Anal. 6, 95 (1984)

AnSw74 Anderson, P. R., Swartz, W. E., Inorg. Chem. 13, 2293 (1974)

Aoki76 Aoki, A., Jpn. J. Appl. Phys. 15, 305 (1976)

ArWa83 Armstrong, J. E., Walton, R. A., Inorg. Chem. 22, 1545 (1983)

Asam76 Asami, K., J. Electron Spectrosc. Relat. Phenom. 9, 469 (1976)

BALS76+ Bancroft, G. M., Adams, I., Lampe, H., Sham, T. K., J. Electron Spectrosc. Relat. Phenom. 9, 191 (1976)

BANM81+ Bohmann, O., Ahlberg, P., Nyholm, R., Martensson, N., Siegbahn, K., Lehn, J. M., Chem. Scr. 18, 44 (1981)

BBB 79+ Brant, P., Benner, L. S., and Balch, A. L., Inorg. Chem. 18, 3422 (1979)

BBG 79 Barlow, S. M., Bayat-Mokhtari, P. and Gallon, T. E., J. Phys. C. 12, 5577 (1979)

BBHF79 Bianconi, A., Bachrach, R. Z., Hagstrom, S. B. M., Flodstrom, S. A., Phys. Rev. B 19, 2837 (1979)

BBLW78+ Barton, J. K., Best, S. A., Lippard, S. J., Walton, R. A., J. Am. Chem. Soc. 100, 3786 (1978)

BCDH73 Barber, M., Connor, J. A., Derrick, L. M. R., Hall, M. B., Hillier, I. H., J. Chem. Soc. 1973, 560

BCGH72 Barber, M., Connor, J. A., Guest, M. F., Hall, M. B., Hillier, I. N., Meredith, W. N. E., Discuss. Faraday Soc. 54, 220 (1972)

BCGH73 Barber, M., Connor, J. A., Guest, M. F., Hillier, I. H., Schwarz, M., Stacey, M., J. Chem. Soc. Faraday Trans. II 69, 551 (1973)

BCH 75+ Birchall, T., Connor, J. A., and Hillier, I. H., J. Chem. Soc. Dalton Trans. 1975, 2003

BCHM72 Barber, M., Connor, J. A., Hillier, I. H., Meredith, W. N. E., J. Electron Spectrosc. Relat. Phenom. 1, 110 (1972)

BCKK73+ Briggs, D., Clark, D. T., Keable, H. R., Kilner, M., J. Chem. Soc. Dalton Trans. 1973, 2144

BCM 78 Barbaray, B., Contour, J. P., and Mouvier, G., Env. Sci. Technol. 12, 1294 (1978)

BCPB81+ Bancroft, G. M., Chan, T., Puddenphatt, R. J., Brown, M. P., Inorg. Chim. Acta 53, L119 (1981)

BDFP81 Battistoni, C., Dormann, J. L. Fiorani, D., Paparazzo, E., Viticoli, S., Solid State Commun. 39, 581 (1981)

BDH 74 Barrie, A., Drummond, I. W., and Herd, Q. C., J. Electron Spectrosc. Relat. Phenom. 5, 217 (1974)

BEB 76+ Brant, P., Enemark, J. H., and Balch, A. L., J. Organometal. Chem. 114, 99 (1976)

BFCB83 Barr, T. L., Fries, C. G., Cariati, F., Bart, J. C. J., Giordano, N., J. Chem. Soc. Dalton Trans. (1983) 1825

BFHL83 Bennett, P. A., Fuggle, J. C., Hillebrecht, F. U., Lenselink, A., Sawatzky, G. A., Phys. Rev. B 27, 2194 (1983)

BFVB74+ Burger, K., Fluck, E., Varhelyi, C., Binder, H., Speyer, I., Z. Anorg. Allg. Chem. 408, 304 (1974)

BGD 75 Bonnelle, J. P., Grimblot, J., and D'huysser, A., J. Electron Spectrosc. Relat. Phenom. 7, 151 (1975)

BGPW81+ Brisdon, B. J., Griffin, G. F., Pierce, J., Walton, R. A., J. Organometal. Chem. 219, 53 (1981)

BHHK70 Baer, Y., Heden, P. F., Hedman, J., Klasson, M., Nordling, C., Siegbahn, K., Phys. Scr. 1, 55 (1970)

BHMS81+ Boehland, H., Hanay, W., Meisel, A., Scheibe, R., Z. Chem. 10, 372 (1981)

BHS 80 Breeze, P. A., Hartnagel, H. L., and Sherwood, P. M. A., J. Electrochem. Soc. 127, 454 (1980)

BHU 81 Broclawik, E., Haber, J., and Ungier, L., J. Phys. Chem. Solids 42, 203 (1981)

BJP 79	Baker, J. M., Johnson, R. W., and Pollak, R. A., J. Vac. Sci. Technol. 16, 1534 (1979)
BKSS81	Beyer, L., Kirmse, R., Stach, J., Szargan, R., Hoyer, E., Z. Anorg. Allg. Chem. 476, 7 (1981)
BMCK77+	Battistoni, C., Mattogno, G., Cariati, F., Kaldini, L., Sgamellotti, A., Inorg. Chim. Acta 24, 207 (1977)
BMM 84+	Battistoni, C., Mattogno, G., and Mingos, D. M. P., Inorg. Chim. Acta 86, L39 (1984)
BMW 80+	Brisdon, B. J., Mialki, W. S., and Walton, R. A., J. Organometal. Chem. 187, 341 (1980)
BMZN82	Battistoni, C., Mattogno, G., Zanoni, R., Naldini, L., J. Electron Spectrosc. Relat. Phenom. 28, 23 (1982)
BNMN79	Berndsson, A., Nyholm, R., Martensson, N., Nilsson, R., Hedman, J., Phys. Status Solidi (B) 93, K103 (1979)
BNSA70	Blackburn, J. R., Nordberg, C. R., Stevic, F., Albridge, R. G., Jones, M. M., Inorg. Chem. 9, 2374 (1970)
BOA 80	Baer, Y., Ott, H. R., and Andres, K., Solid State Commun. 36, 387 (1980)
BPDN83+	Battistoni, C., Paparazzo, E., Dumond, Y., Nogues, M., Solid State Commun. 46, 333 (1983)
BSRR81	Bhide, V. G., Salkalachen, S., Rastogi, A. C., Rao, C. N. R., and Hegde, M. S. J. Phys. D. 14, 1647 (1981)
BTE 77	Burger, K., Tschismarov, F., and Ebel, H., J. Electron Spectrosc. Relat. Phenom. 10, 461 (1977)
BVK 83	Brabers, V. A. M., Van Setten, F. M., and Knapen, P. S. A., J. Solid State Chem. 49, 93 (1983)
BVWW80	Bates, C. W., Van Attekum, P. M. T. M., Werthcim, G. K., West, K. W., Buchanan, D. N. E. Phys. Rev. B 22, 3968 (1980)
BWI 77	Bahl, M. K., Watson, R. L., and Irgolic, K. J., J. Chem. Phys. 66, 5526 (1977)
BWI 78	Bahl, M. K., Watson, R. L., and Irgolic, K. J., J. Chem. Phys. 68, 3272 (1978)
BWI 79	Bahl, M. K., Watson, R. L., and Irgolic, K. J., Phys. Rev. Lett. 42, 165 (1979)
BWI 80	Bahl, M. K., Watson, R. L., and Irgolic, K. J., J. Chem. Phys. 72, 4069 (1980)
BWWI76+	Bahl, M. K., Woodall, R. O., Watson, R. L., and Irgolic, K. J., J. Chem. Phys. 64, 1210 (1976)
BaSa84	Baba, Y., Sasaki, T. A., Surf. Interface Anal. 6, 171 (1984)
BaSt75	Barrie, A., and Street, F. J., J. Electron Spectrosc. Relat. Phenom. 7, 1 (1977)
BaWa77	Bahl, M. K., and Watson, R. L., J. Electron Spectrosc. Relat. Phenom. 10, 111 (1977)
Bahl75	Bahl, M. K., J. Phys. Chem. Solids 36, 485 (1975)
Barr83	Barr, T. L. Appl. Surf. Sci. 15, 1 (1983)
BcFl80	Bertrand, P. A., and Fleischauer, P. D. J. Vac. Sci. Technol. 17, 1309 (1980)

BeMc85 Beers, W. W., McCarley, R. E.,
Inorg. Chem. 24, 472 (1985)

BeWa79 Best, S. A., Walton, R. A.
Inorg. Chem. 18, 486 (1979)

Bert81 Bertrand, P. A.
J. Vac. Sci. Technol. 18, 28 (1981)

BiPo73 Biloen, P., Pott, G. T.,
J. Catal. 30, 169 (1973)

BiSw80 Bird, R. J., and Swift, P.,
J. Electron Spectrosc. Relat. Phenom. 21, 227 (1980)

Bind73+ Binder, H.,
Z. Naturforsch. B 28, 256 (1973)

BrFc76+ Brant, P., Feltham, R. D.,
J. Organometal. Chem. 120, C53 (1976)

BrFe80+ Brant, P., Feltham, R. D.,
Inorg. Chem. 19, 2673 (1980)

BrFc83+ Brant, P., Feltham, R. D.,
J. Electron Spectrosc. Relat. Phenom. 32, 205 (1983)

BrFr74 Brand, P., and Freiser, H.,
Anal. Chem. 46, 1147 (1974)

BrMc72 Brinen, J. S., McClure, J. E.,
Anal. Lett. 5, 737 (1972)

BrWh78 Brainard, W. A., and Wheeler, D. R.
J. Vac. Sci. Technol. 15, 1801 (1978)

Brio80 Brion, D.,
Appl. Surf. Sci. 5, 133 (1980)

BuBu74+ Burger, K., Buvari, A.,
Inorg. Chim. Acta 11, 25 (1974)

BuSw82 Burns, F. C., Swalen, J. D.,
J. Phys. Chem. 86, 5123 (1982)

Burk79 Burkstrand, J. M.
J. Vac. Sci. Technol. 16, 363 (1979)

CAB 71+ Clark, D. T., Adams, D. B., and Briggs, D.,
J. Chem. Soc. Chem. Commun. 1971, 603

CBA 73+ Clark, D. T., Briggs, D., and Adams, D. B.,
J. Chem. Soc. Dalton Trans. 1973, 169

CBR 76 Chuang, T. J., Brundle, C. R., and Rice, D. W.,
Surf. Sci. 59, 413 (1976)

CCC 73+ Cheng, K. L., Carver, J. C., and Carlson, T. A.,
Inorg. Chem. 12, 1702 (1973)

CCHB81 Courteix, D., Chayrouse, J., Heintz, L., Baptist, R.,
Solid State Commun. 39, 209 (1981)

CCT 83 Chuang, T. J., Coufal, H., and Traeger, F.,
J. Vac. Sci. Technol. A 1, 1236 (1983)

CDGV80 Cimino, A., De Angelis, B. A., Gazzoli, D., Valigi, M.,
Z. Anorg. Allg. Chem. 460, 86 (1980)

CDH 74+ Connor, J. A., Derrick, L. M. R., and Hillier, I. H.,
J. Chem. Soc. Faraday Trans. II 70, 941 (1974)

CDN 77 Carlson, T. A., Dress, W. B., and Nyberg, G. L.,
Phys. Scr. 16, 211 (1977)

CEHL75+	Chatt, J., Elson, C. M., Hooper, N. E., Leigh, G. J., J. Chem. Soc. Dalton Trans. 1975, 2392
CELC76+	Chatt, J., Elson, C. M., Leigh, G. J., Connor, J. A., J. Chem. Soc. Dalton Trans. 1976, 1352
CFKM73	Clark, D. T., Feast, W. J., Kilcast, D., Musgrave, W. K. R., J. Polym. Sci. Polym. Chem. Ed. 11, 389 (1973)
CFRS80	Clark, D. T., Fok, T., Roberts, G. G., Sykes, R. W., Thin Solid Films 70, 261 (1980)
CFTT80	Clark, D. T., Feast, W. J., Tweedale, P. J., Thomas, H. R., J. Polym. Sci. Polym. Chem. Ed. 18, 1651 (1980)
CGR 78	Colton, R. J., Guzman, A. M., and Rabalais, J. W., J. Appl. Phys. 49, 409 (1978)
CHW 76	Castle, J. E., Hazell, L. B., and Whitehead, R. D., J. Electron Spectrosc. Relat. Phenom. 9, 247 (1976)
CHW 79	Castle, J. E., Hazell, L. B., and West, R. H., J. Electron Spectrosc. Relat. Phenom. 16, 97 (1979)
CKAM72+	Clark, D. T., Kilcast, D., Adams, D. B., Musgrave, W. K. R., J. Electron Spectrosc. Relat. Phenom. 1, 232 (1972)
CKAM75+	Clark, D. T., Kilcast, D., Adams, D. B., Musgrave, W. K. R. J. Electron Spectrosc. Relat. Phenom. 6, 117 (1975)
CKLN78	Copperthwaite, R. G., Kunze, O. A., Lloyd, J., Neely, J. A., Tuma, W., Z. Naturforsch. 33A, 523 (1978)
CKM 71	Clark, D. T., Kilcast, D., and Musgrave, W. K. R., J. Chem. Soc. Chem. Commun. 1971, 517
CLSW83	Christie, A. B., Lee, J., Sutherland, I., and Walls, J. M., Appl. Surf. Sci. 15, 224(1983)
CMHL77	Contour, J. P., Mouvier, G., Hoogewijs, M., Leclere, C., J. Catal. 48, 217 (1977)
CSC 72	Carver, J. C., Schweitzer, G. K., and Carlson, T. A., J. Chem. Phys. 57, 973 (1972)
CWH 82+	Carvalho, M., Wieserman, L. F., and Hercules, D. M., Appl. Spectrosc. 36, 290 (1982)
CWRG72	Cohen, R. L., Wertheim, G. K., Rosencwaig, A., Guggenheim, H. J., Phys. Rev. B 5, 1037 (1972)
CWRL77+	Clark, D. T., Woolsey, I. S., Robinson, S. D., Laing, K. R., Wingfield, J. N., Inorg. Chem. 16, 1201 (1977)
CaLe73	Cahen, D., Lester, J. E., Chem. Phys. Lett. 18, 109 (1973)
CaRo78	Carley, A. F., Roberts, M. W. Proc. R. Soc. London Ser. A 363, 403 (1978)
CaWe79	Castle, J. E., and West, R. H., J. Electron Spectrosc. Relat. Phenom. 16, 195 (1979)
CaWe80	Castle, J. E., and West, R. H., J. Electron Spectrosc. Relat. Phenom. 18, 355 (1980)
ChGr72	Chadwick, D., Graham, J. Nature (london) Phys. Sci. 237, 127 (1972)
ChHa79	Chadwick, D., Hashemi, T., Surf. Sci. 89, 649 (1979)
Chad73	Chadwick, D. Chem. Phys. Lett. 21, 293 (1973)

CiDe75 Cimino, A., De Angelis, B. A.,
J. Catal. 36, 11 (1975)

CiHa74 Citrin, P. H., Hamann, D. R.,
Phys. Rev. B 10, 4948 (1974)

Citr73 Citrin, P. H.,
Phys. Rev. B 8, 8 (1973)

ClAd71 Clark, D. T., Adams, I.,
J. Chem. Soc. Chem. Commun. 1971, 741

ClRi76 Clarke, T. A., Rizkalla, E. N.,
Chem. Phys. Lett. 37, 523 (1976)

ClTh76+ Clark, D. T., Thomas, H. R.,
J. Polym. Sci. Polym. Chem. Ed. 14, 1701 (1976)

ClTh78 Clark, D. T., Thomas, H. R.,
J. Polym. Sci. Polym. Chem. Ed. 16, 791 (1978)

CoHe72 Cox, L. E., Hercules, D. M.,
J. Electron Spectrosc. Relat. Phenom. 1, 193 (1972)

CoMa83 Corbett, J. D., Marek, H. S.,
Inorg. Chem. 22, 3194 (1983)

CoRa76 Colton, R. J., Rabalais, J. W.,
Inorg. Chem. 15, 237 (1976)

Conn78 Conner, G. R.,
J. Vac. Sci. Technol. 15, 343 (1978)

DAEC79 Dolle, P., Alnot, M., Ehrhardt, J. J., Cassuto, A.,
J. Electron Spectrosc. Relat. Phenom. 17, 299 (1979)

DHKB80 Dennis, A. M., Howard, R. A., Kadish, K. M., Bean, J. L., Brace, J., Winograd, N.,
Inorg. Chim. Acta 44, L139 (1980)

DKMB76 Dufour, G., Karnatak, R. D., Mariot, J. -M., Bonnelle, C.,
Chem. Phys. Lett. 42, 433 (1976)

DML 84 Datta, M., Mathieu, H. J., and Landolt, D.,
Appl. Surf. Sci. 18, 299 (1984)

DMNK76 Dufour, G., Mariot, J. M., Nilsson-Jatko, P. E., and Karnatak, R. C.,
Phys. Scr. 13, 370 (1976)

DPS 76 Dickinson, T., Povey, A. F., and Sherwood, P. M. A.,
J. Chem. Soc. Faraday Trans. I 72, 686 (1976)

DPS 77 Dickinson, T., Povey, A. F., and Sherwood, P. M. A.,
J. Chem. Soc. Faraday Trans. I 73, 332 (1977)

DSBG82 Dharmadhikari, V. S., Sainkar, S. R., Badrinarayan, S., Goswami, A.,
J. Electron Spectrosc. Relat. Phenom. 25, 181 (1982)

Dale76 Dale, A. J.,
Phosphorus 6, 81 (1976)

DeRa77 Debies, T. P., Rabalais, J. W.,
Chem. Phys. 20, 277 (1977)

DeRo84 Derry, G. N., Ross, P. N.,
Solid State Commun. 52, 151 (1984)

DiCl81+ Dilks, A., Clark, D. T.,
J. Polym. Sci. Polym. Chem. Ed. 19, 2847 (1981)

DiTa74+ Dillard, J. G., Taylor, L. T.,
J. Electron Spectrosc. Relat. Phenom. 3, 455 (1974

Dilk81 Dilks, A.,
J. Polym. Sci. Polym. Chem. Ed. 19, 1319 (1981)

EHKT80	Ertl, G., Hierl, R., Knozinger, H., Thiele, N., Urbach, H. P., Appl. Surf. Sci. 5, 49 (1980)
EMGK74+	Escard, J., Mavel, G., Guerchais, J. E., Kergoat, R., Inorg. Chem. 13, 695 (1974)
EPC 75	Escard, J., Pontvianne, B., and Contour, J. P., J. Electron Spectrosc. Relat. Phenom. 6, 17 (1975)
EPCC75	Escard, J., Pontvianne, B., Chenebaux, M. T., Cosyns, J., Bull. Soc. Chim. Fr. 1975, 2400
EUMW80+	Edwards, D. A., Uden, G., Mialki, W. S., Walton, R. A., Inorg. Chim. Acta 40, 25 (1980)
EbSi79	Ebbinghaus, G., Simon, A., Chem. Phys. 43, 117 (1979)
EbWa75+	Ebner, J. R., Walton, R. A., Inorg. Chem. 14, 2289 (1975)
EgPa84	Egert, B., Panzner, G., Phys. Rev. B 29, 2091 (1984)
ErWa75	Ertl, G., Wandelt, K., Surf. Sci. 50, 479 (1975)
EvRe81	Everhart, D. S., and Reillcy, C. N. Surf. Interface Anal. 3, 258 (1981)
Evan85	Evans, S., Surf. Interface Anal. 7, 299 (1985)
FBWF74	Fuggle, J. C., Burr, A. F., Watson, L. M., Fabian, D. J., Lang, W., J. Phys. F. 4, 335 (1974)
FCFG77	Fontaine, R., Caillat, R., Feve, L., Guittet, M. J., J. Electron Spectrosc. Relat. Phenom. 10, 349 (1977)
FEMY77	Fisher, G. B., Erikson, N. E., Madey, T. E., Yates, J. T., Surf. Sci. 65, 210 (1977)
FHPW73	Friedman, R. M., Hudis, J., Perlman, M. L., Watson, R. E., Phys. Rev. B 8, 2434 (1973)
FHR 80	Fukuda, Y., Honda, F., and Rabalais, J. W., Surf. Sci. 93, 335 (1980)
FHT 77+	Freeland, B. H., Habeeb, J. J., and Tuck, D. G., Can. J. Chem. 55, 1528 (1977)
FHV 75	Fiermans, L., Hoogewijs, R., and Vennik, J., Surf. Sci. 63, 390 (1975)
FKWF77	Fuggle, J. C., Kallne, E., Watson, L. M., and Fabian, D. J., Phys. Rev. B 16, 750 (1977)
FMI 74+	Frost, D. C., McDowell, C. A., and Ishitani, A., Mol. Phys. 27, 1473 (1974)
FMPB83	Furlani, C., Mattogno, G., Polzonetti, G., Braca, G., Valentini, G., Inorg. Chem. Acta 69, 199 (1983)
FMSM75	Fuggle, J. C., Madey, T. E., Steinkilberg, M., Menzel, D., Surf. Sci. 52, 521 (1975)
FMW 72	Frost, D. S., McDowell, C. A., and Woolsey, I. S., Chem. Phys. Lett. 17, 320 (1972)
FPPT83+	Furlani, C., Polzonetti, G., Preti, C., Tosi, G., Inorg. Chim. Acta 73, 105 (1983)
FSJL83+	Folkesson, B., Sundberg, P., Johansson, L., Larsson, R., J. Electron Spectrosc. Relat. Phenom. 32, 248 (1983)

FSL 85	Fierro, J. L. G., Salazar, E., and Legarreta, J. A., Surf. Interface Anal. 7, 97 (1985)
FSM 82	Fellenberg, R., Streubel, P., and Meisel, A., Phys. Status Solidi (B) 112, 55 (1982)
FUMT76	Franzen, H. F., Umana, M. X., McCreary, J. R., Thorn, R. J., J. Solid State Chem. 18, 363 (1976)
FWFA75	Fuggle, J. C., Watson, L. M., Fabian, D. J., and Affrossman, S., J. Phys. F. 5, 375 (1975)
FWUM79+	Fischer, A. B., Wrighton, M. S., Umana, M., Murray, R. W., J. Am. Chem. Soc. 101, 3442 (1979)
FaBa79+	Fahey, D. R., Baldwin, B. A., Inorg. Chim. Acta 36, 269 (1979)
FaGo77	Fan, J. C. C., Goodenough, J. B., J. Appl. Phys. 48, 3524 (1977)
FiJo72+	Finn, P., Jolly, W. L., Inorg. Chem. 11, 1435 (1972)
FlMa82	Fleisch, T. H., and Mains, G. J., Appl. Surf. Sci. 10, 51 (1982)
FlMa82a	Fleisch, T. H., Mains, G. J., J. Chem. Phys. 76, 780 (1982)
FlWe75+	Fluck, E., Weber, D., Z Anorg. Allg. Chem. 412, 47 (1975)
FoLa82+	Folkesson, B., Larsson, R., J. Electron Spectrosc. Relat. Phenom. 26, 157 (1982)
Folk73+	Folkesson, B., Acta Chem. Scand. 27, 287 (1973)
FrSa75	Franzen, H. F., Sawatzky, G., J. Solid State Chem. 15, 229 (1975)
FuOs84	Fujimori, A., Osterwalder, J., J. Phys. C. 17, 2869 (1984)
FuSc84	Fujimori, A., Schlapbach, L., J. Phys. C. 17, 341 (1984)
Fugg77	Fuggle, J. C., Surf. Sci. 69, 581 (1977)
GBMP79+	Grimblot, J., Bonnelle, J. P., Mortreux, A., Petit, F., Inorg. Chim. Acta 34, 29 (1979)
GBP 81	Garbassi, F., Bart, J. C. J., and Petrini, G., J. Electron Spectrosc. Relat. Phenom. 22, 95 (1981)
GCH 76+	Gray, R. C., Carver, J. C., and Hercules, D. M., J. Electron Spectrosc. Relat. Phenom. 8, 343 (1976)
GFWA77	Gimzewski, J. K., Fabian, D. J., Watson, L. M., Affrossman, S., J. Phys. F. 7, L305 (1977)
GGM 80	Grunthaner, P. J., Grunthaner, F. J., and Mayer, J. W., J. Vac. Sci. Technol. 17, 924 (1980)
GGM 82	Grunthaner, P. J., Grunthaner, F. J., and Madhukar, A. J. Vac. Sci. Technol. 20, 680 (1982)
GHSS80	Gorlich, E., Haber, J., Stoch, A., Stoch, J., J. Solid State Chem. 33, 121 (1980)
GMD 79	Gresch, R., Mueller-Warmuth, W., and Dutz, H. J. Non-Cryst. Solids 34, 127 (1979)

GMS 74+ Grim, S. O., Matienzo, L. J., and Swartz, W. E., Inorg. Chem. 13, 447 (1974)

GPDG79 Gajardo, P., Pirotte, D., Defosse, C., Grange, P., Delmon, B., J. Electron Spectrosc. Relat. Phenom. 17, 121 (1979)

GSM 75 Ginnard, C. R., Swingle, R. S., and Monroe, B. M., J. Electron Spectrosc. Relat. Phenom. 6, 77 (1975)

GSMJ74 Groenenboom, C. J., Sawatzky, G., Meijer, H. J. D., Jellinek, F., J. Organometal. Chem. 76, C4 (1974)

GZF 73+ Grutsch, P. A., Zeller, M. V., and Fehlner, T. P., Inorg. Chem. 12, 1432 (1973)

GaWi77 Gaarenstroom, S. W., and Winograd, N., J. Chem. Phys. 67, 3500 (1977)

GlWa79+ Glicksman, H. D., Walton, R. A., Inorg. Chim. Acta 33, 255 (1979)

GrHe77+ Gray, R. C., Hercules, D. M., Inorg. Chem. 16, 1426 (1977)

GrMa75+ Grim, S. O., Matienzo, L. J., Inorg. Chem. 14, 1014 (1975)

HAS 75 Halder, H. C., Alonso, J., and Swartz, W. E., Z. Naturforsch A 30, 1485 (1975)

HAS 76 Halder, H. C., Alonso, J., and Swartz, W. E., Phys. Rev. B 13, 2418 (1976)

HBBF77 Hagstrom, S. B. M., Bachrach, R. Z., Bauer, R. S., Flodstrom, S. A., Phys. Scr. 16, 414 (1977)

HCMS74 Hillig, H., Cleff, B., Mehlhorn, W., Schmitz, W., Z. Physik 268, 225 (1974)

HFBZ82 Hillebrecht, F. U., Fuggle, J. C., Bennett, P. A., Zolnierek, Z. Phys. Rev. B 27, 2179 (1982)

HFS 82 Henry, R. M., Fryberger, T. A. B., and Stair, P. C., J. Vac. Sci. Technol. 20, 818 (1982)

HFV 77 Hoogewijs, R., Fiermans, L., and Vennik, J., J. Electron Spectrosc. Relat. Phenom. 11, 171 (1977)

HGW 75 Hammond, J. S., Gaarenstroom, S. W., and N. Winograd Anal. Chem. 47, 2194 (1975)

HHDD81 Hammond, J. S., Holubka, J. W., Devries, J. E., Duckie, R. A., Corros. Sci. 21, 239 (1981)

HHJ 69+ Hendrickson, D. N., Hollander, J. M., and Jolly, W. L., Inorg. Chem. 8, 2642 (1969)

HHJ 70+ Hendrickson, D. N., Hollander, J. M., and Jolly, W. L. Inorg. Chem. 9, 612 (1970)

HHL 70 Hagstrom, S. B. M., Heden, P. O., and Lofgren, H., Solid State Commun. 8, 1245 (1970)

HJGN70 Hamrin, K., Johansson, G., Gelius, U., Nordling, C., Siegbahn, K., Phys. Scr. 1, 277 (1970)

HKNU78 Haycock, D. E., Kasrai, M., Nicholls, C. J., Urch, D. S., J. Chem. Soc. Dalton Trans. 1978, 1791

HLHM79 Hilaire, L., Legare, P., Holl, Y., and Maire, G., Solid State Commun. 32, 157 (1979)

HMUZ78 Haber, J., Machej, T., Ungier, L., and Ziolkowski, J., J. Solid State Chem. 25, 207 (1978)

HNUW78	Haycock, D. E., Nicholls, C. J., Urch, D. S., Webber, M. J., Wieeh, G., J. Chem. Soe. Dalton Trans. 1978, 1785
HSBS81	Hegde, R. I., Sainkar, S. R., Badrinarayanan, S., Sinha, A. P. B., J. Eleetron Speetrose. Relat. Phenom. 24, 19 (1981)
HSGH81+	Horvath, B., Strutz, J., Geyer-Lippmann, J., Horvath, E. G., Z. Anorg. Allg. Chem. 483, 181 (1981)
HSPB78	Hsu, S. L., Signorelli, A. J., Pey, G. P., Baughman, R. H., J. Chem. Phys. 69, 106 (1978)
HSU 76+	Haber, J., Stoeh, J., and Ungier, L., J. Eleetron Speetrose. Relat. Phenom. 9, 459 (1976)
HTW 73+	Hoof, D. L., Tisley, D. G., and Walton, R. A., J. Chem. Soe. Dalton Trans. 1973, 201
HTW 74+	Hamer, A. D., Tisley. D. G., and Walton, R. A., J. Inorg. Nuel. Chem. 36, 1771 (1974)
HUGH79	Haycock, D., Urch, D. S., Garner, C. D., Hillier, I. H., J. Electron Spectrose. Relat. Phenom. 17, 345 (1979)
HVV 79	Hoste, S., Van De Vondel, D. F., and Van Der Kelen, G. P., J. Eleetron Spectrosc. Relat. Phenom. 17, 191 (1979)
HWVV74	Hoste, S., Willeman, H., Van De Vondel, D., Van Der Kelen, G. P., J. Eleetron Speetrosc. Relat. Phenom. 5, 227 (1974)
HWW 75	Hufner, S., Wertheim, G. K., and Werniek, J. H., Solid State Commun. 17, 417 (1975)
HaSh73+	Harker, H., Sherwood, P. M. A., Phil. Mag. 27, 1241 (1973)
HaUn77	Haber, J., and Ungier, L, J. Eleetron Spectrose. Relat. Phenom. 12, 305 (1977)
HaWa74+	Hamer, A. D., Walton, R. A., Inorg. Chem. 13, 1446 (1974)
HaWi77	Hammond, J. S., Winograd, N., J. Eleetroehem. Eleetroanal. Chem. 78, 55 (1977)
HeMa80	Hedman, J., and Martensson, N., Phys. Ser. 22, 176 (1980)
HeSi83	Hegde, R. I., Sinha, A. P. B., Surf. Sci. 133, 233 (1983)
HeWi80	Hewitt, R. W., Winograd, N., J. Appl. Phys. 51, 2620 (1980)
Hegd82	Hegde, R. I., Surf. Interface Anal. 4, 205 (1982)
HoTh79	Howng, W. Y., Thorn, R. J., Chem. Phys. Lett. 62, 57 (1979)
HoTh80	Howng, W. Y., Thorn, R. J., J. Chem. Phys. Solids 41, 75 (1980)
Holl81	Hollinger, G., Appl. Surf. Sci. 8, 318 (1981)
HuBa74	Hughes, W. B., Baldwin, B. A., Inorg. Chem. 13, 1531 (1974)
HuRa81	Hu, H. -K., Rabalais, J. W., Surf. Sei. 1o7, 376 (1981)
IIKK76	Ikemoto, I., Ishii, K., Kinoshita, S., Kuroda, H., Franco, M. A. A., Thomas, J. M. J., Solid State Chem. 17, 425 (1976)

IKIM73	Ihara, H., Kumashiro, Y., Itoh, A., Maeda, K., Jpn. J. Appl. Phys. 12, 1462 (1973)
IKYK82+	Ikemoto, I., Kikuchi, K., Yakushi, K., Kuroda, H., Solid State Commun. 42, 257 (1982)
IMNN79	Iwasaki, H., Mizokawa, Y., Nishitani, R., Nakamura, S., Surf. Sci. 86, 811 (1979)
ITI 82	Iwakuro, H., Tatsuyama, C., and Ichimura, S., Jpn. J. Appl. Phys. 21, 94 (1982)
InYa81	Inoue, Y., Yasumori, I., Bull. Chem. Soc. Jpn. 54, 1505 (1981)
IwOg79	Iwasawa, Y., Ogasawara, S., J. Chem. Soc. Faraday Trans. I 75, 1465 (1979)
JHBK73	Johansson, G., Hedman, J., Berndtsson, A., Klasson, M., and Nilsson, R., J. Electron Spectrosc. Relat. Phenom. 2, 295 (1973)
JJH 80	Joyner, D. J., Johnson, O., and Hercules, D. M., J. Am. Chem. Soc. 102, 1910 (1980)
JWHD84	Jennison, D. R., Weightman, P., Hannah, P., Davies, M., J. Phys. C. 17, 3701 (1984)
JoBe75	Jorgenson, C. K., and Berthou, H., Chem. Phys. Lett. 36, 432 (1975)
JoHc80	Joyner, D. J., Hercules, D. M., J. Chem. Phys. 72, 1095 (1980)
KAKM78	Kowalczyk, S. P., Apai, G., Kaindl, G., McFeely, F. R., Ley, K., Shirley, D. A., Solid State Commun. 25, 847 (1978)
KBAM72	Kumar, G., Blackburn, J. R., Albridge, R. G., Moddeman, W. E., Jones, M. M., Inorg. Chem. 11, 296 (1972)
KBAW74	Kim, K. S., Baitinger, W. E., Amy, J. W., Winograd, N., J. Electron Spectrosc. Relat. Phenom. 5, 351 (1974)
KDR 77	Krishnan, N. G., Delgass, W. N., and Robertson, W. D., J. Phys. F. 7, 2623 (1977)
KEML74	Kowalczyk, S. P., Edelstein, N., McFeely, F. R., Ley, L., Shirley, D. A., Chem. Phys. Lett. 29, 491 (1974)
KGW 74	Kim, K. S., Gossmann, A. F., and Winograd, N., Anal. Chem. 46, 197 (1974)
KGW 76	Kim, K. S., Gaarenstroom, S. W., and Winograd, N., Chem. Phys. Lett. 41, 503 (1976)
KISC80	Kazmerski, L. L., Ireland, P. J. . Sheldon, P., Chu, T. L., Chu, S. S., and Lin, C. L. J., Vac. Sci. Technol. 17, 1061 (1980)
KKL 83	Kasperkiewicz, J., Kovacich, J. A., and Lichtman, D., J. Electron Spectrosc. Relat. Phenom. 32, 128 (1983)
KLMP73	Kowalczyk, S. P., Ley, L., McFeely, F. R., Pollak, R. A., and Shirley, D. A., Phys. Rev. B 8, 3583 (1973)
KLMP74	Kowalczyk, S. P., Ley, L., McFeely, F. R., Pollak, R. A., and Shirley, D. A., Phys. Rev. B 9, 381 (1974)
KMH 78	Kerkhof, F. P. J., Moulijn, J. A., and Heeres, A., J. Electron Spectrosc. Relat. Phenom. 14, 453 (1978)
KMI 81	Kishi, K., Motoyoshi, Y., and Ikeda, S., Surf. Sci. 105, 313 (1981)
KNPP74	Kharitonova, L. C., Nefedov, V. I., Pankratova, L. N., Pershin, V. L., Zh. Neorg. Khim. 19, 860 (1974)

KOAL82 Khumalo, F. S., Olson, C. G., Anderegg, J. W., Lynch, D. W.,
Chem. Phys. 65, 289 (1982)

KOK 83 Kohiki, S., Ohmura, T., and Kusao, K.
J. Electron Spectrosc. Relat. Phenom. 31, 85 (1983)

KOS 79 Kuroda, H., Ohta, T., and Sato, Y.,
J. Elcctron Spectrosc. Relat. Phenom. 15, 21 (1979)

KOW 73 Kim, K. S., O'Leary, T. J., and Winograd, N.
Anal. Chem. 45, 2214 (1973)

KPHB83 Klein, J. C., Proctor, A., Hercules, D. M., Black, J. F.,
Anal. Chem. 55, 2055 (1983)

KPLW80 Koel, B. E., Praline, G., Lee, H. I., White, J. M.,
J. Electron Spectrosc. Relat. Phenom. 21, 31 (1980)

KPML73 Kowalczyk, S. P., Pollak, R. A., McFeely, F. R., Ley, L., and Shirley, D. A.,
Phys. Rev. B 8, 2387 (1973)

KPSL83 Kcndclewicz, T., Petro, W. G., Silberman, J. A., Lindau, I., Spicer, W. E.,
J. Vac. Sci. Technol. B 1, 623 (1983)

KPW 80+ Kouba, J. K., Pierce, J. L., and Walton, R. A.,
J. Organometal. Chcm. 202, C105 (1980)

KSPB76+ Kaplunov, M. G., Shulga, Y. M., Pokhodnya, K. I., Borodko, Y. G.,
Phys. Status Solidi 73, 336 (1976)

KTWY76 Kinomura, F., Tamura, T., Watanabe, I., Yokoyama, Y., Ikcda, S.,
Bull. Chem. Soc. Jpn. 49, 3544 (1976)

KWBF77 Kurmaev, E. Z., Werfel, F., Brummer, O., Fluekiger, R.,
Solid Statc Commun. 22, 375 (1977)

KWD 71 Kim, K. S., Winograd, N., and Davis, R. E.,
J. Am. Chem. Soc. 93, 6296 (1971)

KaEl79 Katrib, A., El-Egaby, M. S.,
Inorg. Chim. Acta 36, L405 (1979)

KaUr79 Kasrai, M., Urch, D. S.,
J. Chcm. Soc. Faraday Trans. II 75, 1522 (1979)

KaWi76+ Karwcik, D. H., Winograd, N.,
Inorg. Chem. 15, 2336 (1976)

KeKl76 Keiser, J., Klcber, R,
Appl. Phys. 9, 315 (1976)

KiIk73+ Kishi, K., Ikeda, S.
Bull. Chem. Soc. Jpn. 46, 341 (1973)

KiIk74 Kishi, K., Ikeda, S.,
J. Phys. Chcm. 78, 107 (1974)

KiWi73 Kim, K. S., Winograd, N.,
Chem. Phys. Lett. 19, 209 (1973)

KiWi74 Kim, K. S., Winograd, N.,
J. Catal. 35, 66 (1974)

KiWi74a Kim, K. S., Winograd, N.,
Surf. Sci. 43, 625 (1974)

KiWi75+ Kim, K. S., Winograd, N.,
Chem. Phys. Lett. 30, 91 (1975)

Kim 75 Kim, K. S.,
Phys. Rev. B 11, 2177 (1975)

KlHc83 Klein, J. C., Hercules, D. M.,
J. Catal. 82, 424 (1983)

KoGr85	Koenig, M. F., Grant, J. T., Appl. Surf. Sci. 20, 481 (1985)
KoNa80	Konno, H., Nagayama, M., J. Electron Spectrosc. Relat. Phenom. 18, 341 (1980)
LAK 77	Lin, A. W. C., Armstrong, N. R., and Kuwana, T., Anal. Chem. 49, 1228 (1977)
LANM81	Lebugle, A., Axelsson, U., Nyholm, R., and Martensson, N. Phys. Scr. 23, 825 (1981)
LBHK73	Leonhardt, G., Berndtsson, A., Hedman, J., Klasson, M., Nilsson, R., Phys. Status Solidi (B) 60, 241 (1973)
LBNN78+	Lindberg, B., Berndtsson, A., Nilsson, R., Nyholm, R., Exner, O., Acta Chem. Scand. A 32, 353 (1978)
LDDB80	Lerebours, B., Duerr, J., D'huisser, A., Bonnelle, J. P., Leuglet, M., Phys. Status Solidi (A) 61, K175 (1980)
LFBC80	Lasser, R., Fuggle, J. C., Beyss, M., Campagna, M., Steglich, F., Hulliger, F., Physica 102b, 360 (1980)
LFS 73+	Larsson, R., Folkesson, B., and Schoen, G., Chem. Scr. 3, 88 (1973)
LFWS79	Lorenz, P., Finster, J., Wendt, G., Salyn, J. V., Zumadilov, E. K., Nefedov, V. I. J. Electron Spectrosc. Relat. Phenom. 16, 267 (1979)
LKMP73	Ley, L., Kowalczyk, S. P., McFeely, F. R., Pollak, R. A., Shirley, D. A., Phys. Rev. B 8, 2392 (1973)
LMF 80	Larsson, R., Malek, A., and Folkesson, B., Chem. Scr. 16, 47 (1980)
LMKJ75	Ley, L., McFeely, F. R., Kowalczyk, S. P., Jenkin, J. G., and Shirley, D. A., Phys. Rev. B 11, 600 (1975)
LPGC77	Lindau, I., Pianetta, P., Garner, C. M., Chye, P. E., Gregory, P. E., Spicer, W. E., Surf. Sci. 63, 45 (1977)
LPKS72	Ley, L., Pollak, R., Kowalczyk, S., Shirley, D. A., Phys. Letters 41A, 429 (1972)
LPMK74	Ley, L., Pollak, R. A., McFeely, F. R., Kowalczyk, S. P., Shirley, D. A., Phys. Rev. B 9, 600 (1974)
LPWF75	Lang, W. C., Padalia, B. D., Watson, L. M., Fabian, D. J., J. Electron Spectrosc. Relat. Phenom. 7, 357 (1975)
LPWF76	Lang, W., Padalia, B., Watson, L., Fabian, D., Norris, P., Discuss. Faraday Soc. 60, 36 (1976)
LPYS76	Lindau, I., Pianetta, P., Yu, K. Y., Spicer, W. E., Phys. Rev. B 16, 492 (1976)
LRLH82	Lampert, W. V., Rachocki, K. D., Lamartine, B. C., Haas, T. W., J. Electron Spectrosc. Relat. Phenom. 26, 133 (1982)
LRSW73	Lindsay, J. R., Rose, H. J., Swartz, W. E., Watts, P. H., Rayburn, K. A., Appl. Spectrosc. 27, 1 (1973)
LaFo76	Larsson, R., Folkesson, B., Chem. Scr. 9, 148 (1976)
LaHa81	Larson, D. T., Haschke, J. M., Inorg. Chem. 20, 1945 (1981)
LaKe76	Lavielle, L., Kessler, H., J. Electron Spectrosc. Relat. Phenom. 8, 95 (1976)
LaLu79	Larkins, F. P., and Lubenfeld, A. J. Electron Spectrosc. Relat. Phenom. 15, 137 (1979)

LaMa84 Landis, W. J., Martin, J. R.,
J. Vac. Sci. Technol. A 2, 1108 (1984)

LaRo84 Latta, E. E., Ronay, M.,
Phys. Rev. Lett. 53, 948 (1984)

LaVe70 Langer, D. W., and Vesely, C. J.,
Phys. Rev. B 2, 4885 (1970)

Lars74 Larson, P.,
J. Electron Spectrosc. Relat. Phenom. 4, 213 (1974)

LeBr72+ Leigh, G. J., Bremser, W.,
J. Chem. Soc. Dalton Trans. 1972, 1217

LeRa77 Lee, T. H., Rabalais, J. W.,
J. Electron Spectrosc. Relat. Phenom. 11, 123 (1977)

LiHe75+ Lindberg, B. J., Hedman, J.,
Chem. Scr. 7, 155 (1975)

LlMa79+ Llopiz, P., Maire, J. -C.,
Bull. Soc. Chim. Fr. 1979, 457

MBDS84 Mandale, A. B., Badrinarayanan, S., Date, S. K., Sinha, A. P. B.,
J. Electron Spectrosc. Relat. Phenom. 33, 61 (1984)

MBN 80 Martensson, N., Berndtsson, A., and Nyholm, R.,
J. Electron Spectrosc. Relat. Phenom. 19, 299 (1980)

MCSS82 McLean, W., Colmenares, C. A., Smith, R. L., Somorjai, G. A.
Phys. Rev. B 25, 8 (1982)

MCSS83 McLean, W., Colmenares, C. A., Smith, R. L., Somorjai, G. A.,
J. Phys. Chem. 87, 788 (1983)

MECC73+ Mavel, G., Escard, J., Costa, P., Castaing, J.,
Surf. Sci. 35, 109 (1973)

MFA 85 Myers, C. E., Franzen, H. F., and Anderegg, J. W.,
Inorg. Chem. 24, 1822 (1985)

MHD 81 Mariot, J-M., Hague, C. F., and Dufour, G.,
Phys. Rev. B 3164 (1981)

MIN 81 Mizokawa, Y., Iwasaki, H., and Nakamura, S.,
Jpn. J. Appl. Phys. 20, L491 (1981)

MINN78 Mizokawa, Y., Iwasaki, H., Nishitani, R., and Nakamura, S.,
J. Electron Spectrosc. Relat. Phenom. 14, 129 (1978)

MKLP73 McFeely, F. R., Kowalczyk, S. P., Ley, L., Pollak, R. A., Shirley, D. A.,
Phys. Rev. B 7, 5228 (1973)

MMRC72+ Mason, R., Mingos, D. M. P., Rucci, G., Connor, J. A.,
J. Chem. Soc. Dalton Trans. 1972, 1730

MNTB70 Malmsten, G., Nilsson, O., Thoren, I., Bergmark, J. E.,
Phys. Scr. 1, 37 (1970)

MRV 82 Martensson, N., Reihl, B., and Vogt, O.,
Phys. Rev. B 25, 824 (1982)

MRV 83 Mousty-Desbuquoit, C., Riga, J., and Verbist, J. J.,
J. Chem. Phys. 79, 26 (1983)

MSAV71+ Morgan, W. E., Stec, W. J., Albridge, R. G., Van Wazer, J. R.,
Inorg. Chem. 10, 926 (1971)

MSC 73 McGuire, G. E., Schweitzer, G. Kk., and Carlson, T. A.,
Inorg. Chem. 12, 2451 (1973)

MSG 72 Matienzo, L. J., Swartz, W. E., and Grim, S. O.,
Inorg. Nucl. Chem. Lett. 8, 1087 (1972)

MSSS81	McIntyre, N. S., Sunder, S., Shoesmith, D. W., and Stanchell, F. W., J. Vac. Sci. Technol. 18, 714 (1981)
MSV 73	Morgan, W. E., Stec, W. J., and Van Wazer, J. R., Inorg. Chem. 12, 953 (1973)
MSV 79+	Maroie, S., Savy, M., and Verbist, J. J., Inorg. Chem. 18, 2560 (1979)
MTHB71+	Malmsten, G., Thoren, I., Hogberg, S., Bergmark, J. E., Karlsson, S. E., Phys. Scr. 3, 96 (1971)
MTT 84+	Miyake, I., Tanpo, T., and Tatsuyama, C., Jpn. J. Appl. Phys. 23, 172 (1984)
MVDN78	Mazalov, L. N., Volkov, B. B., Dvurechensky, S. Y., Nasonova, L. I., Zh. Neorg. Khim. 23, 1860 (1978)
MVS 73	Morgan, W. E., Van Wazer, J. R., and Stec, W. J., J. Am. Chem. Soc. 95, 751 (1973)
MWI 75	Murata, M., Wakino, K., and Ikeda, S., J. Electron Spectrosc. Relat. Phenom. 6, 459 (1975)
MWM 77	McGilp, J. F., Weightman, P., and McGuire, E. J., J. Phys. C. 10, 3445 (1977)
MYGS73+	Matienzo, L. J., Yin, L. I., Grim, S. O., Swartz, W. E., Inorg. Chem. 12, 2762 (1973)
MaDu77	Mariot, J. M., and Dufour, G., Chem. Phys. Lett. 50, 219 (1977)
MaDu78	Mariot, J. M., and Dufour, G., J. Electron Spectrosc. Relat. Phenom. 13, 403 (1978)
MaWo75+	Matsuura, I., Wolfs, M. W. J., J. Catal. 37, 174 (1975)
McCo75	McIntyre, N. S. and Cook, M. G. Anal. Chem. 47, 2208 (1975)
McGi82	McEvoy, A. J., Gissler, W., Phys. Status Solidi (A) 69, K91 (1982)
McTh76	McCreary, J. R., Thorne, R. J., J. Electron Spectrosc. Relat. Phenom. 8, 425 (1976)
McWe76	McGilp, J. F., Weightman, P. J. Phys. C. 9, 3541 (1977)
McZe77	McIntyre, N. S., Zetaruk, D. G. Anal. Chem. 49, 1521 (1977)
MiLa73+	Mixan, C. E., Lambert, J. B., J. Org. Chem. 38, 1351 (1973)
MiMi84	Mielczarski, J., Minni, E., Surf. Interface Anal. 6, 221 (1984)
MoVa73	Morgan, W. E., Van Wazer, J. R. J. Phys. Chem. 77, 96 (1973)
MuTh80	Murch, G. E., Thorn, R. J., J. Phys. Chem. Solids 41, 785 (1980)
NBK 74	Nefedov, V. I., Buslaev, Y. A., and Kokunov, Y. V., Zh. Neorg. Khim. 19, 1166 (1974)
NBKY74	Nefedov, V. I., Buslaev, Kuznetsova, A. A., Yankina, L. F., Zh. Neorg. Khim. 19, 1416 (1974)
NBM 80	Nyholm, R., Berndtsson, A., and Martensson, N., J. Phys. 13, L1091 (1980)

NBMO73+	Nefedov, V. I., Baranovskii, I. B., Molodkin, A. K., Omuralieva, V. O., Zh. Neorg. Khim. 18, 1295 (1973)
NFM 81	Nakagaki, R., Frost, D. C., and McDowell, C. A. J. Electron Spectrosc. Relat. Phenom. 22, 289 (1981)
NFS 82+	Nefedov, V. I., Firsov, M. N., and Shaplygin, I. S., J. Electron Spectrosc. Relat. Phenom. 26, 65 (1982)
NGDS75	Nefedov, V. I., Gati, D., Dzhurinskii, B. F., Sergushin, N. P., Salyn, Y. V., Zh. Neorg. Khim. 20, 2307 (1975)
NIMN78	Nishitani, R., Iwasaki, H., Mizokawa, Y., Nakamura, S., Jpn. J. Appl. Phys. 17, 321 (1978)
NIS 72	Nagakura, I., Ishii, T., and Sagawa, T., J. Phys. Soc. Japan 33, 758 (1972)
NSBM80+	Nefedov, V. I., Salyn, Y. V., Baranovski, I. B., Majorova, A. G., Zh. Neorg. Khim. 25, 216 (1980)
NSBN77+	Nefedov, V. I., Salyn, Y. V., Baronovskii, I. B., Nikolskii, A. B., Zh. Neorg. Khim. 22, 1715 (1977)
NSCP74	Nefedov, V. I., Salyn, Y. V., Chertkov, A. A., Padurets, L. N., Zh. Neorg. Khim. 19, 1443 (1974)
NSDU75	Nefedov, V. I., Salyn, Y. V., Domashevskaya, E. P., Ugai, Y. A., Terekhov, V. A., J. Electron Spectrosc. Relat. Phenom. 6, 231 (1975)
NSK 79	Nefedov, V. I., Salyn, Y. V., and Keller, X., Zh. Neorg. Khim. 24, 2564 (1979)
NSLS77	Nefedov, V. I., Salyn, Y. V., Leonhardt, G., Scheibe, R., J. Electron Spectrosc. Relat. Phenom. 10, 121 (1977)
NSMN74+	Nefedov, V. I., Salyn, Y. V., Majorova, A. G., Nazarova, L. A., Baranovski, I. B., Zh. Neorg. Khim. 19, 1353 (1974)
NSNN78+	Nakai, I., Sugitani, Y., Nagashima, K., Niwa, Y., J. Inorg. Nucl. Chem. 40, 789 (1978)
NSSK80+	Nefedov, V. I., Salyn, Y. V. Shtemenko, A. V., Kotelnikova, A. S., Inorg. Chim. Acta 45, L49 (1980)
NSSP80	Nefedov, V. I., Salyn, Y. V., Solozhenkin, P. M., Pulatov, G. Y. Surf. Interface Anal. 2, 171 (1980)
NSWM80+	Nefedov, V. I., Salyn, Y. V., Walther, B., Messbauer, B., Schoeps, R., Inorg. Chim. Acta 45, L103 (1980)
NSWU77+	Nefedov, V. I., Salin, J. V., Walther, D., Uhlig, E., Dinjus, E., Z. Chem. 17, 191 (1977)
NZB 78+	Nefedov, V. I., Zhumadilov, E. K., and Baer, L., Zh. Neorg. Khim. 23, 2113 (1978)
NZK 77	Nefedov, V. I., Zhumadilov, A. K., and Konitova, T. Y., J. Struct. Chem. Ussr 18, 692 (1977)
NcBa72+	Nefedov, V. I., Baranovskii, I. B. Zh. Neorg. Khim. 17, 466 (1972)
NcPo72+	Nefedov, V. I., Porai-Koshits, M. A., Mater. Res. Bull. 7, 1543 (1972)
NcSa78	Nefedov., V. I., Salyn, Y. V., Inorg. Chim. Acta 28, L135 (1978)
Ncfe78+	Nefedov, V. I., Koord. Khim. 4, 1285 (1978)
Ncfc82	Nefedov, V. I. J. Electron Spectrosc. Relat. Phenom. 25, 29 (1982)

NgHe74+	Ng, K. T., Hercules, D. M., J. Am. Chem. Soc. 97, 4169 (1974)
NgHe76	Ng, K. T., Hercules, D. M., J. Phys. Chem. 80, 2095 (1976)
NoGe72	Novakov, T., Geballe, T. H., Solid State Commun. 10, 225 (1972)
NyMa80	Nyholm, R., and Martensson, N. J. Phys. C. 13, L279 (1980)
NyMa81	Nyholm, R., Martensson, N., Solid State Commun. 40, 311 (1981)
OCH 79	Okamoto, Y., Carter, W. J., and Hercules, D. M., Appl. Spectrosc. 33, 287 (1979)
OGB 80	Ohyoshi, A., Goetzfried, F., and Beck, W., Chem. Lett. 1980, 1537
OHDH81	Oscarson, D. W., Huang, P. M., Defosse, C., and Herbillon, A. Nature 291, 50 (1981)
OHI 75+	Oku, M., Hirokawa, K., and Ikeda, S., J. Electron Spectrosc. Relat. Phenom. 7, 465 (1975)
OIIT79	Okamoto, Y., Ishida, N., Imanaka, T., Teranishi, S., J. Catal. 58, 82 (1979)
OIT 80	Okomoto, Y., Imanaka, T., and Teranishi, S., J. Catal. 65, 448 (1980)
OYK 74+	Ohta, T., Yamada, M., and Kuroda, H., Bull. Chem. Soc. Jpn. 47, 1158 (1974)
OkHi76	Oku, M., Hirokawa, K., J. Electron Spectrosc. Relat. Phenom. 8, 475 (1976)
PADS78	Povey, A. F., Anscll, R. O., Dickinson, T., Sherwood, P. M. A., J. Electroanal. Chem. 87, 189 (1978)
PCLH76	Patterson, T. A., Carver, J. C., Leyden, D. E., Hercules, D. M., J. Phys. Chem. 80, 1702 (1976)
PEJ 82	Powell, C. J., Erickson, N. E., and Jach, T., J. Vac. Sci. Technol. 20, 625 (1981)
PFD 73	Pignataro, S., Foffani, A., and Distefano, G., Chem. Phys. Lett. 20, 351 (1973)
PHHJ70+	Pelavin, M., Hendrickson, D., Hollander, J., Jolly, W., J. Phys. Chem. 74, 1116 (1970)
PHM 78+	Peeling, J., Hruska, F. E., McIntyre, N. S., Can. J. Chem. 56, 1555 (1978)
PHMC78+	Peeling, J., Hruska, F., McKinnon, D. M., Chauhan, M. S., McIntyre, N. S. Can. J. Chem. 56, 2407 (1978)
PJHK77	Platau, A., Johansson, L. I., Hagstrom, A. L., Karlsson, S. E., Hagstrom, S. B. M., Surf. Sci. 63, 153 (1977)
PKHL80	Praline, G., Koel, B. E., Hance, R. L., Lee, H. I., White, J. M., J. Electron Spectrosc. Relat. Phenom. 21, 17 (1980)
PKLJ73	Poole, R. T., Kemeny, P. C., Liesegang, J., Jenkins, J. G., Leckey, R. C. G., J. Phys. F. 3, L46 (1973)
PKLS72	Pollak, R. A., Kowalczyk, S. P., Ley, L., Shirley, D. A., Phys. Rev. Lett. 29, 274 (1972)
PLJL73	Poole, R. T., Leckey, R. C. G., Jenkin, J. G., Liesegang, J., Phys. Rev. B 8, 1401, (1973)

PLNW77	Paladia, B. D., Lang, W. C., Norris, P. R., Watson, L. M., Fabian, P. J., Proc. Roy. Soc. Ser. A 354, 269 (1977)
PNSS74+	Petrukhin, O. M., Nefedov, V. I., Salyn, Y. V., Shevchenko, V. N. Zh. Neorg. Khim. 19, 1418 (1974)
PWA 79	Parry-Jones, A. C., Weightman, P., and Andrews, P. T., J. Phys. C. 12, 1587 (1979)
PcKa77	Peterson, L. G., Karlsson, S. E., Phys. Scr. 16, 425 (1977)
Pede82	Pederson, L. R., J. Electron Spectrosc. Relat. Phenom. 28, 203 (1982)
PiLu72	Pignataro, S., Lunazzi, L. Tetrahedron Lett. 52, 5341 (1972)
Pola82	Polak, M., J. Electron Spectrosc. Relat. Phenom. 28, 171 (1982)
RBO 72	Robert, T., Bartel, M., and Offergeld, G., Surf. Sci. 33, 123 (1972)
RGBH80	Ryzhkov, M. V., Gubanov, V. A., Butzman, M. P., Hagstrom, A. L., Kurmaev, E. Z., J. Electron Spectrosc. Relat. Phenom. 21, 193 (1980)
RHJF69	Ramqvist, L., Hamrin, K., Johansson, G., Fahlman, A., and Nordling, C., J. Phys. Chem. Solids 30, 1835, (1969)
RJBB76	Reisfeld, R., Jorgenson, C. K., Bornstein, A., and Berthou, H., Chimia 30, 451 (1976)
RLAT79	Riley, J. D., Ley, L., Azouley, J., Terahura, K., Phys. Rev. B 20, 776 (1979)
RLRL83	Rosenberg, R. A., Laroe, P. R., Rehn, V., Loubriel, G. M., Thornton, G., Phys. Rev. B 28, 6083 (1983)
RMBR85	Roche, A., Montes, H., Brissot, J., Romand, M., Josseaux, P., De Mesmaekcr, A. K., Appl. Surf. Sci. 21, 12 (1985)
RNS 73	Rosolovskii, V. Y., Nefedov, V. I., and Sinelńikov, S. M., Izv. Akad. Nauk Sssr, Ser. Khim. 7, 1445 (1973)
RRD 78	Romand, R., Roubin, M., and Deloume, J. P., J. Electron Spectrosc. Relat. Phenom. 13, 229 (1978)
RRD 78a	Romand, R., Roubin, M., and Deloume, J-P., J. Solid State Chem. 25, 59 (1978)
RSVH79+	Rao, C. N. R., Sarma, D. D., Vasudevan, S., Hegde, M. S., Proc. R. Soc. London Ser. A 367, 239 (1979)
RVJK85	Riga, J., Verbist, J. J., Josseaux, P., Mesmaeker, A. K., Surf. Interface Anal. 7, 163 (1985)
RVWK78	Riga, J., Verbist, J. J., Wudl, F., Kruger, A., J. Chem. Phys. 69, 3221 (1978)
RWJ 75	Roberts, E. D., Weightman, P., and Johnson, C. E., J. Phys. C. 8, 1301 (1975)
RWW 84	Ricco, A. J., White, H. S., and Wrighton, M. S., J. Vac. Sci. Technol. A 2, 910 (1984)
Ravc79	Raven, M. S., Surf. Interface Anal. 1, 20 (1979)
RiVe83+	Riga, R., Verbist, J. J., J. Chem. Soc. Perkin Trans. II 1983, 1545
Rigg72+	Riggs, W. M., Anal. Chem. 44, 830 (1972)

RoOf72	Robert, T., and Offergeld, G. Phys. Status Solidi (A) 14, 277 (1972)
RoRo76	Romand, M., Roubin, M., Analusis 4, 309 (1976)
SATD73	Seals, R. D., Alexander, R., Taylor, L. T., Dillard, J. G., Inorg. Chem. 12, 2486 (1973)
SBB 80	Sun, T. S., Buchner, S. P., and Byer, N. E. J. Vac. Sci. Technol. 17, 1067 (1980)
SBG 85	Setiawan, L. D., Baumann, H., and Gribbin, D., Surf. Interface Anal. 7, 188 (1985)
SCKK75+	Saethre, L. J., Carlson, T. A., Kaufman, J. J., Koski, W. S., Molec. Pharm. 11, 492 (1975)
SCT 73	Shevchik, N. J., Cardona, M., and Tejeda, J., Phys. Rev. B 8, 2833 (1973)
SDIO77	Sharma, J., Downs, D. S., Iqbal, Z., Owens, F. J., J. Chem. Phys. 67, 3045 (1977)
SDR 80	Shalvoy, R. B., Davis, B. H., and Reucroft, P. J., Surf. Interface Anal. 2, 12 (1980)
SFM 80	Seifert, G., Finster, J., and Mueller, H., Chem. Phys. Lett. 75, 373 (1980)
SFR 84	Streubel, P., Fellenberg, R., and Reif, A., J. Electron Spectros. Relat. Phemon. 34, 261 (1984)
SFS 77	Shalvoy, R. B., Fisher, G. B., and Stiles, P. J., Phys. Rev. B 15, 1680 (1977)
SGCT74+	Swartz, W. E., Gray, R. C., Carver, J. C., Taylor, R. C., Hercules, D. M., Spectrochim Acta A 30, 1561 (1974)
SGKS79	Schwartz, G. P., Gualtieri, G. J., Kammlott, G. W., Schwartz, B., J. Electrochem. Soc. 126, 1737 (1979)
SGOV82	Sharma, J., Garrett, W. L., Owens, F. J., Vogel, V. L., J. Phys. Chem. 86, 1657 (1982)
SGRS72	Sharma, J., Gora, T., Rimstidt, J. D., and Staley, R., Chem. Phys. Lett. 15, 233 (1972)
SGSO70	Siegbahn, K., Gelius, U., Siegbahn, H., Olson, E., Phys. Scr. 1, 272 (1970)
SHH 78	Steiner, P., Hoechst, H., and Hufner, S., Z. Physik B 30, 129 (1978)
SHR 82	Sen, P., Hegde, M. S., and Rao, C. N., Appl. Surf. Sci. 10, 63 (1982)
SLCO83	Su, C. Y., Lindau, I., Chye, P. W., Oh, S. J., Spicer, W. E., J. Electron Spectrosc. Relat. Phenom. 31, 221 (1983)
SMAV72+	Stec, W. J., Morgan, W. E., Albridge, R. G., Van Wazer, J. R., Inorg. Chem. 11, 220 (1972)
SMS 80	Schreifels, J. A., Maybury, P. C., and Swartz, W. E., J. Catal. 65, 195 (1980)
SMSB81	Salvati, L., Makovsky, L. E., Stencel, J. M., Brown, F. R., Hercules, D. M., J. Phys. Chem. 85, 3700 (1981)
SNMK78+	Salyn, Y. V., Nefedov, V. I., Makarova, A. G., Kuznetsova, G. N., Zh. Neorg. Khim. 23, 829 (1978)
SNRS76+	Sergushin, N. N., Nefedov, V. I., Rozanov, I. A., Slovyanovski, N. B., Gracheva, N. V., Zh. Neorg. Khim. 21, 856 (1976)

SPB 76	Simon, D., Perrin, C., and Baillif, P., C. R. Acad. Sci. Ser. C 283, 241 (1976)
SPB 76a	Simon, D., Perrin, C., and Bardolle, J., J. Microsc. Spectrosc. Electron 1, 175 (1976)
SRD 79	Shalvoy, R. B., Reucroft, P. J., and Davis, B. H., J. Catal. 56, 336 (1979)
SRH 72	Swartz, W. E., Ruff, J. R., and Hercules, D. M., J. Am. Chem. Soc. 94, 5228 (1972)
SRHH78	Steiner, P., Reiter, F. J., Hocchst, H., Huefner, S., and Fuggle, J. C., Phys. Lett. 66A, 229 (1978)
SRHH78a	Steiner, P., Reiter, F. J., Hoechst, H., Huefner, S., and Fuggle, J. C., Phys. Status Solidi (B) 90, 45 (1978)
SRHR79+	Sarode, P. R., Rao, K. J., Hcgde, M. S., Rao, C. N. R., J. Phys. C. 12, 4119 (1979)
SSEW79+	Srinivasan, V., Stieffel, E. I., Elsberry, A., Walton, R. A., J. Am. Chem. Soc. 101, 2612 (1979)
SSHU83	Schulze, P. D., Shaffer, S. L., Hance, R. L., and Utley, D. L. J. Vac. Sci. Technol. A 1, 97 (1983)
SSOT81	Suzuki, K., Soma, M., Onishi, T., Tamaru, K., J. Electron Spectrosc. Relat. Phcnom. 24, 283 (1981)
STA 74+	Seno, M., Tsuchiya, S., and Asahara, T., Chem. Lett. 1974, 405
STAB76	Shulǵa, Y. M., Troitskii, V. N., Aivazov, M. I., Borodko, Y. G., Zh. Neorg. Khim. 21, 2621 (1976)
STHU76+	Seno, M., Tsuchiya, S., Hidai, M., Uchida, Y., Bull. Chem. Soc. Jpn. 49, 1184 (1976)
SWH 71	Swartz, W. E., Wynne, K. J., and Hercules, D. M., Anal. Chem. 43, 1884 (1971)
SaBa85	Sasaki, T. A., Baba, Y., Phys. Rev. B 31, 791 (1985)
SaPo79	Sawatzky, G. A., Post, D., Phys. Rev. B 20, 1546 (1979)
SaRa80	Sarma, D. D., Rao, C. N. R., J. Electron Spectrosc. Relat. Phenom. 20, 25 (1980)
ScBr81	Schaerli, M., and Brunner, J., Z. Phys. B 42, 285 (1981)
ScLa79	Schneider, W. D., Laubschat, C., Phys. Rev. B 20, 4416 (1979)
ScLa80	Schneider, W. D., Laubschat, C., Physica 102B, 111 (1980)
ScLa81	Schneider, W-D., Laubschat, C., Phys. Rev. B 23, 997 (1981)
ScOs82	Schlapbach, L., Osterwalder, J., Solid State Commun. 42, 271 (1982)
ScSc82	Schlapbach, L., Scherrer, H. R., Solid State Commun. 41, 893 (1982)
Scho72	Schoen, G. J. Electron Spectrosc. Relat. Phenom. 1, 377 (1972)
Scho73	Schoen, G., Acta Chem. Scand. 27, 2623 (1973)

Scho73a	Schoen, G., J. Electron Spectrosc. Relat. Phenom. 2, 75 (1973)
Scho73b	Schoen, G., Surf. Sci. 35, 96 (1973)
SeAv83	Sexton, B. A., Avery, N. R., Surf. Sci. 129, 21 (1983)
SeSo81	Seyama, H., Soma, M., Chem. Lett. 1981, 1009
SeTs76+	Seno, M., Tsuchiya, S., J. Electron Spectrosc. Relat. Phenom. 8, 165 (1976)
ShIq78	Sharma, J., Iqbal, Z., Chem. Phys. Lett. 56, 373 (1978)
ShRe79	Shalvoy, R. B., and Reucroft, P. J. J. Vac. Sci. Technol. 16, 567 (1979)
ShTr75	Shabanova, I. N., and Trapeznikov, V. A. J. Electron Spectrosc. Relat. Phenom. 6, 297 (1975)
Sher76	Sherwood, P. M. A., J. Chem. Soc. Faraday Trans. II 72, 1806 (1976)
Shut80	Shuttleworth, D., J. Phys. Chem. 84, 1629 (1980)
SiLe78	Sinharoy, S., Levenson, L. L., Thin Solid Films 53, 31 (1978)
SiWo80	Sinharoy, S., Wolfe, A. L., J. Electron Spectrosc. Relat. Phenom. 18, 369 (1980)
SlDe81	Slinkard, W. E., Degroot, P. B., J. Catal. 68, 423 (1981)
SlWi79	Slusser, G. J., Winograd, N., Surf. Sci. 84, 211 (1979)
SmBl84	Smith, K. L., Black, K. M., J. Vac. Sci. Technol. A 2, 744 (1984)
SmWa77+	Smith, T. J., Walton, R. A., J. Inorg. Nucl. Chem. 39, 1331 (1977)
SrWa77	Srinivasan, R., Walton, R. A. Inorg. Chim. Acta 25, L85 (1977)
StEd75	Stevens, G. C., Edmonds, T., J. Catal. 37, 544 (1975)
StHe84	Strohmeier, B. R., Hercules, D. M., J. Phys. Chem. 88, 4922 (1984)
StHo79	Steiner, P., Hoechst, H., Z. Phys. B 35, 51 (1979)
SuFa74	Su, C., Faller, J. W., Inorg. Chem. 13, 1734 (1974)
SwAl74+	Swartz, W. E., Alfonso, R. A., J. Electron Spectrosc. Relat. Phenom. 4, 351 (1974)
SwHe71+	Swartz, W. E., Hercules, D. M., Anal. Chem. 43, 1774 (1971)
Swif82	Swift, P., Surf. Interface Anal. 4, 47 (1982)
TBHH77+	Thomas, V. P., Beyer, L., Hennig, K., Hoyer, E., Nefedov, V. I., Zumadilov, E. K., Z. Anorg. Allg. Chem. 437, 299 (1977)

TBVL82	Thibaut, E., Boutique, J., Verbist, J. J., Levet, J. -C., Noel, H., J. Am. Chem. Soc. 104, 5266 (1982)
THC 83	Tobin, J. P., Hirschwald, W., and Cunningham, J., Appl. Surf. Sci. 16, 441 (1983)
TINK81+	Tsutsumi, T., Ikemoto, I., Namikawa, T., Kuroda, H., Bull. Chem. Soc. Jpn. 54, 913 (1981)
TIWB72	Thomas, J. M., Adams, I., Williams, R. H., Barber, M., J. Chem. Soc. Faraday Trans. II 68, 755 (1972)
TLIR78	Taylor, J. A., Lancaster, G. M., Ignatiev, A., Rabalais, J. W., J. Chem. Phys. 68, 1776 (1978)
TLR 78	Taylor, J. A., Lancaster, G. M., and Rabalais, J. W., J. Electron Spectrosc. Relat. Phenom. 13, 435 (1978)
TMR 80	Turner, N. H., Murday, J. S., and Ramaker, D. E., Anal. Chem. 52, 84 (1980)
TRLK73+	Tolman, C. A., Riggs, W. M., Linn, W. J., King, C. M., Wendt, R. C., Inorg. Chem. 12, 2772 (1973)
TSH 84	Takahashi, T., Sagawa, T., and Hamanoka, H., J. Non-Cryst. Solids 65, 261 (1984)
TSOT80	Takagi-Kawai, M., Soma, M., Onishi, T., Tamaru, K., Can. J. Chem. 58, 2132 (1980)
TVG 76	Teuret-Noel, C., Verbist, J., and Gobillon, Y., J. Microsc. Spectrosc. Electron 1, 255 (1976)
TaPc84	Taylor, J. A., Perry, D. L., J. Vac. Sci. Technol. A 2, 771 (1984)
TaRa81	Taylor, J. A., and Rabalais, J. W., J. Chem. Phys. 75, 1735 (1981)
Tapp82	Tapping, R. L., Inorg. Chem. 21, 1691 (1982)
Tayl78	Taylor, J. A., Appl. Surf. Sci. 1, 506 (1978)
Tayl81	Taylor, J. A., Appl. Surf. Sci. 7, 168 (1981)
Tayl82	Taylor, J. A., J. Vac. Sci. Technol. 20, 751 (1982)
TeLc79	Terzieff, P., Lee, K., J. Appl. Phys. 50, 3566 (1979)
ThSh78	Thomas, J. H., and Sharma, S. P. J. Vac. Sci. Technol. 15, 1707 (1978)
Thom81+	Thomas, P., Z. Anorg. Allg. Chem. 477, 144 (1981)
TrRi82	Trowbridge, L. D., and Richards, H. L., Surf. Interface Anal. 4, 89 (1982)
Tric74	Tricker, M. J., Inorg. Chem. 13, 743 (1974)
UBS 83+	Umapathy, P., Badrinaryanan, S., and Sinha, A. P. B. J. Electron Spectrosc. Relat. Phenom. 28, 261 (1983)
UIY 84	Uwamino, Y., Ishizuka, Y., and Yamatera, H., J. Electron Spectrosc. Relat. Phenom. 34, 69 (1984)
USK 80	Usami, K., Shimada, T., and Katayama, Y., Jpn. J. Appl. Phys. 19, L389 (1980)

UcOd81	Ueno, T., Odajima, A., Jpn. J. Appl. Phys. 20, L501 (1981)
UeOd82	Ueno, T., Odajima, A., Jpn. J. Appl. Phys. 21, 230 (1982)
Ueno83	Ueno, T., Japan J. Appl. Phys. 22, 1349(1983)
UmRe78	Umezawa, Y., Reilley, C. N., Anal. Chem. 50, 1294 (1978)
VHE 82	Van Der Veen, J. F., Himpsel, F. J., and Eastman, D. E. Phys. Rev. B 25, 7388 (1982)
VHVH80	Van Der Heide, H., Hemmel, R., Van Bruggen, C. F., Haas, C., J. Solid State Chem. 33, 17 (1980)
VLDH77	Veal, B. W., Lam, D. J., Diamond, H., Hoekstra, H. R., Phys. Rev. B 15, 2929 (1977)
VLG 83	Vasquez, R. P., Lewis, B. F., and Grunthaner, F. J., J. Vac. Sci. Technol. B 1, 791 (1983)
VRPC74	Verbist, J, Riga, J., Pireaux, J. J., Caudano, R., J. Electron Spectrosc. Relat. Phenom. 7, 193 (1974)
VVT 80+	Van Attekum, J. M. Th. M., Van Der Velden, J. W. A., and Trooster, J. M., Inorg. Chem. 19, 701 (1980)
VWHS81	Van Der Laan, G., Westra, C., Haas, C., and Sawatzky, G. A., Phys. Rev. B 23, 4369 (1981)
VWVB77	Van De Vondel, D. F., Wuyts, L. F., Van Der Kelen, G. P., Bevernage, L. J. Electron Spectrosc. Relat. Phenom. 10, 389 (1977)
VaGr81	Vasquez, R. P., Grunthaner, F. J. J. Appl. Phys. 52, 3509 (1981)
VaTr78	Van Attekum, P. M. Th. M., and Trooster, J. M., J. Phys. F. 8, L169 (1978)
VaTr78a	Van Attekum, P. M. Th. M., Trooster, J. M., Phys. Rev. B 18, 3872 (1978)
VaTr79	Van Attekum, P. M. Th. M., Trooster, J. M., Phys. Rev. B 20, 2335 (1979)
VaTr79a	Van Attekum, P. M. Th. M., Trooster, J. M., J. Phys. F. 9, 2287 (1979)
VaTr80	Van Attekum, P. M., Trooster, J. M., J. Electron Spectrosc. Relat. Phenom. 18, 1354 (1980)
VaVc80	Van Doveren, H., and Verhoeven, J. A. Th., J. Electron Spectrosc. Relat. Phenom. 21, 265 (1980)
VanO77	Van Ooij, W. J., Surface Technology 6, 1 (1977)
Vann76	Vannerberg, N. -G. Chem. Scr. 9, 122 (1976)
Vayr81	Vayrynen, J., J. Electron Spectrosc. Relat. Phenom. 22, 27 (1981)
VeLa71+	Vesely, C. J., Langer, D. W., Phys. Rev. B 4, 451 (1971)
VeLa74	Veal, B. W., Lam, D. J., Phys. Rev. B 10, 4903 (1974)
VeVa82	Verhoeven, J. A. Th., Van Doveren, H., Surf. Sci. 123, 369 (1982)

WAP 79	Weightman, P., Andrews, P. T., and Parry-Jones, A. C., J. Phys. C. 12, 3635 (1979)
WHG 73	Wertheim, G. K., Huefner, S., and Guggenheim, H. J., Phys. Rev. B 7, 556 (1973)
WHMC78	Wittberg, T. N., Hocnigman, J. R., Moddeman, W. E., Cothern, C. R., Gulctt, M. R., J. Vac. Sci. Technol. 15, 348(1978)
WHP 71	Watson, R. E., Hudis, J., and Perlman, M. L., Phys. Rev. B 4, 4139 (1971)
WPT 79	Wren, A. G., Phillips, R. W., and Tolentino, C. U., J. Colloid Interface Sci. 70, 544 (1979)
WSP 77	Weser, U., Sokolowski, G., and Pilz, W., J. Electron Spectrosc. Relat. Phenom. 10, 429 (1977)
WVB 80	Wertheim, G. K., Van Attekum, P. M. Th. M., and Basu, S., Solid State Commun. 33, 1127 (1980)
WVV 79+	Willemen, H., Van Dc Vondel, D. F., and Van Der Kclen, G. P., Inorg. Chim. Acta 34, 175 (1979)
WWC 78	Wertheim, G. K., Wernick, J. H., and Crecelius, G., Phys. Rev. B 18, 878 (1978)
WWVV77	Willemen,H., Wuyts, L. F., Van De Vondel, D. F., Van Der Kclcn, G. P., J. Electron Spectrosc. Relat. Phenom. 11, 245 (1977)
WZR 80+	Wagner, C. D., Zatko, D. A., and Raymond, R. H., Anal. Chem. 52, 1445 (1980)
WaBi73	Wagner, C. D., and Biloen, P., Surf. Sci. 35, 82 (1973)
WaHu74	Watts, P. H., Huheey, J. E., Inorg. Nucl. Chcm. Lett. 10, 287 (1974)
WaTa80+	Wagner, C. D., Taylor, J. A., J. Electron Spectrosc. Relat. Phenom. 20, 83 (1980)
WaTa82	Wagner, C. D., Taylor, J. A., J. Electron Spectrosc. Relat. Phenom. 28, 211 (1982)
Wagn75	Wagner, C. D., Discuss. Faraday Soc. 60, 291(1975)
Wagn78+	Wagner, C. D., J. Vac. Sci. Technol. 15, 518(1978)
Wagn80	Wagner, C. D., J. Electron Spectrosc. Relat. Phenom. 18, 345 (1980)
Walt77+	Walton, R. A., J. Inorg. Nucl. Chem. 39, 549(1977)
Walt77a	Walton, R. A., J. Less Common Metals 54, 71 (1977)
WcAn80	Weightman, P., and Andrews, P. T., J. Phys. C. 13, L815, L821 (1980)
WcAn80a	Weightman, P., and Andrews, P. T., J. Phys. C. 13, 3529 (1980)
WcCa82	West, R. H., and Castle, J. E., Surf. Interface Anal. 4, 68 (1982)
WeMe78	Westerhof, A., Meijer, H. J. D., J. Organometal. Chem. 144, 61(1978)
Weig76	Weightman, P., J. Phys. C. 9, 1117 (1976)

WhFa84	Wheeler, D. R., Faut, O. D., Appl. Surf. Sci. 18, 106(1984)
WiWa83	Wittberg, T. N. and Wang, P. S. J. Electron Spectrosc. Relat. Phenom. 31, 81 (1983)
YMK 78+	Yamashita, M., Matsumoto, N., and Kida, S., Inorg. Chim. Acta 31, L381 (1978)
YSMN73+	Yoshihara, K., Shiokawa, T., Maeda, K., Nakai, Y., Chem. Lett. 1973, 380
YYS 78+	Yoshida, T., Yamasaki, K., and Sawada, S., Bull. Chem. Soc. Jpn. 51, 1561 (1978)
YYS 79+	Yoshida, T., Yamasaki, K., and Sawada, S., Bull. Chem. Soc. Jpn. 52, 2908 (1979)
YaBa80	Yang, S. J., and Bates, C. W., Appl. Phys. Lett. 36, 675 (1980)
YaWe83	Yates, K., West, R. H., Surf. Interface Anal. 5, 133 (1983)
YaYa79	Yamamoto, F., Yamakama, S., J. Polym. Sci. Polym. Phys. 17, 1581 (1979)
YoSa74+	Yoshida, T., Sawada, S., Bull. Chem. Soc. Jpn. 47, 50 (1974)
YoSa74a	Yoshida, T., Sawada, S., Bull. Chem. Soc. Jpn. 47, 1024 (1974)
YoSa75+	Yoshida, T., Sawada, S., Bull. Chem. Soc. Jpn. 48, 345(1975)
YoYa81+	Yoshida, T., Yamasaki, K., Bull. Chem. Soc. Jpn. 54, 935(1981)
Yosh78+	Yoshida, T., Bull. Chem. Soc. Jpn. 51, 3257 (1978)
Yosh80+	Yoshida, T., Bull. Chem. Soc. Jpn. 53, 498(1980)
Yos+80a	Yoshida, T., Bull. Chem. Soc. Jpn. 53, 1327, (1980)
Yos+80b	Yoshida, T., Bull. Chem. Soc. Jpn. 53, 1449 (1980)
ZBN 83	Zakharov, A. I., Batirev, I. G., and Narmonev, A. G., Solid State Commun. 46, 739 (1983)
ZMN 78+	Zhumadilov, E. K., Markova, E. I., and Nefedov, V. I., Koord. Khim. 4, 997 (1978)
ZMTB80	Zingg, D. S., Makovsky, L. E., Tischer, R. E., Brown, F. R., Hercules, D. M., J. Phys. Chem. 84, 2898 (1980)
ZSOS79	Zhdan, P. A., Shepelin, A. P., Osipova, Z. G., Sokolovskii, V. D., J. Catal. 58, 8 (1979)
ZcHa71	Zeller, M. V., and Hayes, R. G., Chem. Phys. Lett. 10, 610 (1971)
ZeMa79	Zehner, D. M., and Madden, H. H., J. Vac. Sci. Technol. 16, 562(1979)
Zemb81	Zembutsu, S., Appl. Phys. Lett. 39, 969 (1981)
ZiHe78	Zingg, D. S., Hercules, D. M., J. Phys. Chem. 82, 1992 (1978)

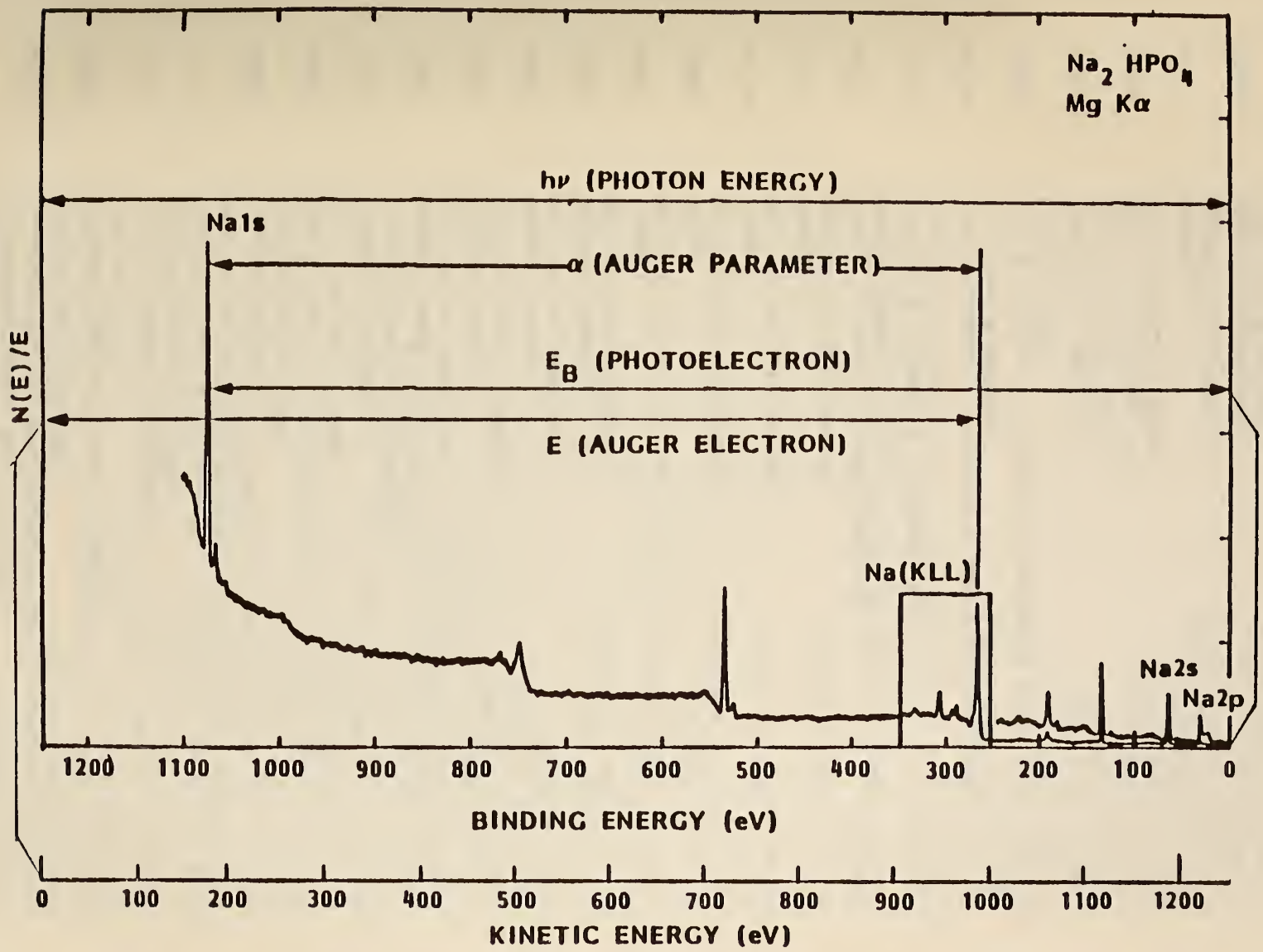

Figure 1. Spectrum of sodium hydrogen phosphate showing photoelecton line, Auger line, and Auger parameter ($E + E_B \ \alpha + h\nu$, modified).

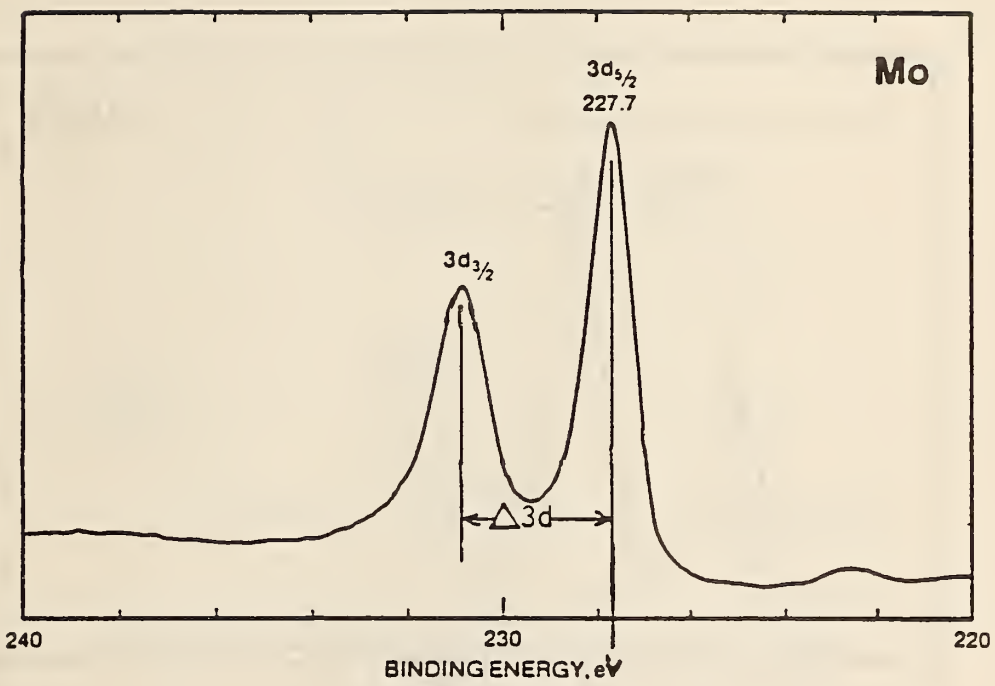

Figure 2. Doublet separation in photoelectron line.

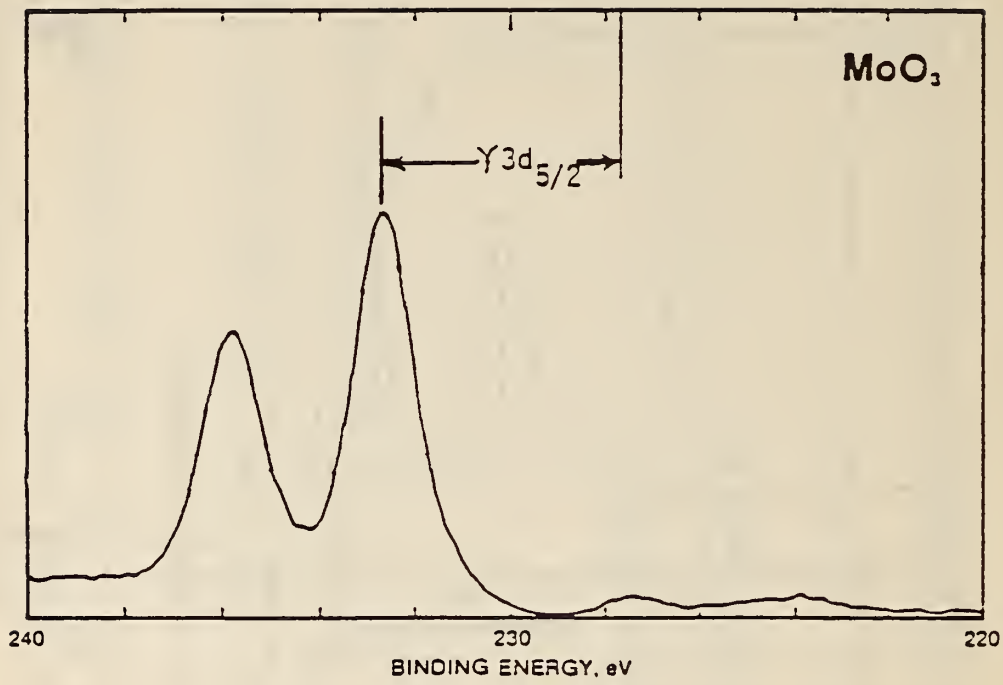

Figure 3. Chemical shift from elemental form.

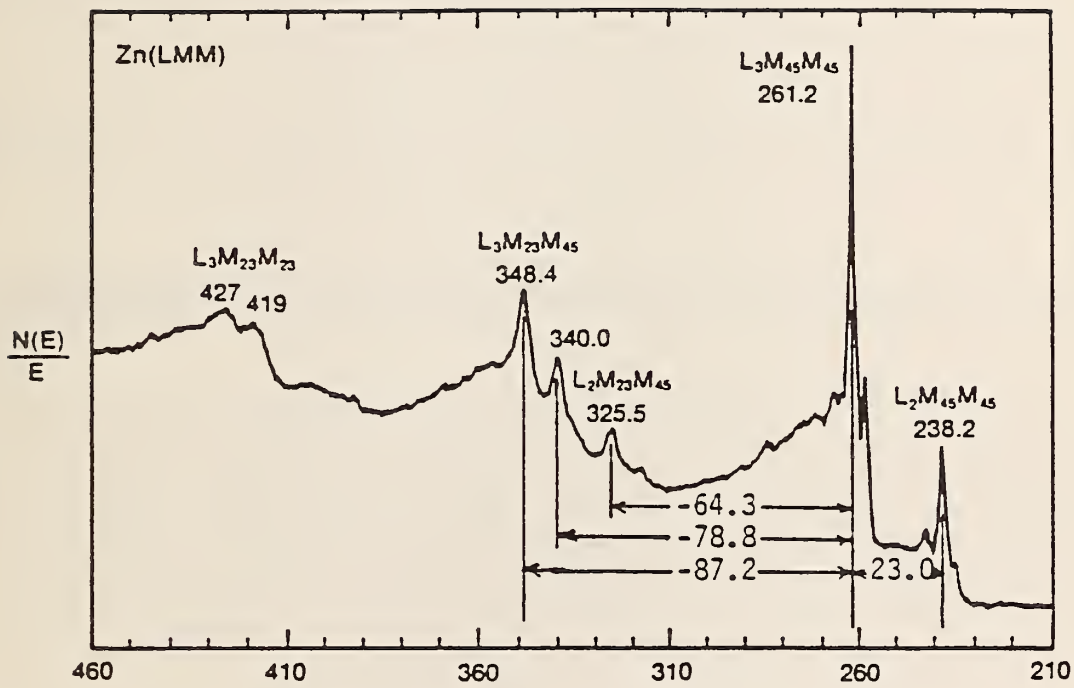

Figure 4. Separation from the sharpest Auger line.

NIST-114A
(REV. 3-90)

U.S. DEPARTMENT OF COMMERCE
NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY

BIBLIOGRAPHIC DATA SHEET

1. PUBLICATION OR REPORT NUMBER
NIST/TN-1289

2. PERFORMING ORGANIZATION REPORT NUMBER

3. PUBLICATION DATE
October 1991

4. TITLE AND SUBTITLE

The NIST X-Ray Photoelectron Spectroscopy (XPS) Database

5. AUTHOR(S)

Charles D. Wagner

6. PERFORMING ORGANIZATION (IF JOINT OR OTHER THAN NIST, SEE INSTRUCTIONS)

U.S. DEPARTMENT OF COMMERCE
NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY
GAITHERSBURG, MD 20899

7. CONTRACT/GRANT NUMBER

8. TYPE OF REPORT AND PERIOD COVERED
Final

9. SPONSORING ORGANIZATION NAME AND COMPLETE ADDRESS (STREET, CITY, STATE, ZIP)

Same as item 6.

10. SUPPLEMENTARY NOTES

11. ABSTRACT (A 200-WORD OR LESS FACTUAL SUMMARY OF MOST SIGNIFICANT INFORMATION. IF DOCUMENT INCLUDES A SIGNIFICANT BIBLIOGRAPHY OR LITERATURE SURVEY, MENTION IT HERE.)

The technique known as XPS (X-Ray Photoelectron Spectroscopy) involves x-ray irradiation of surface samples under high vacuum. Electrons escaping from the samples are sorted and arranged to form a spectrum. A compilation of data for binding energy and kinetic energy of sample electrons from all elments has been collected. Depending on the nature of the chemical bond, the chemical shift can be as much as 10 eV. Over the past 6 years the author has indexed articles related to this subject area. The data bank contains a total of 13,200 records, from a total of 800 papers.

12. KEY WORDS (6 TO 12 ENTRIES; ALPHABETICAL ORDER; CAPITALIZE ONLY PROPER NAMES; AND SEPARATE KEY WORDS BY SEMICOLONS)

Auger electron; Auger parameter; binding energy; chemical shift; core level; doublet separation; photoelectron; XPS; X-Ray generation

13. AVAILABILITY

X	UNLIMITED
	FOR OFFICIAL DISTRIBUTION. DO NOT RELEASE TO NATIONAL TECHNICAL INFORMATION SERVICE (NTIS).
X	ORDER FROM SUPERINTENDENT OF DOCUMENTS, U.S. GOVERNMENT PRINTING OFFICE, WASHINGTON, DC 20402.
X	ORDER FROM NATIONAL TECHNICAL INFORMATION SERVICE (NTIS), SPRINGFIELD, VA 22161.

14. NUMBER OF PRINTED PAGES
69

15. PRICE

ELECTRONIC FORM

*U.S.G.P.O.:1991-311-891:40052

NIST Technical Publications

Periodical

Journal of Research of the National Institute of Standards and Technology—Reports NIST research and development in those disciplines of the physical and engineering sciences in which the Institute is active. These include physics, chemistry, engineering, mathematics, and computer sciences.
Papers cover a broad range of subjects, with major emphasis on measurement methodology and the basic technology underlying standardization. Also included from time to time are survey articles on topics closely related to the Institute's technical and scientific programs. Issued six times a year.

Nonperiodicals

Monographs—Major contributions to the technical literature on various subjects related to the Institute's scientific and technical activities.

Handbooks—Recommended codes of engineering and industrial practice (including safety codes) developed in cooperation with interested industries, professional organizations, and regulatory bodies.

Special Publications—Include proceedings of conferences sponsored by NIST, NIST annual reports, and other special publications appropriate to this grouping such as wall charts, pocket cards, and bibliographies.

Applied Mathematics Series—Mathematical tables, manuals, and studies of special interest to physicists, engineers, chemists, biologists, mathematicians, computer programmers, and others engaged in scientific and technical work.

National Standard Reference Data Series—Provides quantitative data on the physical and chemical properties of materials, compiled from the world's literature and critically evaluated. Developed under a worldwide program coordinated by NIST under the authority of the National Standard Data Act (Public Law 90-396). NOTE: The Journal of Physical and Chemical Reference Data (JPCRD) is published bi-monthly for NIST by the American Chemical Society (ACS) and the American Institute of Physics (AIP). Subscriptions, reprints, and supplements are available from ACS, 1155 Sixteenth St., NW., Washington, DC 20056.

Building Science Series—Disseminates technical information developed at the Institute on building materials, components, systems, and whole structures. The series presents research results, test methods, and performance criteria related to the structural and environmental functions and the durability and safety characteristics of building elements and systems.

Technical Notes—Studies or reports which are complete in themselves but restrictive in their treatment of a subject. Analogous to monographs but not so comprehensive in scope or definitive in treatment of the subject area. Often serve as a vehicle for final reports of work performed at NIST under the sponsorship of other government agencies.

Voluntary Product Standards—Developed under procedures published by the Department of Commerce in Part 10, Title 15, of the Code of Federal Regulations. The standards establish nationally recognized requirements for products, and provide all concerned interests with a basis for common understanding of the characteristics of the products. NIST administers this program as a supplement to the activities of the private sector standardizing organizations.

Consumer Information Series—Practical information, based on NIST research and experience, covering areas of interest to the consumer. Easily understandable language and illustrations provide useful background knowledge for shopping in today's technological marketplace.
Order the **above** *NIST publications from: Superintendent of Documents, Government Printing Office, Washington, DC 20402.*
Order the **following** *NIST publications—FIPS and NISTIRs—from the National Technical Information Service, Springfield, VA 22161.*

Federal Information Processing Standards Publications (FIPS PUB)—Publications in this series collectively constitute the Federal Information Processing Standards Register. The Register serves as the official source of information in the Federal Government regarding standards issued by NIST pursuant to the Federal Property and Administrative Services Act of 1949 as amended, Public Law 89-306 (79 Stat. 1127), and as implemented by Executive Order 11717 (38 FR 12315, dated May 11, 1973) and Part 6 of Title 15 CFR (Code of Federal Regulations).

NIST Interagency Reports (NISTIR)—A special series of interim or final reports on work performed by NIST for outside sponsors (both government and non-government). In general, initial distribution is handled by the sponsor; public distribution is by the National Technical Information Service, Springfield, VA 22161, in paper copy or microfiche form.

U.S. Department of Commerce
National Institute of Standards and Technology
Gaithersburg, MD 20899