Compilation of Energy Band Gaps in Elemental and Binary Compound Semiconductors and Insulators

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Energy band gaps are tabulated for elemental and binary compound semiconductors and insulators reported in 723 references. The method of measurement, transition, type of sample, and other pertinent information are included for each entry. The determinations believed to be the most reliable are indicated.

Key words: Band gaps; binary compounds; electronic properties; insulators; semiconductors.

1. Introduction

This compilation of energy band gaps in elemental and binary compound semiconductors and insulators is intended for scientists who are concerned with energy states and electronic properties of solids and for materials engineers who are concerned with the application of solid state science to semiconductor device technology. Binary compounds included in this compilation are those involving elements in Groups IIIA, IVA, VA, VIA, and VIIA of the Periodic Table with elements of atomic numbers 3 (lithium) through 92 (uranium). In addition to the band gap, the compilation gives the method of measurement, the form of the sample, and the temperature at which the measurement was made for each material listed. When available, temperature coefficients of band gaps and indications of whether the material exhibits cathodoluminescence, electroluminescence, laser emission, mechanical luminescence, photoluminescence, or thermoluminescence are also given.

The data tabulated in this report were obtained from the files of the Electronic Properties Information Center (EPIC), Hughes Aircraft Company, Culver City, California, and from the Research Materials Information Center (RMIC), Oak Ridge National Laboratory, Oak Ridge, Tennessee. Additional data were extracted from Chemical Abstracts, published by the American Chemical Society, and from the open literature. An effort has been made to cover the literature through 1971.

2. Energy Band Gaps

According to the band theory of solids [1, 2, 3],[1] when atoms are brought together to form a crystal, the discrete electronic energy states of the isolated atoms merge into energy bands which represent the allowed energies for electrons in the crystal. These bands may be separated by forbidden regions or gaps. The conductivity of a solid, and hence its classification as a metal, semiconductor, or insulator, depends upon the distribution of electrons in the allowed energy bands. Electrons contained in a filled band make no contribution to the electrical conductivity. Thus, if the valence electrons exactly fill one or more bands leaving others empty, the crystal will be an insulator; if the valence electrons partially fill one or more bands the crystal will be a conductor. In an insulator at temperatures above 0 K, some electrons from the highest valence band are thermally excited into the lowest empty band and conduction becomes possible (intrinsic semiconduction). The number of electrons excited into the conduction band is a function of both the temperature and the magnitude of the energy band gap E_g, which is defined as the separation between the maximum energy in the valence band and the minimum energy in the conduction band. If E_g is small (0–3 or 4 eV) a material is considered to be a semiconductor and if E_g is large (4–12 eV) a material is considered to be an insulator. As the electrical and optical properties of a semiconductor are dependent upon the energy gap, these data are important in semiconductor device design.

Attempts have been made to correlate band gaps with other properties of the solids or with properties of the constituent elements in the solid. Correlations have been proposed between band gaps and heats of formation [4, 5], heats of atomization [6], reciprocal bond length [7], the ratio of bond length to cation radius [8], single bond energies [9], average bond energies [10], electronegativities [11], and atomic numbers [12, 13, 14]. None of these correlations yields empirical relations which are sufficiently general to be of practical use. This may be attributed in part to the number of compounds for which energy band gaps were known at the time the correlations were proposed. Winkler [15], lists only about 90 inorganic compounds which, in 1955, were known to exhibit semiconductor properties.

3. Measurement of Energy Band Gaps

Band gaps have been measured by both spectroscopic and conductivity methods. They have been determined from absorption and reflectance spectra [16], from photoconductivity measurements [17], and from the thermal activation energies in electrical conductivity measurements [18]. Absorption edge measurements account for a majority of the band gaps listed in this compilation.

In determining a band gap by absorption spectroscopy, the absorption coefficient, α, is measured as a function of energy from below to above the absorption edge. At

[1] Numbers in brackets indicate references in section 6.

the absorption edge α rises steeply above background and may change by a factor of 10^7 in an energy range of 0.3–0.6 eV. The threshold energy, E_g, is determined by extrapolating the linear portion of the α vs energy curve to a value of α which is estimated or assumed to represent background. Some workers take the absorption edge to be the energy value which corresponds to a preselected value of α (usually between 1 and 100 cm^{-1}) while other workers attempt to correct for actual background. Often, the original reference does not specify the experimental procedures with sufficient detail to permit a precise comparison of results obtained by other workers. Consequently, when two or more values for a particular band gap are available, whether they have been measured by the same method or by different methods, an attempt has been made to classify the degree of reliability of the values. This classification takes into consideration the material, the method of measurement, the reported sample purity, and the experimental conditions. A review of the band gap data compiled shows that the actual experimental uncertainties are frequently greater than 5 percent and seldom less than 1 percent.

4. Arrangement of Table

The energy band gap table consists of 1504 entries. Entry numbers are given at the left hand side of the table; they are cited in the author cross index. Tabulated data and comments are arranged in columns and the numbers assigned at the top of the columns denote the following:

Column 1 Chemical symbol of the first elements
2 Stoichiometry of the first element
3 Chemical symbol of the second element
4 Stoichiometry of the second element
5 Band gap
6 Temperature at which the quoted band gap was measured
7 Temperature dependence of the band gap e denotes 10 raised to the indicated power
8 Reliability rating:
"1" selected as the most reliable measurement for the band gap listed
"2" denotes other citations for the same compound
9 Method of determination:
0 Not specified
1 Reflection
2 Absorption
3 Photoconduction
4 Thermal activation
5 Electroreflection
6 Magnetoabsorption
7 Magnetoreflection
8 Others
9 Estimated
10 Type of sample the band gap was determined on:
0 Not specified
1 Thin film, single crystalline
2 This film, polycrystalline
3 Single crystalline
4 Polycrystalline
5 Amorphous
6 Other
11 Transition involved:
First entry denotes:
U = Unspecified transition
E = Excitonic transition
D = Direct transition
I = Indirect transition
If applicable, second entry denotes:
A = Allowed transition
F = Forbidden transition
If applicable, third entry denotes:
D = Direct transition is the lowest transition
I = Indirect transition is the lowest transition
12 Selected effects reported in the citation:
C = Cathodoluminescence
E = Electroluminescence
L = Laser emission
M = Mechanical luminescence
P = Photoluminescence
T = Thermoluminescence
13 Color
14 Bibliographic reference number
15 Comments

5. Acknowledgements

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6. General References

[1] Seitz, F., "The Modern Theory of Solids," McGraw-Hill Book Company, Inc., New York (1958).
[2] Kittel, C., "Introduction to Solid State Physics," John Wiley & Sons, Inc., New York (1956).
[3] Ziman, J. M. "Electrons and Phonons," Oxford University Press, New York (1960).
[4] Ruppel, W., Rose, A., Gerritsen, H. J., Helv. Phys. Acta, **30**, 238 (1957).
[5] Vijh, A. K., J. Phys. Chem. Solids, **29**, 2233 (1968).
[6] Bailly, F., Manca, P., J. Phys. Chem. Solids, **27**, 783 (1966).
[7] Goodman, C. H. L., J. Elec., **1**, 115 (1955).
[8] Miyauchi, T., J. Phys. Soc. Jap., **12**, 308 (1957).
[9] Manca, P., J. Phys. Chem. Solids, **20**, 268 (1961).

[10] Vijh, A. K., J. Phys. Chem. Solids, **30**, 1999 (1969).
[11] Hooge, F. N., Z. Phys. Chem., **24**, 275 (1960).
[12] Cornish, A. J., J. Electrochem. Soc., **106**, 685 (1959).
[13] Bube, R. H., "Photoconductivity of Solids," John Wiley & Sons, Inc., New York (1960), p. 54.
[14] Gromakov, S. D., Latypov, Z. M., Kirilyuk, P. S., Russ. J. Phys. Chem., **40**, 677 (1966).
[15] Winkler, U., Helv. Phys. Acta, **28**, 633 (1955).
[16] Greenaway, D. L., Harbeke, G., "Optical Properties and Band Structure of Semiconductors," Pergamon Press, Oxford (1968).
[17] Moss, T. S., "Optical Properties of Semiconductors", Butterworth, (1959).
[18] Smith, R. A., "Semiconductors", Cambridge University Press (1959).

Note

This material was originally compiled by Minnesota Mining and Manufacturing Company, St. Paul, Minnesota.

Energy band gaps in elemental and binary compound semiconductors and insulators

Entry No.	1 2 3 4 Compound	E(g) (eV)	Temp. (Kelvin)	dE/dT (eV/Deg)	R	By	On	Tr	Effect	Color	Ref	Comment
1	Li 1 F 1	13.6	300.0		1	1	3	D D			532	
2	Li 1 F 1	12.61	300.0		1	1	3	E			532	
3	Li 1 F 1	12.6	.0		2	9	3	E			384	
4	Li 1 F 1	12.1	77.0		2	2	3	U			313	ABSORPTION EDGE.
5	Li 1 F 1	12.	200.0		2	2	3	U			313	ABSORPTION EDGE.
6	Li 1 F 1	11.7	300.0		2	2	3	U			313	ABSORPTION EDGE.
7	Li 1 Cl 1	9.33	55.0		1	1	3	U			55	G EDGE.
8	Li 1 Br 1	7.95	80.0		1	2	2	D D			501	TRANSITION G15 -> G1.
9	Li 1 Br 1	7.5	55.0		2	1	3	U			55	G EDGE.
10	Li 3 Sb 1	1.	300.0		1	4	2	U			246	
11	Li 1 I 1	6.	55.0		1	1	3	U			55	L EDGE.
12	Li 1 I 1	6.	.0		2	9	0	I I			45	
13	Li 1 I 1	5.62	4.7		2	2	2	E			45	
14	Li 1 I 1	5.9	80.0		2	2	3	E			607	
15	Li 1 I 1	6.3	.0		2	9	0	D I			45	
16	Li 3 Bi 1	.7	300.0		1	4	2	U			245	ACTIVATION ENERGY.
17	Be 1 O 1	10.39	300.0	-3.00e-04	1	1	3	E			531	
18	Be 1 O 1	10.57	300.0	-3.00e-04	1	1	3	D D			531	
19	Be 1 O 1	11.2	300.0		2	1	3	U			405	
20	Be 1 O 1	11.6	300.0		2	0	0	U	EPT	WHITE	146	
21	Be 1 O 1	14.5	300.0		2	0	0	U			569	
22	Be 1 O 1	5.2	300.0		2	4	0	U			513	
23	Be 1 S 1	4.17	.0		1			I I			598	CALCULATED, SCOPW METHOD.
24	Be 1 Se 1	3.61	.0		1			I I			598	CALCULATED, SCOPW METHOD.
25	Be 3 Sb 2	.67	300.0		1	4	2	U			637	
26	Be 1 Te 1	2.89	.0		1			I I			598	CALCULATED, SCOPW METHOD.
27	B	.93	300.0		1	2	3	IAI			193	
28	B	1.47	300.0		2	2	3	DAI			193	
29	B	1.53	300.0		2	2	3	D I			95	
30	B	.74	300.0		2	2	5	I I			454	
31	B	1.16	300.0		2	3	3	U			10	
32	B	1.27	300.0		2	4	3	U			116	
33	B	1.38	300.0		2	2	5	D I			454	
34	B	1.41	300.0		2	3	3	U			116	
35	B	1.42	300.0		2	4	3	U			95	
36	B	1.44	300.0		2	3	3	U			116	
37	B	1.55	300.0		2	4	3	U			560	
38	B 1 N 1	8.	300.0		1	0	3	I I		WHITE	677	CUBIC, CALCULATED, APW METHOD.
39	B 1 N 1	3.4	.0		2	9	0	U			16	
40	B 1 N 1	3.8	300.0		2	2	2	U	T		517	
41	B 2 O 3	7.	300.0		1						328	
42	B 2 O 3	4.9	300.0		2	8	2	U			417	
43	B 1 P 1	2.	300.0		1	2	3	I I		RED	33	
44	B 1 P 1	2.	300.0		2	8	0	U			223	
45	B 1 P 1	2.	300.0		2	2	3	I I			665	
46	B 1 P 1	5.9	.0		2	0	0	U			676	
47	B 1 P 1	4.5	300.0		2	0	0	U			543	
48	B 1 As 1	1.46	300.0		1	2	4	U		DK BROWN	383	CUBIC.
49	B 1 As 1	1.6	.0		2			I I			597	CALCULATED, SCOPW METHOD.
50	B 1 As 1	3.56	.0		2			D I			597	CALCULATED, SCOPW METHOD.
51	B 2 Se 3		.0		2					ORANGE	157	
52	B 1 Sb 1	2.6	300.0		1	0	0	U			126	
53	C	5.47	295.0	-5.40e-05	1	2	3	I I	EPT	COLORLESS	144	
54	C	7.02	295.0	-6.30e-04	1	1	3	D I	EPT	COLORLESS	144	
55	C	5.413	90.0		2	3	3	E			178	
56	C	5.493	90.0		2	3	3	E			178	
57	C	5.503	90.0		2	3	3	I I			178	
58	C	5.542	90.0		2	3	3	E			178	NATURAL DIAMOND.
59	C	5.41	100.0		2	2	3	E	P		154	
60	C	6.	.0		2	9	0	D I			500	TRANSITION G25 -> G15.
61	C 1 Br 4	3.7	300.0		1	2	4	U			601	
62	C 1 I 4	2.26	300.0		1	2	4	U			601	
63	Na N		.0		2				T		356	
64	Na 1 F 1	10.5	300.0		1	0	0	U			198	
65	Na 2 S 1	2.4	300.0		1	9	0	U			602	
66	Na 1 Cl 1	8.97	300.0		1	2	3	D D			485	TRANSITION G15 -> G1.
67	Na 1 Cl 1	8.5	55.0		2	1	3	D D			54	G EDGE.
68	Na 1 Cl 1	8.6	55.0		2	1	3	U			55	G EDGE.
69	Na 1 Cl 1	8.97	77.0		2	1	3	D D			534	TRANSITION G15 -> G1.
70	Na 1 Cl 1	8.4	80.0		2	2	3	D D			501	TRANSITION G15 -> G1.
71	Na 1 Cl 1	8.6	80.0		2	2	3	U			198	
72	Na 2 Se 1	2.	300.0		1	9	0	U			602	
73	Na 1 Br 1	7.5	80.0		1	2	3	D D			501	TRANSITION G15 -> G1.
74	Na 1 Br 1	7.26	55.0		2	1	3	U			55	G EDGE.
75	Na 1 Br 1	7.025	77.0		2	1	3	E			433	
76	Na 1 Br 1	7.7	80.0		2	2	3	U			198	ABSORPTION EDGE.
77	Na 3 Sb 1	1.1	300.0		1	2	2	DFD			588	
78	Na 3 Sb 1	1.1	300.0		2	2	3	U	P		586	
79	Na 3 Sb 1	1.1	300.0		2	3	0	U			587	HEXAGONAL.

Energy band gaps in elemental and binary compound semiconductors and insulators—Continued

Entry No.	1 2 3 4 Compound	E(g) (eV)	Temp. (Kelvin)	dE/dT (eV/Deg)	R	By	On	Tr	Effect	Color	Ref	Comment
80	Na 3 Sb 1	1.17	250.0		2	4	3	U			722	
81	Na 3 Sb 1	1.	300.0		2	3	2	I I			321	
82	Na 3 Sb 1	2.2	300.0		2	2	2	D I			321	
83	Na 2 Te 1	2.3	355.0		1	4	4	U			477	
84	Na 2 Te 1	2.	300.0		2	9	0	U			602	
85	Na 1 I 1	5.890	77.0		1	1	3	U			433	
86	Na 1 I 1	6.	5.8		2	2	3	U			198	ABSORPTION EDGE.
87	Na 1 I 1	5.93	55.0		2	1	3	U			55	G EDGE.
88	Na 1 I 1	5.8	80.0		2	2	3	U			607	ABSORPTION EDGE.
89	Na 1 I 1	6.75	80.0		2	2	3	D D			501	TRANSITION G15 -> G1.
90	Mg 1 O 1	7.77	295.0		1	1	3	D D	CPT	COLORLESS	533	
91	Mg 1 O 1	7.69	295.0		2	1	3	E			533	
92	Mg 1 O 1	7.4	300.0		2	2	3	U	EPT		336	
93	Mg 1 F 2	11.8	300.0		1	1	3	E			678	
94	Mg 1 F 2	11.1	77.0		2	2	3	U			313	ABSORPTION EDGE.
95	Mg 1 F 2	10.8	300.0		2	2	3	U			313	ABSORPTION EDGE.
96	Mg 1 F 2	5.65	300.0		2	4	3	U			656	ACTIVATION ENERGY.
97	Mg 1 F 2		.0		2				PT		119	K(LO) = 4.84, K(HI) = .00.
98	Mg 1 F 2		.0		2						593	K(LO) = .00, K(HI) = .95.
99	Mg 1 F 2		.0		2						192	K(LO) = 5.26, K(HI) = .00.
100	Mg 2 Si 1	.6	300.0		1	9	4	I I			679	
101	Mg 2 Si 1	2.27	300.0		1	5	3	D I			36	
102	Mg 2 Si 1	.77	.0	-6.00e-04	2	4	4	I I			679	
103	Mg 2 Si 1	.78	.0		2	4	3	U			456	
104	Mg 2 Si 1	.655	15.0		2	3	3	I I			592	
105	Mg 2 Si 1	2.17	77.0		2	1	3	DAI			648	TRANSITION G15 -> G1.
106	Mg 2 Si 1	.66	90.0		2	2	3	I I			592	
107	Mg 2 Si 1	2.27	300.0		2	5	3	DAI			648	TRANSITION G15 -> G1.
108	Mg 3 P 2	1.4	300.0		1	9	0	U			602	
109	Mg 1 Cl 1		.0		2				P		474	
110	Mg 2 Ge 1	.532	300.0	-1.80e-04	1	2	3	I I			408	
111	Mg 2 Ge 1	1.64	300.0		1	5	3	DAI	P		648	TRANSITION G15 -> G1.
112	Mg 2 Ge 1	.69	.0		2	4	3	I I			522	
113	Mg 2 Ge 1	.57	4.2	-1.80e-04	2	2	3	I I			408	
114	Mg 2 Ge 1	1.804	10.0		2	8	3	D I			437	
115	Mg 2 Ge 1	.66	15.0		2	3	3	I I			592	
116	Mg 2 Ge 1	.567	77.0	-1.80e-04	2	2	3	I I			408	
117	Mg 2 Ge 1	.57	77.0		2	8	3	I I			437	
118	Mg 2 Ge 1	1.67	77.0		2	1	3	DAI	P		648	TRANSITION G15 -> G1.
119	Mg 2 Ge 1	1.78	77.0		2	8	3	D I			437	
120	Mg 2 Ge 1	.63	90.0		2	3	3	I I			592	
121	Mg 2 Ge 1	.54	195.0		2	8	3	I I			437	
122	Mg 2 Ge 1	1.737	195.0		2	8	3	D I			437	
123	Mg 2 Ge 1	.548	300.0		2	2	3	I I			437	
124	Mg 2 Ge 1	1.64	300.0		2	5	0	D I			36	
125	Mg 2 Ge 1	.74	.0	-8.00e-04	2	4	4	I I			679	
126	Mg 3 As 2	2.55	300.0		1	4	4	U		BROWN	509	VALUE VARIES: 2.2–2.9 EV.
127	Mg 3 As 2	1.	300.0		2	9	0	U			602	
128	Mg 1 Se 1	5.6	70.0		1	2	3	U			546	
129	Mg 1 Se 1	5.63	90.0		2	2	2	U			451	
130	Mg 1 Se 1	5.6	300.0		2	0	0	U			126	
131	Mg 2 Sn 1	.135	296.0	-1.70e-04	1	2	3	I I			404	
132	Mg 2 Sn 1	.18	296.0	-1.70e-04	1	1	3	DFI			404	
133	Mg 2 Sn 1	.185	.0		2	2	3	I I			404	
134	Mg 2 Sn 1	.23	.0		2	2	3	DFI			404	
135	Mg 2 Sn 1	.34	.0		2	4	4	U			690	
136	Mg 2 Sn 1	.36	.0	-3.00e-04	2	4	4	I I			679	
137	Mg 2 Sn 1	.33	5.0		2	2	3	I I			90	
138	Mg 2 Sn 1	.31	85.0	-3.50e-04	2	2	3	I I			90	
139	Mg 2 Sn 1	.22	300.0	-3.50e-04	2	2	3	I I		BLUISH	90	
140	Mg 3 Sb 2	.82	.0	-3.50e-04	1	4	4	U			123	
141	Mg 3 Sb 2	.8	.0		2	3	2	U			457	
142	Mg 1 Te 1	4.7	300.0		1	0	0	U			126	
143	Mg 1 Te 1	3.6	70.0		2	2	3	U			546	
144	Mg 2 Pb 1	.041	77.0	-5.00e-05	1	4	3	U			359	
145	Mg 2 Pb 1	.1	300.0		2	4	4	U			239	
146	Mg 2 Pb 1	.1	300.0		2	9	0	U			602	METALLIC.
147	Mg 3 Bi 2	.1	300.0		1	9	0	U			602	PROBABLY METALLIC.
148	Mg 3 Bi 2	.1	300.0		2	4	4	U			452	APPROXIMATE VALUE.
149	Al 1 B 1	.82	300.0		1	4	3	U		BLUE	135	ACTIVATION ENERGY.
150	Al 1 B 1	.5	300.0		2	4	3	U		BROWN	135	ACTIVATION ENERGY.
151	Al B	.74	400.0		2	4	3	U		BROWN	136	ACTIVATION ENERGY.
152	Al 1 N 1	5.74	300.0		1	2	3	D I	EPT	WHITE	496	POLARIZED E ∥ C.
153	Al 1 N 1	5.88	300.0		2	2	3	D I	EPT	WHITE	496	POLARIZED E ⊥ C.
154	Al 1 N 1	5.9	300.0		2	2	3	U			150	
155	Al 1 N 1	5.9	300.0		2	2	3	U	EPT	WHITE	200	
156	Al 2 O 3	9.5	300.0		1	2	3	E			31	
157	Al 2 O 3	9.9	300.0		1	2	3	U			31	ABSORPTION EDGE.
158	Al 2 O 3	8.7	300.0		2	2	3	U			524	
159	Al 2 O 3	8.56	.0	-1.50e-03	2	0	3	U			284	

Energy band gaps in elemental and binary compound semiconductors and insulators—Continued

Entry No.	1 2 3 4 Compound	E(g) (eV)	Temp. (Kelvin)	dE/dT (eV/Deg)	8 R	9 By	10 On	11 Tr	12 Effect	13 Color	14 Ref	15 Comment
160	Al 2 O 3	7.	300.0		2	3	3	U			295	SAPPHIRE.
161	Al 2 O 3	7.3	300.0		2	4	2	U			217	SAPPHIRE.
162	Al 1 P 1	2.45	300.0		1	2	3	I I			407	
163	Al 1 P 1	2.51	6.0		2	2	3	E			306	
164	Al 1 P 1	2.42	293.0	−4.00e−04	2	8	4	U	P		264	
165	Al 1 P 1	2.65	300.0		2	9	3	U	EP	YELLOW	439	
166	Al 2 S 3	4.1	300.0	−1.15e−03	1	2	0	U		WHITE	349	
167	Al 1 As 1	2.1	300.0		1	0	3	I I			436	
168	Al 1 As 1	2.9	300.0		1	0	3	D I		ORANGE	436	
169	Al 1 As 1	2.25	.0	−4.00e−04	2	8	3	U	E		364	
170	Al 1 As 1	2.228	2.0		2	2	4	E			407	TRANSITION G1 −> X1.
171	Al 1 As 1	2.223	77.0		2	2	4	E			407	TRANSITION G1 −> X1.
172	Al 1 As 1	2.205	145.0		2	2	4	E			407	TRANSITION G1 −> X1.
173	Al 1 As 1	2.13	300.0	−4.00e−04	2	8	3	U	E		364	
174	Al 1 As 1	2.16	300.0		2	2	3	I I			407	
175	Al 1 As 1	2.2	300.0		2	2	2	I I			444	
176	Al 1 As 1	3.5	300.0		2			D I			444	
177	Al 1 As 1	2.233	77.0		2	2	3	I I			407	
178	Al 1 As 1	2.215	145.0		2	2	3	I I			407	
179	Al 2 Se 3	3.1	300.0	−1.12e−03	1	2	0	U		WHITE	349	
180	Al 1 Sb 1	1.62	300.0		1	1	3	I I		DK GREY	131	
181	Al 1 Sb 1	2.218	300.0		1	1	3	D I		DK GREY	131	
182	Al 1 Sb 1	1.62	300.0	−3.50e−04	2	1	3	D D			221	
183	Al 1 Sb 1	1.6	.0		2	0	3	U	P	DK GREY	131	
184	Al 2 Te 3	2.5	300.0		1	2	0	U			349	
185	Al 2 Te 3	2.5	300.0		2	4	6	U		YELLOW	446	
186	Al 2 Te 3	2.2	800.0		2	4	6	U		YELLOW	446	
187	Al 1 Bi 1	.4	300.0		1	9	0	U			602	
188	Si 1 C 1	2.2	300.0		1	2	3	I I		YELLOW	499	CUBIC.
189	Si 1 C 1	2.86	300.0	−3.30e−04	1	2	3	I I			142	HEXAGONAL.
190	Si 1 C 1	2.39	4.2		2	2	3	E			141	CUBIC.
191	Si 1 C 1	2.6	300.0		2	2	3	I I		YELLOW	708	CUBIC.
192	Si 1 C 1	2.86	300.0		2	2	3	I I	EPT		499	HEXAGONAL.
193	Si 1 C 1	3.33	4.2		2	2	3	I I	EPT		497	HEXAGONAL.
194	Si 1 C 1	4.4	300.0		2	9	3	D I			339	HEXAGONAL.
195	Si 3 N 4	5.	300.0		1	8	0	U			703	
196	Si 3 N 4	5.1	300.0		2	2	1	U			251	
197	Si 3 N 4	4.5	300.0		2	2	5	U			109	
198	Si 1 O 2	11.	300.0		1	1	3	U	EMPT		405	
199	Si 1 O 2	10.4	300.0		2	1	3	E			405	
200	Si 1 O 2	8.	300.0		2	2	5	I I			313	FUSED QUARTZ, ABSORPTION EDGE.
201	Si 1 O 2	8.4	300.0		2	2	3	U			313	SYNTHETIC QUARTZ, ABSORPTION EDGE.
202	Si	1.12	291.0		1	2	3	I I			415	
203	Si	1.166	4.2		2	8	3	I I			207	
204	Si	1.17	4.2		2	2	3	I I			415	
205	Si	1.165	35.0		2	2	3	I I			57	
206	Si	1.16	77.0		2	2	3	I I			415	
207	Si	1.16	85.0		2	2	3	I I			57	
208	Si	1.12	300.0		2	2	3	I I			57	
209	Si 1 P 2	1.89	300.0		1	2	3	U			591	ORTHORHOMBIC.
210	Si 1 As 1	1.45	300.0		1	2	3	I I			443	POLARIZED E ⊥ B.
211	Si 1 As 1	1.48	300.0		2	2	3	DFD			443	POLARIZED E ∥ B.
212	Si 1 As 1	1.57	300.0		2	2	3	D I			443	
213	Si 1 As 1	2.2	300.0		2	2	3	U			322	
214	Si 1 Se 2	1.72	300.0		1	2	3	I I			286	POLARIZED E ∥ C.
215	Si 1 Se 2	1.74	300.0		2	2	3	I I			286	POLARIZED E ⊥ C.
216	Si 1 Sn 1	.59	300.0		1	0	0	U			126	
217	Si 2 Te 3	1.98	300.0	−6.50e−04	1	2	3	I I			649	
218	Si 1 Te 2	1.85	300.0		1	2	3	I I			520	
219	Si 1 Te 2	2.18	300.0		1	2	3	D I			520	
220	Si 2 Te 3	2.	300.0		2	2	3	U		RED	53	
221	P	.33	300.0	2.80e−04	1	1	3	U	P	BLACK	571	
222	P	1.6	300.0		1	1	3	U	P	RED	571	
223	P	1.4	300.0		2	2	3	U		RED	274	
224	P	.35	300.0	2.80e−04	2	4	3	U			667	
225	P As	.23	300.0		1	4	5	U			103	36 TO 50 % PHOSPHORUS.
226	S	3.82	300.0		1	3	3	U			438	A−PHASE, ORTHORHOMBIC.
227	S	4.2	300.0		2	1	3	D D	P		584	A−PHASE, ORTHORHOMBIC, VALUE VARIES: 4.2−4.3 EV.
228	S	3.82	300.0		2	3	3	U			619	A−PHASE, ORTHORHOMBIC.
229	K 1 F 1	10.9	300.0		1	1	3	D D			530	TRANSITION G15 −> G1.
230	K 1 F 1	10.9	80.0		2	2	3	U			198	ABSORPTION EDGE.
231	K 1 F 1	9.61	293.0		2	1	3	E			594	
232	K 1 F 1	10.3	293.0		2	1	3	D D			594	TRANSITION G15 −> G1.
233	K 2 S 1	2.1	300.0		1	9	0	U			602	
234	K 1 Cl 1	8.5	80.0		1	2	3	D D			501	TRANSITION G15 −> G1.
235	K 1 Cl 1	8.9	10.0		2	3	1	U			305	
236	K 1 Cl 1	7.8	55.0		2	1	3	E			54	

Energy band gaps in elemental and binary compound semiconductors and insulators—Continued

Entry No.	1 2 3 4 Compound	5 E(g) (eV)	6 Temp. (Kelvin)	7 dE/dT (eV/Deg)	8 R	9 By	10 On	11 Tr	12 Effect	13 Color	14 Ref	15 Comment
237	K 1 Cl 1	8.69	77.0		2	1	3	D D	P		534	TRANSITION G15 -> G1.
238	K 1 Cl 1	7.68	300.0		2	1	3	E			86	
239	K 2 Se 1	1.8	300.0		1	9	0	U			602	
240	K 1 Br 1	7.6	300.0		1	2	3	D D			502	TRANSITION G15 -> G1.
241	K 1 Br 1	8.	10.0		2	3	2	U			305	
242	K 1 Br 1	7.3	20.0		2	2	3	DAD	P		227	TRANSITION G8- -> G6+.
243	K 1 Br 1	6.75	55.0		2	1	3	E			54	
244	K 1 Br 1	7.215	78.0		2	1	3	E			625	TRANSITION G8- -> G6+.
245	K 1 Br 1	7.76	80.0		2	2	3	D D			502	TRANSITION G15 -> G1.
246	K 1 Br 1	6.58	300.0		2	1	3	E			86	
247	K 1 Br 1	7.13	300.0		2	1	3	E			86	
248	K 3 Sb 1	1.8	300.0		1	2	2	D I			321	HEXAGONAL, VALUE VARIES: 1.7–1.9 EV.
249	K 3 Sb 1	1.	300.0		1	4	2	I I			321	
250	K 3 Sb 1	1.4	300.0		1	2	3	U			578	CUBIC.
251	K 3 Sb 1	1.1	300.0		2	3	2	U			587	HEXAGONAL.
252	K 3 Sb 1	1.1	300.0		2	2	2	DFD			588	
253	K 3 Sb 1	1.1	300.0		2	2	2	U			586	
254	K 2 Te 1	1.9	300.0		1	9	0	U			602	
255	K 1 I 1	6.17	300.0		1	1	3	D D			625	TRANSITION G8- -> G6+.
256	K 1 I 1	6.31	10.0		2	2	3	D D			514	
257	K 1 I 1	6.25	55.0		2	1	3	D D	P		54	G EDGE.
258	K 1 I 1	6.375	78.0		2	1	3	D D			625	
259	K 1 I 1	6.08	80.0		2	2	3	D D			502	TRANSITION G15 -> G1.
260	K 1 I 1	6.2	80.0		2	2	3	U			198	ABSORPTION EDGE.
261	K 1 I 1	6.2	80.0		2	2	3	U			607	ABSORPTION EDGE.
262	K 1 I 1	5.61	300.0		2	1	3	D D			86	TRANSITION G15 -> G1.
263	K 1 I 1	5.92	300.0		2	2	3	D D			502	TRANSITION G15 -> G1.
264	K 1 I 1	6.28	300.0		2	2	3	U			112	
265	Ca 1 B 6	4.5	300.0		1	1	3	U			361	
266	Ca 1 B 6	4.4	.0		2	9	0	U			406	
267	Ca 1 B 6	3.3	300.0		2	1	3	U			361	UNCERTAIN ABOUT TRANSITION INVOLVED.
268	Ca 1 O 1	7.7	300.0		1	9	3	U			238	
269	Ca 1 O 1	6.1	300.0		2	2	3	E	PT	WHITE	464	
270	Ca 1 O 1	7.	300.0		2	2	3	E			238	
271	Ca 1 O 1	7.03	300.0		2	1	3	E			673	
272	Ca 1 O 1	7.5	300.0		2	9	3	U	PT	WHITE	464	
273	Ca 1 F 2	10.	300.0		1	2	3	U			313	ABSORPTION EDGE, SEE ALSO SOV. PHYS.–SOLID STATE, 11, 1505 (1970).
274	Ca 2 Si 1	1.9	300.0		1	4	4	U			124	SEE ALSO ADVAN. PHYS., 5, 315 (1956).
275	Ca 1 S 1	5.8	300.0		1	2	2	U	EPT		399	ESTIMATED VALUE: 5.8–6.2 EV.
276	Ca 1 S 1	5.38	70.0		2	2	2	U	EPT	BROWN	546	
277	Ca 1 Se 1	4.87	77.0		1	2	2	U	E	YELLOW	546	
278	Ca 2 Sn 1	.9	300.0		1	4	4	U			145	SEE ALSO ADVAN. PHYS., 5, 315 (1956).
279	Ca 1 Te 1	4.07	70.0		1	2	2	U	P	WHITE	546	
280	Ca 1 I 2	5.98	77.0		1	2	2	E			627	
281	Ca 2 Pb 1	.46	300.0		1	4	4	U			124	ACTIVATION ENERGY.
282	Sc 1 N 1	2.6	.0		1	9	0	U			553	
283	Sc 2 O 3	6.	300.0	−9.60e−04	1	2	3	U	EP		622	
284	Sc 2 O 3	6.2	80.0	−9.60e−04	2	2	3	U	EP		622	
285	Sc 2 O 3	5.4	300.0		2	1	4	U			147	
286	Sc 2 O 3	1.7	873.0		2	4	4	U			473	ACTIVATION ENERGY.
287	Sc 2 S 3	2.	300.0		1	4	3	U			181	
288	Ti C	.3	293.0		1	7	0	U			247	TI 1.0 – C 0.9.
289	Ti 2 O 3	.02	4.2		1	8	0	U			300	VALUE VARIES: 0.02–0.06 EV.
290	Ti 1 O 2	3.	296.0		1	5	3	I I			47	RUTILE.
291	Ti 1 O 2	3.3	296.0		1	5	3	D I			47	RUTILE.
292	Ti 2 O 3	.02	4.2		2	0	3	U			299	QUESTIONABLE VALUE.
293	Ti 2 O 3	.050	180.0		2	4	3				138	
294	Ti 1 O 2	3.05	300.0		2	3	3	U			153	
295	Ti 1 O 2	3.5	300.0		2	5	3	D D			228	
296	Ti 1 O 2	3.75	300.0		2	2	3	D D			664	RUTILE.
297	Ti 1 O 2	2.9	300.0		2	2	3	U			60	RUTILE, ABSORPTION EDGE.
298	Ti 1 S 2	1.24	300.0		1	9	3	U			261	FROM FIGURE 8.
299	Ti 2 S 3	.3	300.0		1	4	4	U			542	
300	Ti 1 S 3	.9	300.0		1	2	0	U			265	
301	Ti 1 S 2	1.95	300.0		2	1	3	U			261	E1 REFLECTION PEAK.
302	Ti 1 Cl 3		300.0		2	2	3	U			56	
303	Ti 1 Se 2	.69	300.0		1	9	3	U			261	*FROM FIGURE 8.*
304	Ti 1 Se 2	1.55	300.0		2	1	3	U			261	E1 REFLECTION PEAK.
305	Ti 1 Te 2	1.	300.0		1	1	3	U			261	E1 REFLECTION PEAK.
306	V 1 O 1	.3	.0		1	9	0	U			11	
307	V 2 O 3	.1	77.0		1	2	3	U			215	
308	V 2 O 5	2.34	300.0		1	2	3	DFD			357	POLARIZED ‖ C.
309	V 1 O 2	.65	300.0		1	2	3	U			74	VALUE VARIES: 0.6–0.7 EV.
310	V 2 O 4	.66	300.0		1	2	3	U			388	

Energy band gaps in elemental and binary compound semiconductors and insulators—Continued

Entry No.	1 2 3 4 Compound	E(g) (eV)	Temp. (Kelvin)	dE/dT (eV/Deg)	R	By	On	Tr	Effect	Color	Ref	Comment
311	V 5 O 9	0.15	100.0		1	4	3	U			481	ACTIVATION ENERGY, VARIES: 0.1–0.2 EV.
312	V 4 O 7	.8	200.0		1	4	3	U			480	ACTIVATION ENERGY.
313	V 2 O 5	2.49	.0	−6.10e−04	2	2	3	DFD			92	POLARIZED E ∥ C.
314	V 2 O 5	2.54	.0	−7.30e−04	2	2	3	DFD			92	POLARIZED E ⊥ C.
315	V 2 O 5	2.3	300.0	−6.10e−04	2	2	3	DFD			92	POLARIZED E ∥ C.
316	V 2 O 5	2.36	300.0		2	2	3	DFD			357	POLARIZED E ⊥ C.
317	V 1 O 2	.4	300.0		2	2	3	U			448	
318	V 2 O 5	2.32	300.0	−7.30e−04	2	2	3	DFD			92	POLARIZED E⊥C.
319	V 1 O 2	.12	339.0		2						96	
320	V 2 O 5	1.95	273.0		2	4	4	U	P		710	
321	Cr 2 O 3	1.68	300.0		1	4	3	U			152	ACTIVATION ENERGY.
322	Cr 1 O 2	.23	300.0		1	2	4	U			186	
323	Cr 2 O 3	1.59	300.0		2	4	3	U			152	ACTIVATION ENERGY.
324	Cr 2 O 3	1.	300.0		2						59	
325	Cr 2 O 3	1.62	300.0		2	1	4	U	P		659	
326	Cr 1 O 2		300.0		2	4	0	U			143	
327	Cr 1 Si 2	.35	300.0		1	4	3	U			564	
328	Cr 2 S 3	.9	300.0		1	4	2	U			542	
329	Cr 3 Se 4	.015	300.0		1	4	0	U			326	ACTIVATION ENERGY.
330	Cr 2 Se 3	.025	300.0		1	4	0	U			326	ACTIVATION ENERGY.
331	Cr 3 Se 4	.015	300.0		2	4	0	U			325	ACTIVATION ENERGY.
332	Cr 2 Se 3	.15	300.0		2	4	0	U			325	ACTIVATION ENERGY.
333	Cr 1 Br 3		.0		2						338	K(LO) = 4.17, K(HI) = 6.20.
334	Cr 1 Sb 1	.2	300.0		1	4	4	U			643	ACTIVATION ENERGY.
335	Cr Te	.02	300.0		1	4	4	U			643	ACTIVATION ENERGY.
336	Mn 1 O 2	.26	300.0		1	4	3	U			140	B–PHASE.
337	Mn 1 O 1	3.7	300.0		1	2	3	U			324	VALUE VARIES: 3.6–3.8 EV, SEE ALSO PHYS. REV., 116, 281 (1959).
338	Mn 1 O 1	1.84	300.0		2	4	4	U			475	
339	Mn 1 O 1	2.6	300.0		2	4	3	U			17	
340	Mn 1 O 2	.28	300.0		2	4	3	U			186	
341	Mn 1 O 2	.7	300.0		2	4	3	U			140	
342	Mn 1 O 1	2.2	300.0		2	4	4	U			475	HOPPING TYPE SEMICONDUCTOR OR BAND CONDUCTION OF ELECTRONS.
343	Mn 1 F 2	9.9	77.0		1	2	3	I I			429	
344	Mn 1 F 2	10.2	300.0		1	2	3	E			429	
345	Mn 1 F 2	10.24	77.0		2	2	3	E			429	
346	Mn 1 Al 3	.58	300.0		1	4	4	U			370	
347	Mn Si	.6	600.0		1	4	0	U			373	MN 1.0–SI 1.67–1.73.
348	Mn Si	.8	.0		2	4	3	U			470	MN 11–SI 19.
349	Mn 1 S 1	6.2	300.0		1	1	3	U			304	A–PHASE.
350	Mn 1 S 1	6.	300.0		2	1	3	E			304	A–PHASE.
351	Mn 1 Se 2	.2	300.0		1	4	4	U			308	ACTIVATION ENERGY.
352	Mn 1 Se 1	1.8	300.0		1	1	3	U		BRN–BLACK	675	
353	Mn 1 Te 1	1.25	300.0		1	1	3	U			695	
354	Mn 1 Te 2	.48	300.0		1	4	4	U			187	ACTIVATION ENERGY.
355	Mn 1 Te 1	1.35	80.0		2	1	3	U			695	
356	Mn 1 Te 2	.2	300.0		2	4	4	U			308	ACTIVATION ENERGY.
357	Mn 1 I 2	4.04	77.0		1	2	2	U			627	ABSORPTION EDGE.
358	Mn 1 I 2	4.4	77.0		2	2	2	E			627	
359	Fe 2 O 3	2.34	300.0		1	4	4	U			455	
360	Fe 2 O 3	1.06	600.0		2	4	4	U			79	ACTIVATION ENERGY.
361	Fe 2 O 3	2.2	300.0		2	1	4	U			659	
362	Fe 1 Si 2	.9	.0		1	4	4	U			81	VALUE SOMEWHAT SMALLER THAN 0.9 EV.
363	Fe 1 Si 1	.1	300.0		1	4	3	DAD			342	APPROXIMATE VALUE.
364	Fe 1 Si 2	.85	.0		2	4	6	U			82	
365	Fe 1 Si 2	.88	.0		2	4	0	U			666	
366	Fe 1 P 2	.4	300.0		1	4	4	U			308	ACTIVATION ENERGY.
367	Fe 1 S 2	1.2	300.0		1	4	3	U		YELLOW	424	
368	Fe 1 As 2	.2	300.0		1	4	4	U			308	ACTIVATION ENERGY.
369	Fe 1 As 2	.2	300.0		2	4	4	U			337	
370	Fe 1 Se 2	.6	300.0		1	4	4	U			187	ACTIVATION ENERGY, VALUE VARIES: 0.6–0.95 EV.
371	Fe 1 Se 2	.5	300.0		2	4	4	U			308	ACTIVATION ENERGY.
372	Fe 1 Sb 2	.17	300.0		1	4	4	U			187	ACTIVATION ENERGY.
373	Fe 1 Sb 2	.05	300.0		2	4	4	U			308	
374	Fe 2 Te 3	.6	300.0		1	2	4	U			422	
375	Fe 1 Te 2	.46	300.0		1	4	4	U			187	ACTIVATION ENERGY.
376	Fe 2 Te 3	0.34	0.0		2	4	4	U			32	
377	Fe 1 I 2	5.15	300.0		1	2	2	D I			627	
378	Co 1 O 1	0.47	250.0		1	4	3	U			40	ACTIVATION ENERGY.
379	Co 1 O 1	.73	373.0		2	4	3	U			518	ACTIVATION ENERGY.
380	Co 1 O 1	.125	500.0		2	4	0	U	P		115	
381	Co 1 F 2		300.0		2	2	2	D D	P		687	K(LO) = 4.80, K(HI) = 2.25.
382	Co 1 F 2		300.0		2	2	2	D D	P		687	K(LO) = 6.10, K(HI) = 2.25.
383	Co 1 Si 1	.045	300.0		1	8	3	U			341	

Energy band gaps in elemental and binary compound semiconductors and insulators—Continued

Entry No.	1 2 3 4 Compound	5 E(g) (eV)	6 Temp. (Kelvin)	7 dE/dT (eV/Deg)	8 R	9 By	10 On	11 Tr	12 Effect	13 Color	14 Ref	15 Comment
384	Co 1 As 2	.15	300.0		1	4	4	U			308	ACTIVATION ENERGY.
385	Co 1 As 3	.25	300.0		1	4	4	U			308	ACTIVATION ENERGY.
386	Co Te	.2	300.0		1	2	0	U			421	NONSTOICHIOMETRIC, CO 1.0 TE 1.88.
387	Ni 1 O 1	3.7	300.0		1	5	3	U		DK GREEN	435	
388	Ni 1 O 1	0.92	300.0		2	4	3	U			102	ACTIVATION ENERGY.
389	Ni 1 O 1	4.	300.0	−2.90e−04	2	1	2	U	P		536	
390	Ni 1 O 1	3.7	700.0		2	4	3	U			382	
391	Ni 1 P 2	.5	300.0		1	4	6	U			311	
392	Ni 1 S 1	0.12	264.0		1	4	3	U			583	ACTIVATION ENERGY.
393	Ni 1 S 2	.5	300.0		1	4	4	U			308	ACTIVATION ENERGY.
394	Ni 1 S 1	0.01	77.0		2	4	3	U			583	ACTIVATION ENERGY.
395	Ni 1 As 2	.05	.0		1	4	4	U			308	
396	Ni Te	0.23	300.0		1	4	0	U			547	ACTIVATION ENERGY.
397	Cu 1 N 3	4.17	300.0		1	2	2	U			175	
398	Cu 1 N 3	4.96	300.0		2	2	2	D D		YELLOW	174	
399	Cu 2 O 1	2.023	77.0		1	5	4	I I			98	
400	Cu 2 O 1	2.17	.0		2	1	2	E			99	TRANSITION G25 -> G1.
401	Cu 2 O 1	2.58	.0		2	1	2	D I			99	TRANSITION G25 -> G12.
402	Cu 2 O 1	2.59	293.0		2	5	0	D I			563	
403	Cu 2 O 1	2.02	300.0		2	1	4	U			610	
404	Cu 2 O 1	2.02	300.0		2	1	4	U			611	
405	Cu 2 O 1	2.67	300.0		2	1	4	D I			610	TRANSITION G25 -> G12.
406	Cu 1 P 2	1.4	300.0		1	2	3	I I			255	
407	Cu 1 P 2	1.51	300.0		2	2	3	D I			255	
408	Cu 2 S 1	1.21	300.0		1	1	2	I I	E		425	
409	Cu 2 S 1	1.93	293.0		2	1	3	U			658	
410	Cu 2 S 1	1.7	300.0		2	2	2	D I			515	
411	Cu 2 S 1	1.8	300.0		2	4	4	U			581	
412	Cu 2 S 1	1.84	300.0		2	3	3	U			580	
413	Cu 2 S 1	1.93	300.0		2	1	3	D I			570	
414	Cu 2 S 1	1.26	80.0		2	1	2	I I	E		425	
415	Cu 2 S 1	1.05	300.0		2	2	2	I I			515	
416	Cu 1 Cl 1	3.306	80.0		1	2	2	E	EP		134	
417	Cu 2 Se 1	1.23	293.0		1	1	3	U			658	
418	Cu 2 Se 1	1.23	300.0		2	1	3	D I			570	
419	Cu 2 Se 1	1.29	300.0		2	3	3	U			580	
420	Cu 2 Se 1	1.3	300.0		2	2	3	U	EP		2	
421	Cu 1 Br 1	2.987	80.0		1	2	2	E	P		134	
422	Cu 1 Br 1	3.02	8.0		2	3	2	U			256	
423	Cu 2 Te 1	1.08	300.0	−3.00e−04	1	2	2	U			162	
424	Cu 2 Te 1	1.15	80.0	−3.00e−04	2	2	2	U			162	
425	Cu 2 Te 1	1.02	300.0		2	3	3	U			580	
426	Cu 2 Te 1	1.04	300.0		2	1	3	U			658	
427	Cu 2 Te 1	1.04	300.0		2	1	3	D D			570	
428	Cu 1 I 1	3.07	300.0	−1.00e−04	1	9	3	D D	P		352	
429	Cu 1 I 1	3.047	80.0		2	2	2	E			134	
430	Zn 1 O 1	3.35	300.0		1	1	3	U	EPT		296	
431	Zn 1 O 1	3.435	1.2		2	1	3	D D			494	
432	Zn 1 O 1	3.26	77.0		2	8	3	E	I.		468	
433	Zn 1 O 1	3.31	300.0		2	5	3	U			297	
434	Zn 1 O 1	3.418	77.0		2	1	3	E			197	
435	Zn 1 P 2	1.65	293.0	−2.30e−04	1			I I			574	TETRAGONAL, POLARIZED E ⊥ C.
436	Zn 1 P 2	1.85	293.0	−2.30e−04	1			I I			574	TETRAGONAL, POLARIZED E ∥ C.
437	Zn 1 P 2	2.18	293.0	−5.50e−04	1			D I			574	TETRAGONAL.
438	Zn 3 P 2	1.15	300.0		1	1	3	U			573	
439	Zn 1 P 2	2.03	300.0	−4.00e−04	1	2	3	U	EP	RED	365	TETRAGONAL.
440	Zn 1 S 1	3.87	300.0		1	1	3	U	E		130	HEXAGONAL, POLARIZED E ⊥ C.
441	Zn 1 S 1	3.68	300.0	−4.86e−04	2	2	3	U			463	POLARIZED E ∥ C.
442	Zn 1 S 1	3.69	300.0		2	2	3	U		WHITE	78	HEXAGONAL, POLARIZED E ⊥ C.
443	Zn 1 S 1	3.704	300.0	−4.86e−04	2	2	3	U			463	POLARIZED E ⊥ C.
444	Zn 1 S 1	3.73	300.0		2	2	3	U		WHITE	78	HEXAGONAL, POLARIZED E ∥ C.
445	Zn 1 S 1	3.88	300.0		2	1	3	U	E		130	HEXAGONAL, POLARIZED E ∥ C.
446	Zn 1 S 1	3.82	.0		2	8	3	E	L		317	
447	Zn 1 As 2	.9	297.0		1	2	3	U			629	POLARIZED E ∥ C.
448	Zn 3 As 2	.93	297.0		1	2	3	U			629	
449	Zn 3 As 2	.86	.0	−5.40e−04	2	4	4	U			508	
450	Zn 1 As 2	.93	297.0		2	2	3	U			629	POLARIZED E ⊥ C.
451	Zn 3 As 2	.51	300.0		2	2	2	U			280	
452	Zn 1 As 2	1.3	.0	−7.50e−04	2	4	3	U			639	
453	Zn 1 Se 1	2.67	297.0		1	1	3	D D		YELLOW	42	
454	Zn 1 Se 1	2.874	15.0		2	2	3	DAD			401	HEXAGONAL.
455	Zn 1 Se 1	2.81	23.0		2	1	3	E		YELLOW	42	
456	Zn 1 Se 1	2.68	150.0		2	8	3	U	L		93	
457	Zn 1 Se 1	2.795	300.0		2	3	3	U			493	HEXAGONAL, POLARIZED E ⊥ C.
458	Zn 1 Se 1	2.76	290.0		2	8	3	D D			197	
459	Zn 1 Sb 1	.5	300.0		1	2	3	I I			372	
460	Zn 1 Sb 1	.99	300.0		1	2	3	D I			372	
461	Zn 3 Sb 2	.22	300.0		1	2	3	U			572	
462	Zn 4 Sb 3	1.2	300.0		1	2	3	U			572	

Energy band gaps in elemental and binary compound semiconductors and insulators—Continued

Entry No.	1 2 3 4 Compound	5 E(g) (eV)	6 Temp. (Kelvin)	7 dE/dT (eV/Deg)	8 R	9 By	10 On	11 Tr	12 Effect	13 Color	14 Ref	15 Comment
463	Zn 1 Sb 1	508	4.2		2	2	3	I I			428	POLARIZED E ‖C.
464	Zn 1 Sb 1	.603	4.2		2	2	3	I I			428	POLARIZED E ‖C.
465	Zn 1 Sb 1	.606	4.2		2	2	3	I I			428	POLARIZED E ‖B.
466	Zn 1 Sb 1	.61	4.2		2	2	3	I I			428	POLARIZED E ‖A.
467	Zn 1 Sb 1	.61	4.2		2	2	3	I I			372	
468	Zn 1 Sb 1	1.05	4.2		2	2	3	D I			372	POLARIZED E ‖C.
469	Zn 1 Sb 1	1.09	4.2		2	2	3	D I			372	POLARIZED E ‖B.
470	Zn 1 Sb 1	1.11	4.2		2	2	3	D I			372	POLARIZED E ‖A.
471	Zn 1 Sb 1	.59	77.0		2	2	3	I I			428	POLARIZED E ‖B.
472	Zn 1 Sb 1	.59	77.0		2	2	3	I I			372	
473	Zn 1 Sb 1	.53	297.0		2	2	3	U			629	
474	Zn 1 Sb 1	.48	300.0		2	2	3	I I			697	
475	Zn 1 Sb 1	.514	300.0		2	2	3	I I			428	POLARIZED E ‖A.
476	Zn 3 Sb 2	.2	300.0		2	4	4	U			636	
477	Zn 1 Sb 1	.5	300.0		2	2	3	U			572	
478	Zn 1 Te 1	2.25	300.0		1	2	3	DAD		RED	462	TRANSITION G15 –> G1.
479	Zn 1 Te 1	2.385	4.2		2	2	3	DAD		RED	462	TRANSITION G15 –> G1.
480	Zn 1 Te 1	2.29	77.0		2	1	3	I I			548	
481	Zn 1 Te 1	2.35	77.0		2	1	3	D I			548	
482	Zn 1 Te 1	2.372	77.0		2	8	2	U			526	
483	Zn 1 Te 1	2.37	80.0		2	2	3	DAD		RED	462	TRANSITION G15 –> G1.
484	Zn 1 Te 1	2.34	290.0		2	8	3	U			197	CUBIC.
485	Zn 1 Te 1	2.281	295.0		2	8	2	U			526	
486	Zn 1 Te 1	2.176	300.0		2	1	3	I I			548	
487	Zn 1 Te 1	2.23	300.0		2	2	3	D D			319	
488	Zn 1 Te 1	2.255	300.0		2	1	3	D I			548	
489	Zn 1 Te 1	2.35	300.0		2	1	3	D D	EPT		128	TRANSITION G15 –> G1.
490	Zn 1 Te 1	2.29	110.0		2	8	3	U	L		655	
491	Zn 1 I 2	4.53	77.0		1	2	2	E			615	
492	Ga 1 N 1	3.24	300.0		1	2	1	D D			489	
493	Ga 1 N 1	3.25	300.0	−3.90e−04	2	2	4	U			348	
494	Ga 1 N 1	3.39	300.0		2	2	3	D D		COLORLESS	427	
495	Ga 1 N 1	3.8	300.0		2	1	1	D D			376	
496	Ga 2 O 3	4.54	300.0		1	2	3	D D			623	B–PHASE.
497	Ga 2 O 3	4.4	300.0	−8.30e−04	2	2	3	U	EP	WHITE	349	
498	Ga 1 P 1	2.22	300.0	−5.20e−04	1	2	3	I I			692	TRANSITION G15 –> X1.
499	Ga 1 P 1	2.78	300.0	−4.60e−04	1	2	3	D I			692	TRANSITION G15 –> G1.
500	Ga 1 P 1	2.235	.0	−2.34e−06	2	2	3	I I			233	
501	Ga 1 P 1	2.895	.0	−2.34e−06	2	3	3	D I			465	
502	Ga 1 P 1	2.78	290.0		2	2	3	D I			1	
503	Ga 1 P 1	2.223	300.0	−2.34e−06	2	2	3	I I			233	
504	Ga 1 P 1	2.75	300.0		2	5	3	D I			618	
505	Ga 1 S 1	2.5	295.0		1	2	3	I I	EPT		104	
506	Ga 2 S 3	3.59	.0	−9.50e−04	1	8	3	U			590	
507	Ga 1 S 1	2.591	77.0		2	2	3	I I			39	
508	Ga 1 S 1	2.62	77.0		2	2	3	I I	EPT		104	
509	Ga 1 S 1	2.7	77.0		2	8	3	U	E		14	
510	Ga 1 S 1	2.58	150.0		2	2	3	I I	EPT		104	
511	Ga 1 S 1	2.38	300.0	−7.20e−04	2	3	3	U			13	
512	Ga 1 S 1	2.5	300.0		2	1	3	U			15	
513	Ga 1 S 1	2.52	300.0		2	2	3	U			105	
514	Ga 1 S 1	2.53	300.0	−7.20e−04	2	2	3	U			13	
515	Ga 1 S 1	2.84	.0		2	8	3	U	P	PALEYELLOW	590	
516	Ga 2 S 3	2.85	300.0		2	2	3	U		YELL–WHITE	349	
517	Ga 1 As 1	1.42	300.0		1	1	3	D D			561	
518	Ga 1 As 1	1.46	4.2		2	8	3	U	L		315	
519	Ga 1 As 1	1.521	21.0		2	2	3	D D			599	
520	Ga 1 As 1	1.518	55.0		2	2	3	D D			599	
521	Ga 1 As 1	1.507	77.0		2	8	3	U	P		49	
522	Ga 1 As 1	1.51	77.0		2	2	3	D D			600	
523	Ga 1 As 1	1.511	90.0		2	2	3	D D			599	
524	Ga 1 As 1	1.479	185.0		2	2	3	D D			599	
525	Ga 1 As 1	1.43	295.0		2	2	3	D D			600	
526	Ga 1 As 1	1.37	300.0		2	2	3	D D			589	
527	Ga 1 As 1	1.62	300.0		2	2	3	I D			589	
528	Ga 1 As 1	1.35	473.0		2	2	3	D D			488	TRANSITION G15 –> G1.
529	Ga 1 As 1	1.253	673.0		2	2	3	D D			488	TRANSITION G15 –> G1.
530	Ga 1 As 1	1.147	873.0		2	2	3	D D			488	TRANSITION G15 –> G1.
531	Ga 1 As 1	1.09	973.0		2	2	3	D D			488	TRANSITION G15 –> G1.
532	Ga 1 As 1	1.33	500.0		2	8	3	D D			195	TRANSITION G15 –> G1.
533	Ga 1 As 1	1.435	294.0		2	2	3	D D			599	
534	Ga 1 Se 1	1.98	300.0		1	2	3	I I	EPT		418	
535	Ga 1 Se 1	2.12	300.0		1	2	3	D I			418	
536	Ga 2 Se 3	2.05	300.0		1	2	3	U		RED	459	
537	Ga 1 Se 1	2.2	.0	−5.70e−04	2	8	3	U			590	
538	Ga 1 Se 1	2.132	4.2		2	6	3	U			27	
539	Ga 1 Se 1	2.065	77.0		2	2	3	I I			39	G– AND E– PHASES.
540	Ga 1 Se 1	2.07	77.0		2	8	3	E	L		61	
541	Ga 1 Se 1	2.109	77.0		2	5	3	U			346	
542	Ga 1 Se 1	2.117	77.0		2	2	3	I I			39	B–PHASE.

Energy band gaps in elemental and binary compound semiconductors and insulators—Continued

Entry No.	1 2 3 4 Compound	5 E(g) (eV)	6 Temp. (Kelvin)	7 dE/dT (eV/Deg)	8 R	9 By	10 On	11 Tr	12 Effect	13 Color	14 Ref	15 Comment
543	Ga 1 Se 1	2.12	77.0		2	2	3	D I			39	G– AND E– PHASES.
544	Ga 1 Se 1	2.169	77.0		2	2	3	D I			39	B–PHASE
545	Ga 1 Se 1	1.93	300.0	−8.00e−04	2	3	3	U			13	
546	Ga 1 Se 1	1.97	300.0	−4.00e−04	2	2	3	U			117	
547	Ga 1 Se 1	1.97	300.0	−8.00e−04	2	2	3	U			13	
548	Ga 1 Se 1	2.01	300.0		2	4	3	U			44	
549	Ga 1 Se 1	2.1	300.0		2	1	3	D I			15	
550	Ga 2 Se 3	2.3	.0	−4.75e−04	2	8	3	U			590	
551	Ga 2 Se 3	1.86	300.0		2	4	3	U		RED	201	
552	Ga 1 Sb 1	.725	300.0	−4.10e−04	1	2	3	U			624	
553	Ga 1 Sb 1	.773	.0		2	3	3	U			412	
554	Ga 1 Sb 1	.812	1.7		2	2	3	D D		LT GREY	335	
555	Ga 1 Sb 1	.813	4.2	−4.10e−04	2	2	3	D D			624	
556	Ga 1 Sb 1	.725	300.0		2	2	3	D D			64	
557	Ga 1 Sb 1	.81	4.0		2	8	3	U	L		69	
558	Ga 1 Te 1	1.42	293.0	−4.00e−04	1	2	1	U			257	
559	Ga 2 Te 3	1.13	300.0	−6.00e−04	1	1	3	I I			458	
560	Ga 2 Te 3	1.32	300.0	−6.00e−04	1	1	3	DAI			458	
561	Ga 2 Te 3	1.08	.0	−4.80e−04	2	2	3	I I			282	
562	Ga 1 Te 1	1.52	.0	−4.80e−04	2	2	1	U			258	
563	Ga 1 Te 1	1.74	.0		2	4	3	U			3	
564	Ga 1 Te 1	1.74	77.0		2	1	3	U			66	
565	Ga 2 Te 3	1.33	300.0	−4.00e−04	2	2	3	U			259	
566	Ga 2 Te 3	1.5	300.0		2	4	3	U		BLACK	459	
567	Ga 1 Te 1	1.5	300.0		2	3	3	U			13	
568	Ga 1 Te 1	1.63	300.0		2	1	3	U			66	
569	Ga 1 Te 1	1.67	300.0		2	2	3	U			13	
570	Ga 1 Te 1	1.7	300.0	−4.35e−04	2						612	
571	Ga 2 Te 3	1.45	933.0		2	4	3	U			538	
572	Ga 1 Bi 1	.1	300.0		1	9	0	U			602	
573	Ge 1 O 2	5.56	300.0		1	1	3	U			486	
574	Ge 1 O 2	5.54	300.0		2	2	3	U	PT	GREY	492	
575	Ge 1 O 2	5.63	300.0		2	1	5	U			486	
576	Ge 1 O 2	6.	300.0		2	2	5	U			127	
577	Ge Si	1.042	300.0		2	5	4	DAD			366	6.45 % SILICON.
578	Ge Si	1.042	300.0		2	5	2	U	P		410	7 % SILICON.
579	Ge Si	1.126	300.0		2	5	4	DAD			366	10.9 % SILICON.
580	Ge Si	1.319	300.0		2	5	4	DAD			366	16.2 % SILICON.
581	Ge Si	1.503	300.0		2	5	4	DAD			366	22.6 % SILICON.
582	Ge Si	1.914	300.0		2	5	4	DAD			366	34.7 % SILICON.
583	Ge Si	2.238	300.0		2	5	4	DAD			366	45.8 % SILICON.
584	Ge 1 S 1	1.58	300.0		1	4	0	I I			159	
585	Ge 1 S 2	3.54	300.0		1	2	3	U		AMBER	402	
586	Ge 1 S 1	1.69	77.0	−4.30e−04	2	2	3	U			402	POLARIZED E ‖ A.
587	Ge 1 S 1	1.77	77.0	−4.30e−04	2	2	3	U			402	POLARIZED E ‖ C.
588	Ge 1 S 1	1.59	300.0	−4.30e−04	2	2	3	U			402	POLARIZED E ‖ A.
589	Ge 1 S 1	1.68	300.0	−4.30e−04	2	2	3	U			402	POLARIZED E ‖ C.
590	Ge 1 S 2	3.71	77.0		2	2	3	U		AMBER	402	
591	Ge	.665	291.0		1	2	3	I I			414	
592	Ge	.805	293.0	−3.90e−04	1	6	3	D I			716	
593	Ge	.744	1.5		2	6	3	I I			716	
594	Ge	.771	1.7		2	6	3	I I			279	
595	Ge	.735	77.0		2	2	3	I I			414	
596	Ge	.889	77.0	−3.90e−04	2	6	3	D I			716	
597	Ge	.880	89.0		2	2	3	D I			229	
598	Ge	.799	305.0		2	2	3	D I			229	
599	Ge	.882	77.0	−3.50e−04	2	2	1	D I	EP		483	
600	Ge	.88	300.0		2	2	5	I I			614	
601	Ge 1 As 1	.65	300.0		1	2	3	I I			519	VALUE VARIES: 0.6–0.7 EV.
602	Ge 1 As 2	1.	300.0		1	2	3	I I			519	VALUE VARIES: 0.9–1.1 EV.
603	Ge 1 As 2	1.45	300.0		1	2	3	D I			519	VALUE VARIES: 1.1–1.8 EV.
604	Ge 1 As 1	1.45	300.0		1	2	3	D I			519	VALUE VARIES: 1.0–1.9 EV.
605	Ge 1 Se 1	1.1	300.0		1	2	3	IFI			411	
606	Ge 1 Se 1	1.53	300.0		1	2	3	D I			344	
607	Ge 1 Se 2	2.38	300.0		1	2	3	I I			232	EXTRAPOLATED VALUE.
608	Ge 1 Se 2	2.485	300.0		1	2	3	D I		YELL–ORAN	232	
609	Ge 1 Se 2	2.69	.0		2	2	3	D I		YELL–ORAN	232	
610	Ge 1 Se 1	1.	100.0		2	4	3	U			35	
611	Ge 1 Se 1	1.17	300.0		2	3	3	U			344	
612	Ge 1 Sn 1	.8	300.0		1	0	0	U			126	
613	Ge 1 Te 1	.84	300.0		1	2	2	D D			51	VALUE VARIES: 0.73–0.95 EV.
614	Ge 1 Te 2	.3	293.0		1						720	
615	Ge 1 Te 1	.8	300.0		2	2	2	U			52	
616	Ge 1 Te 1	.33	.0		2	4	0	U			209	
617	Ge 1 Te 1	.77	77.0		2	2	5	U			303	
618	Ge 1 Te 1	.7	295.0		2	2	5	U			303	
619	Ge 1 I 2	1.5	300.0		1	9	0	U			602	
620	As 2 O 3	4.	300.0		1	2	2	U			184	
621	As 2 O 3	5.	300.0		2	1	4	U			609	ESTIMATED VALUE.

Energy band gaps in elemental and binary compound semiconductors and insulators—Continued

Entry No.	1 2 3 4 Compound	5 E(g) (eV)	6 Temp. (Kelvin)	7 dE/dT (eV/Deg)	8 R	9 By	10 On	11 Tr	12 Effect	13 Color	14 Ref	15 Comment
622	As 2 S 3	2.43	293.0		1	2	3	I I			252	POLARIZED E ⊥ C, PHONON ASSISTED TRANSITION.
623	As 4 S 4	2.4	300.0		1	3	3	U			596	
624	As 2 S 5	2.48	298.0	−6.70e−04	1	2	5	U			374	
625	As 2 S 3	2.2	.0	−6.80e−04	2	2	5	U			368	
626	As 2 S 3	3.	.0	−1.40e−03	2	2	3	U			368	
627	As 2 S 3	2.35	77.0	−6.70e−04	2	2	5	D I			236	
628	As 2 S 3	2.57	90.0		2	2	3	I I			252	POLARIZED E ⊥ C, PHONON ASSISTED TRANSITION.
629	As 2 S 3	2.64	90.0		2	2	3	I I			252	POLARIZED E ∥ C, PHONON ASSISTED TRANSITION.
630	As 2 S 3	2.45	293.0		2	2	3	I I			252	POLARIZED E ∥ C, PHONON ASSISTED TRANSITION.
631	As 2 S 3	2.	300.0	−6.80e−04	2	2	5	U			368	
632	As 2 S 3	2.062	300.0		2	2	5	I I			713	
633	As 2 S 3	2.21	300.0	−6.70e−04	2	2	5	D I			236	
634	As 2 S 3	2.23	300.0		2	2	5	D I			713	
635	As 2 S 3	2.48	300.0		2	1	4	U			611	
636	As 2 S 3	2.56	300.0	−1.40e−03	2	2	3	U			368	
637	As 2 S 3	2.355	403.0		2	2	3	I I			252	POLARIZED E ⊥ C, PHONON ASSISTED TRANSITION.
638	As 2 S 3	2.365	403.0		2	2	3	I I			252	POLARIZED E ∥ C, PHONON ASSISTED TRANSITION.
639	As 2 S 3	2.43	80.0	−5.10e−04	2	2	5	U			374	
640	As 2 S 5	2.62	80.0	−6.70e−04	2	2	5	U			374	
641	As 2 S 3	2.32	293.0	−5.10e−04	2	2	5	U			374	
642	As 2 S 3	1.89	300.0		2	2	5	I I			714	
643	As 2 S 5	2.01	300.0		2	2	5	I I			714	
644	As 2 S 3	2.1	300.0		2	2	5	D I			714	
645	As 2 S 5	2.21	300.0		2	2	5	D I			714	
646	As 2 S 3	2.32	300.0		2	2	5	U			218	
647	As 2 S 3	2.36	300.0		2	3	5	U			218	
648	As 2 S 3	2.74	300.0	−6.92e−04	2	2	3	U			374	POLARIZED E ∥ C.
649	As 2 S 3	2.8	300.0	−6.92e−04	2	2	3	U			374	POLARIZED E ⊥ C.
650	As	1.2	300.0		1	3	3	U		GREY	391	
651	As	.172	4.2		2	7	3	D D			420	
652	As	.346	4.2		2	7	3	D D			419	
653	As	1.07	300.0		2	1	2	U			280	
654	As 1 Se 1	1.01	300.0		1	2	5	I I			712	
655	As 1 Se 1	1.42	300.0		1	2	5	D I			712	
656	As 2 Se 3	1.77	300.0		1	1	3	I I			67	
657	As 2 Se 3	1.8	.0	−1.10e−03	2	2	5	U			368	
658	As 2 Se 3	1.81	.0		2	4	5	U			199	
659	As 2 Se 3	1.85	.0		2	2	5	U			199	
660	As 2 Se 3	2.	.0	−8.00e−04	2	2	3	U			368	
661	As 2 Se 3	1.63	297.0		2	2	5	U			199	
662	As 2 Se 3	1.5	300.0	−1.10e−03	2	2	5	U			368	
663	As 2 Se 3	1.7	300.0	−8.00e−04	2	2	3	U			368	
664	As 2 Se 3	1.7	300.0		2	8	2	U			417	
665	As 2 Se 3	1.73	300.0		2	2	2	U			203	
666	As 2 Se 3	1.1	300.0		2	8	5	U			380	
667	As 1 Br 3	2.6	300.0		1	2	4	U		ORANGE RED	25	
668	As 2 Te 3	.48	300.0	−3.00e−04	1	2	3	U			368	
669	As 1 Te 1	.74	293.0		1	8	5	U			490	
670	As 2 Te 3	.58	.0	−3.00e−04	2	2	3	U			368	
671	As 2 Te 3	1.1	.0	−1.60e−03	2	2	5	U			368	
672	As 2 Te 3	.62	300.0	−1.60e−03	2	2	5	U			368	
673	As 2 Te 3	.9	300.0		2	8	2	U			417	
674	As 2 Te 3	1.	300.0		2	2	4	U			85	
675	As 1 I 3	2.29	300.0	−8.20e−04	1	9	3	D D			631	
676	As 1 I 3	2.54	.0	−8.20e−04	2	2	3	D D			631	
677	Se S	1.9	300.0		1	2	4	U			668	50 % SULFUR.
678	Se	1.71	300.0		1	2	3	D D			528	TRIGONAL, POLARIZED E ⊥ C.
679	Se	1.72	300.0		1	2	3	D I			528	TRIGONAL, POLARIZED E ∥ C.
680	Se	1.75	300.0		1	2	3	I I			244	HEXAGONAL, POLARIZED E ∥ C.
681	Se	1.81	.0		2	2	3	I I			528	TRIGONAL, POLARIZED E ∥ C.
682	Se	2.85	.0	−2.38e−03	2	3	3	U			369	HEXAGONAL.
683	Se	2.01	20.0		2	2	3	DAD			632	TRIGONAL.
684	Se	1.8	77.0		2	2	3	I I			528	TRIGONAL, POLARIZED E ∥ C.
685	Se	2.3	80.0		2	2	3	U			291	
686	Se	1.56	300.0		2	2	3	I I			528	TRIGONAL, POLARIZED E ∥ C.
687	Se	1.7	300.0		2	2	3	U			527	
688	Se	1.77	300.0		2	2	3	I I			244	HEXAGONAL, POLARIZED E ⊥ C.
689	Se	1.98	300.0		2	2	3	U			291	
690	Se	2.01	300.0		2	1	3	U			290	TRIGONAL, POLARIZED E ⊥ C.
691	Se	2.14	300.0	−2.38e−03	2	3	3	U			369	HEXAGONAL.
692	Se	2.2	300.0		2	1	3	D D			544	
693	Se	1.85	300.0		2	2	3	U			512	HEXAGONAL.
694	Se	2.4	300.0		2	2	3	U			512	HEXAGONAL.

Energy band gaps in elemental and binary compound semiconductors and insulators—Continued

Entry No.	1 2 3 4 Compound	E(g) (eV)	Temp. (Kelvin)	dE/dT (eV/Deg)	R	By	On	Tr	Effect	Color	Ref	Comment
695	Se 1 Te 1	.64	300.0		1	2	3	I I			605	
696	Se 3 Te 1	1.87	300.0		1	2	2	U			392	
697	Se Te	.561	300.0		2	2	0	U			358	50 % TELLURIUM.
698	Se 1 Te 1	1.58	300.0		2	2	2	U			392	
699	Rb 1 F 1	10.4	80.0		1	2	3	U			198	ABSORPTION EDGE.
700	Rb 1 Cl 1	8.29	300.0		1	2	3	U			719	
701	Rb 1 Cl 1	8.5	10.0		2	2	3	D D			616	TRANSITION G8− −> G6+.
702	Rb 1 Cl 1	8.3	55.0		2	1	3	DAD			54	G EDGE.
703	Rb 1 Cl 1	8.1	80.0		2	2	3	D D			501	TRANSITION G15 −> G1.
704	Rb 1 Cl 1	8.2	80.0		2	2	3	U			198	
705	Rb 1 Br 1	7.2	80.0		1	2	3	DAD			227	TRANSITION G8− −> G6+.
706	Rb 1 Br 1	7.25	55.0		2	1	3	DAD			54	G EDGE.
707	Rb 1 Br 1	7.65	80.0		2	2	3	D D			501	TRANSITION G15 −> G1.
708	Rb 1 Br 1	7.7	80.0		2	2	3	U			198	
709	Rb 3 Sb 1	1.	300.0		1	2	2	D D			588	
710	Rb 3 Sb 1	.9	300.0		2	4	0	I I			321	
711	Rb 3 Sb 1	1.	300.0		2	2	2	U			586	
712	Rb 3 Sb 1	1.7	300.0		2	2	0	D I			321	VALUE VARIES: 1.6–1.8 EV.
713	Rb 2 Te 1	4.5	300.0		1	3	0	U			298	
714	Rb 1 I 1	5.83	300.0		1	2	3	D D			501	TRANSITION G15 −> G1.
715	Rb 1 I 1	6.26	10.0		2	2	3	D D			616	TRANSITION G8− −>G6+
716	Rb 1 I 1	6.37	10.0		2	3	1	U			305	
717	Rb 1 I 1	6.25	55.0		2	1	3	DAD			54	G EDGE.
718	Rb 1 I 1	6.05	80.0		2	2	3	D D			501	TRANSITION G15 −> G1.
719	Rb 1 I 1	6.1	80.0		2	2	3	U			607	ABSORPTION EDGE.
720	Rb 1 I 1	6.1	80.0		2	2	3	U			198	ABSORPTION EDGE.
721	Rb 1 I 1	6.36	80.0		2	3	1	U			305	
722	Sr 1 O 1	5.77	70.0		1	2	2	U			546	
723	Sr 1 O 1	5.7	300.0		2	1	4	U			659	
724	Sr 1 O 1	1.16	873.0		2	4	0	U	EPT		473	ACTIVATION ENERGY.
725	Sr 1 S 1	4.76	113.0		1	2	2	U	EPT		709	
726	Sr 1 S 1	4.8	70.0		2	2	3	U	EPT		546	
727	Sr 1 Se 1	4.42	113.0		1	2	2	U	EP	WHITE	709	
728	Sr 1 Se 1	4.45	70.0		2	2	3	U	EP	WHITE	546	
729	Sr 1 Te 1	3.73	113.0		1	2	2	U			709	
730	Sr 1 Te 1	3.77	70.0		2	2	3	U			546	
731	Y 1 N 1	1.9	300.0		1	2	4	U			556	
732	Y 2 O 3	5.6	300.0		1	2	3	U		BLUE	469	ABSORPTION EDGE.
733	Y 2 O 3	1.46	873.0		2	4	0	U			473	ACTIVATION ENERGY.
734	Zr C	.6	293.0		1	4	0	U	T		247	ACTIVATION ENERGY.
735	Zr 6 O 1	.18	300.0		1	4	4	U			240	
736	Zr 3 O 1	.2	300.0		1	4	4	U			240	
737	Zr 1 O 2	4.99	300.0		1	1	4	U			68	
738	Zr 1 O 2	0.65	873.0		2	4	6	U			473	ACTIVATION ENERGY.
739	Zr 1 O 2	0.56	523.0		2	4	4	U	EPT	COLORLESS	169	ACTIVATION ENERGY.
740	Zr 1 S 2	1.68	300.0	−4.20e−04	1	2	3	I I		VIOLET	261	
741	Zr 1 S 2	2.75	300.0		1	1	3	D I			261	
742	Zr 1 S 3	2.17	300.0		1	2	3	U		COPPER RED	265	
743	Zr 1 S 3	2.28	300.0		2	3	3	U		COPPER RED	265	
744	Zr 1 S 2	.85	300.0		2	4	4	U	P		542	
745	Zr 1 Se 2	2.	300.0		1	1	3	D I			261	
746	Zr 1 Se 3	1.25	300.0		1	2	3	U		DK GREY	265	
747	Nb 1 N 1		.0		2	0	0	U			371	SUPERCONDUCTOR.
748	Nb 1 O 2	0.25	300.0		1	4	0	U			331	ACTIVATION ENERGY, SEE ALSO REV. MOD. PHYS., 40, 714 (1968).
749	Nb 2 O 5	3.48	300.0		1	2	2	I I			188	
750	Nb 2 O 5	1.65	573.0		2	4	3	U	EPT		262	ACTIVATION ENERGY.
751	Nb 2 O 5	3.08	300.0		2	1	4	U			659	
752	Nb 2 S 3	.12	300.0		1	4	4	U			542	
753	Nb 1 Se 2	1.4	293.0		1	1	3	D D			26	
754	Mo 1 O 3	3.66	300.0		2	4	3	U			173	
755	Mo 1 O 3	3.23	0.0	−6.20e−04	1	2	3	U			173	POLARIZED E ⊥ C.
756	Mo 1 O 3	3.66	0.0	−9.30e−04	1	2	3	U			173	POLARIZED E ⊥ C.
757	Mo 1 O 3	2.8	300.0	−6.20e−04	1	2	3	E			173	POLARIZED E ⊥ C.
758	Mo 1 O 3	2.96	300.0	−9.30e−04	1	2	3	E			173	POLARIZED E ∥ C.
759	Mo 1 O 3	3.54	300.0		2	4	3	U			194	
760	Mo 1 O 3	3.7	300.0		2	2	2	E			171	
761	Mo 1 Si 2		.0		2						466	
762	Mo 1 S 2	1.89	290.0		1	2	3	U			212	
763	Mo 1 S 2	.25	300.0		1	2	3	I I			148	
764	Mo 1 S 2	1.935	70.0		2	2	3	E			211	
765	Mo 1 S 2	1.83	290.0		2	2	3	E			225	
766	Mo 1 S 2	0.874	250.0		2	4	3	U			212	ACTIVATION ENERGY.
767	Mo 1 S 2	1.	300.0		2	4	4	U			542	
768	Mo 1 Te 2	.83	302.0		1	2	3	I I			398	
769	Mo 1 Te 2	1.02	.0	−5.40e−04	2	2	3	I I			398	
770	Mo 1 Te 2	1.08	77.0	−1.50e−04	2	2	3	E			354	
771	Mo 1 Te 2	1.82	300.0		2			E			226	
772	Ru 1 P 2	1.	300.0		1	1	4	U			310	
773	Ru 1 S 2	1.8	300.0		1	1	4	U			311	

Energy band gaps in elemental and binary compound semiconductors and insulators—Continued

Entry No.	1 2 3 4 Compound	E(g) (eV)	Temp. (Kelvin)	dE/dT (eV/Deg)	8 R	9 By	10 On	11 Tr	12 Effect	13 Color	14 Ref	15 Comment
774	Ru 1 As 2	.8	300.0		1	1	4	U			310	
775	Ru 1 Se 2	1.	300.0		1	1	4	U			311	
776	Ru 1 Sb 2	.3	300.0		1	4	4	U			310	
777	Ru 1 Te 2	.25	300.0		1	4	4	U			311	
778	Ru 1 Te 2	.25	300.0		2	4	4	U			717	
779	Rh 2 S 3	.8	300.0		1	4	6	U			312	
780	Rh 1 S 3	1.5	300.0		1	2	6	U			312	
781	Rh 1 Se 2	.6	.0		1	2	6	U			312	METALLIC AT HIGH TEMPERATURES.
782	Rh 1 Se 3	.7	300.0		1	2	6	U			312	
783	Pd 1 O 1	1.5	300.0		1	4	2	U			479	
784	Pd 1 O 1	.6	300.0		2	1	4	U			309	
785	Pd 1 P 2	.65	300.0		1	4	4	U			311	
786	Pd 1 S 1	.5	300.0		1	4	3	U			309	
787	Pd 1 S 2	.75	300.0		1	4	3	U			309	
788	Pd 1 As 2		.0		2						311	METALLIC.
789	Pd 1 Se 1	.2	300.0		1	4	3	U			309	
790	Pd 1 Se 2	.4	300.0		1	4	3	U			309	
791	Pd 1 In 1		.0		2						330	METALLIC.
792	Pd 1 Sb 2		.0		2						311	METALLIC.
793	Pd 1 Te 2	1.8	293.0		1						720	
794	Ag 1 N 3	3.9	300.0		1	3	4	U			686	
795	Ag 1 N 3	3.44	77.0		2	2	3	E			434	
796	Ag 2 O 1	1.2	300.0	2.00e−03	1	3	2	U			224	
797	Ag 2 O 1	1.5	300.0		2	4	2	U			224	
798	Ag 2 O 1	1.591	20.0		2	2	3	E			266	
799	Ag 2 O 1	0.64	500.0		2	4	0	U			608	ACTIVATION ENERGY.
800	Ag 2 F 1		.0		2	0	0	U			23	SUPERCONDUCTOR.
801	Ag 2 S 1	1.03	296.0		1	3	2	U			318	B–PHASE.
802	Ag 2 S 1	.87	300.0		1	2	1	D D			234	A–PHASE.
803	Ag 2 S 1	1.23	77.0		2	3	2	U			318	B–PHASE.
804	Ag 2 S 1	1.	300.0		2	1	3	D D			570	
805	Ag 1 Cl 1	3.25	300.0		1	2	3	I I			557	
806	Ag 1 Cl 1	5.13	300.0		1	2	3	D I			557	
807	Ag 1 Cl 1	3.22	.0		2	2	3	I I			108	
808	Ag 1 Cl 1	5.1	.0		2	9	0	D I			113	TRANSITION G15 –> G1.
809	Ag 1 Cl 1	3.246	4.2		2	2	3	I I	EPT		111	
810	Ag 1 Cl 1	3.25	4.2		2	2	3	I I			113	
811	Ag 1 Cl 1	3.252	4.2		2	2	3	I I			334	
812	Ag 1 Cl 1	3.22	77.0		2	2	3	I I			113	
813	Ag 1 Cl 1	3.226	77.0		2	2	3	I I	EPT		111	
814	Ag 1 Cl 1	3.08	300.0		2	2	3	I I			113	
815	Ag 2 Se 1	.13	80.0		1	2	4	D D			161	B2–PHASE.
816	Ag 2 Se 1	.07	.0		2	4	4	D D			161	B1–PHASE.
817	Ag 2 Se 1	.18	.0		2	4	4	D D			161	B2–PHASE.
818	Ag 2 Se 1	.05	.0		2	4	4	U			48	
819	Ag 2 Se 1	.18	.0		2	4	4	U			48	
820	Ag 1 Br 1	2.68	300.0		1	2	3	I I			557	
821	Ag 1 Br 1	4.29	300.0		1	2	3	D I			557	
822	Ag 1 Br 1	2.97	.0	−1.36e−03	2	2	3	I I			504	
823	Ag 1 Br 1	4.292	.0		2	2	3	E			108	
824	Ag 1 Br 1	2.683	4.2		2	2	3	U	P		111	
825	Ag 1 Br 1	2.69	4.2		2	2	3	I I			113	
826	Ag 1 Br 1	2.691	4.2		2	2	3	I I			334	
827	Ag 1 Br 1	2.676	77.0		2	2	3	U	P		111	
828	Ag 1 Br 1	2.68	77.0		2	2	3	I I			113	
829	Ag 1 Br 1	2.52	300.0		2	2	3	I I			113	
830	Ag 1 Br 1	2.6	300.0	−1.36e−03	2	2	3	I I			504	
831	Ag 2 Te 1	.064	300.0		1	2	2	D D			164	B–PHASE.
832	Ag 1 Te 1	.85	300.0		1	2	4	U			576	
833	Ag 2 Te 1	.064	.0		2	8	4	U			160	B–PHASE.
834	Ag 2 Te 1	.025	300.0		2	8	2	U			491	B–PHASE.
835	Ag 2 Te 1	.028	300.0		2	4	0	U			681	B–PHASE.
836	Ag 2 Te 1	0.13	300.0		2	4	2	U			12	ACTIVATION ENERGY.
837	Ag 2 Te 1	.28	300.0		2	8	0	U			645	A–PHASE.
838	Ag 2 Te 1	.85	300.0		2	1	3	U			576	
839	Ag 2 Te 1	.064	.0		2	4	3	U			160	B–PHASE.
840	Ag 2 Te 1	.67	300.0		2	2	3	U			29	B–PHASE.
841	Ag 2 Te 1	.2	600.0		2	8	6	U			645	A–PHASE.
842	Ag 1 I 1	2.919	80.0		2	2	1	E			134	
843	Ag 1 I 1	2.82	300.0		2	2	2	U	P		385	
844	Cd 1 O 1	1.2	300.0	−3.30e−04	1	2	3	I I			19	
845	Cd 1 O 1	2.3	300.0		1	2	3	D I			19	TRANSITION G15 –> G1.
846	Cd 1 O 1	2.35	295.0		2	1	3	U			453	
847	Cd 1 F 2	6.	300.0		1	8	3	U	PT	COLORLESS	21	
848	Cd 1 P 2	1.55	293.0	−4.20e−04	1			I I			574	TETRAGONAL, POLARIZED E ⊥ C.
849	Cd 1 P 2	1.65	293.0	−3.70e−04	1			I I			574	TETRAGONAL, POLARIZED E ∥ C.
850	Cd 1 P 2	1.92	293.0	−8.60e−04	1			D I			574	TETRAGONAL.
851	Cd 1 P 2	2.02	293.0	−1.12e−04	1	2	3	U	P	DK RED	698	
852	Cd 3 P 2	.52	300.0		1	4	3	U			700	

Energy band gaps in elemental and binary compound semiconductors and insulators—Continued

Entry No.	1 2 3 4 Compound	E(g) (eV)	Temp. (Kelvin)	dE/dT (eV/Deg)	8 R	9 By	10 On	11 Tr	12 Effect	13 Color	14 Ref	15 Comment
853	Cd 1 P 4	1.	300.0		1	2	4	U			699	
854	Cd 3 P 2	.58	4.2		2	8	3	U	L		84	
855	Cd 3 P 2	.589	4.2		2	8	3	U	PL	GREY	83	
856	Cd 3 P 2	.586	77.0		2	8	3	U	PL	GREY	83	
857	Cd 1 P 2	2.15	77.0	−1.12e−04	2	2	3	U	P	DK RED	698	
858	Cd 3 P 2	.55	300.0		2	0	0	U			602	
859	Cd 1 P 2	1.93	300.0	−7.00e−04	2	3	3	U			365	
860	Cd 1 P 4	1.15	300.0		2	4	4	U			9	
861	Cd 1 S 1	2.41	300.0		1	3	3	DAD			58	POLARIZED E ⊥ C.
862	Cd 1 S 1	2.425	300.0		1	3	3	DAD			58	POLARIZED E ∥ C.
863	Cd 1 S 1	2.526	4.2		2	8	3	E	L		316	
864	Cd 1 S 1	2.582	4.2		2	1	3	D D			617	CUBIC.
865	Cd 1 S 1	2.386	250.0		2	8	3	E	L		316	
866	Cd 1 S 1	2.582	4.2	−4.90e−04	2	2	3	U			87	
867	Cd 1 S 1	2.573	77.0	−4.90e−04	2	2	3	U			88	
868	Cd 1 Cl 2	5.7	300.0		1	1	4	U			611	
869	Cd 1 Cl 2	5.8	.0		2	0	0	U			537	
870	Cd 1 As 2	1.	297.0		1	2	3	U			629	POLARIZED E ∥ C.
871	Cd 3 As 2	.13	300.0		1	2	3	U			629	
872	Cd 1 As 2	1.04	297.0		2	2	3	U			629	POLARIZED E ⊥ C.
873	Cd 3 As 2	.14	300.0		2	8	3	U			701	
874	Cd 1 As 2	.89	300.0		2	2	2	U			293	
875	Cd 3 As 2	.048	4.2		2	7	3	U			278	
876	Cd 3 As 2	0.425	300.0	−5.80e−04	2	4	3	U		GREY	638	
877	Cd 3 As 2	.53	300.0		2	3	3	U		GREY	638	
878	Cd 1 Se 1	1.714	293.0	−3.60e−04	1	3	3	E			495	POLARIZED E ⊥ C.
879	Cd 1 Se 1	1.816	4.2		2	3	3	E			495	POLARIZED E ⊥ C.
880	Cd 1 Se 1	1.83	4.2		2	3	3	E			495	POLARIZED E ∥ C.
881	Cd 1 Se 1	1.840	4.2		2	2	3	DAD			577	POLARIZED E ⊥ C.
882	Cd 1 Se 1	1.865	4.2		2	2	3	DAD			577	POLARIZED E ∥ C.
883	Cd 1 Se 1	1.815	77.0	−3.60e−04	2	3	3	E	L		495	POLARIZED E ⊥ C.
884	Cd 1 Se 1	1.821	77.0		2	3	3	E			495	POLARIZED E ∥ C.
885	Cd 1 Se 1	1.733	293.0		2	3	3	E			495	POLARIZED E ∥ C.
886	Cd 1 Br 2	4.47	300.0		1	1	4	U			611	
887	Cd 1 In 1	.6	300.0		1	9	0	U			606	
888	Cd 1 Sb 1	.45	300.0		1	2	3	I I			572	
889	Cd 4 Sb 3	1.25	300.0		1	2	3	U			572	
890	Cd 1 Sb 1	.535	.0	−3.56e−04	2	3	3	U			4	
891	Cd 1 Sb 1	.57	.0	−6.00e−04	2	4	3	I I			442	
892	Cd 1 Sb 1	.585	78.0	−5.40e−04	2	2	3	U			628	
893	Cd 1 Sb 1	.428	300.0	−3.56e−04	2	3	3	U			4	
894	Cd 1 Sb 1	.43	300.0		2	2	3	IAI			696	
895	Cd 1 Sb 1	.45	300.0	−6.00e−04	2	2	3	I I			442	
896	Cd 1 Sb 1	.465	300.0	−5.40e−04	2	2	3	U			628	
897	Cd 1 Sb 1	.7	300.0		2	2	3	D I			5	
898	Cd 1 Te 1	1.517	300.0		1	5	3	D D			409	TRANSITION G15 −> G1.
899	Cd 1 Te 1	1.595	6.0		2	5	3	D D			409	TRANSITION G15 −> G1.
900	Cd 1 Te 1	1.594	20.0		2	5	3	D D			409	TRANSITION G15 −> G1.
901	Cd 1 Te 1	1.58	300.0		2	4	3	DAD			302	
902	Cd 1 I 2	3.266	300.0		1	2	3	I I			183	
903	Cd 1 I 2	3.857	300.0		1	2	3	D I			183	
904	Cd 1 I 2	3.478	77.0		2	2	3	I I			183	
905	Cd 1 I 2	3.8	77.0		2	3	3	I I			682	
906	Cd 1 I 2	4.228	80.0		2	2	3	D I			183	
907	Cd 1 I 2	3.2	290.0	−1.50e−03	2	3	3	U			688	
908	Cd 1 I 2	3.19	300.0	−1.20e−03	2	2	3	I I	P	WHITE	261	
909	Cd 1 I 2	3.2	300.0		2	3	3	I I			682	
910	Cd 1 I 2	6.25	77.0		2	2	2	E			627	
911	Cd 1 I 2	3.26	300.0		2	1	4	U			611	
912	Cd 3 Bi 2	.2	300.0		1	9	0	U			602	PROBABLY METALLIC.
913	In 1 N 1	2.4	300.0		1	9	0	U		BLACK	482	
914	In 2 O 3	2.619	300.0		1	2	3	IFI	E	YELLOW	670	
915	In 2 O 3	3.75	300.0		1	2	3	D I	E	YELLOW	670	
916	In 2 O 3	2.8	300.0		2	1	3	I I			669	
917	In 2 O 3	3.55	300.0		2	2	2	D I			642	
918	In 1 P 1	1.351	298.0	−2.90e−04	1	2	3	D D			630	
919	In 1 P 1	1.413	77.0		2	2	3	U	L		205	
920	In 1 P 1	1.34	300.0		2	5	3	D D	L	DK GREY	132	
921	In 1 P 1	1.45	300.0		2	2	2	U	EP		395	
922	In 1 P 1	1.41	.0		2	0	0	U			552	
923	In 2 S 3	1.1	300.0		1	4	3	I I		RED	523	ACTIVATION ENERGY.
924	In 2 S 3	2.03	300.0	−7.00e−04	1	2	3	D I		RED	523	
925	In 1 S 1	1.86	300.0		1	4	3	U			539	
926	In 4 S 5	.9	300.0	−3.00e−04	1	3	3	U			413	
927	In 2 S 3	2.28	.0	−1.04e−03	2	2	3	U			230	
928	In 1 As 1	.356	298.0		1	6	3	D D	EP	DK GREY	8	
929	In 1 As 1	.41	.0		2	6	1	U			507	
930	In 1 As 1	.410	.0		2	6	3	D D	EP	DK GREY	8	
931	In 1 As 1	.409	20.0		2	6	3	D D	EP	DK GREY	8	
932	In 1 As 1	.412	20.0		2	8	3	U	L		70	

Energy band gaps in elemental and binary compound semiconductors and insulators—Continued

Entry No.	1 2 3 4 Compound				5 E(g) (eV)	6 Temp. (Kelvin)	7 dE/dT (eV/Deg)	8 R	9 By	10 On	11 Tr	12 Effect	13 Color	14 Ref	15 Comment
933	In	1	As	1	.404	80.0		2	6	3	D D	EP	DK GREY	8	
934	In	1	As	1	.33	300.0		2	2	3	DAD	P		120	
935	In	1	Se	1	1.187	293.0	−4.20e−04	1	2	3	I I			24	
936	In	1	Se	1	1.293	293.0	−3.00e−04	1	2	3	D I			24	
937	In	2	Se	1	.65	300.0		1	2	3	DFD			73	
938	In	2	Se	1	.828	300.0	−5.50e−04	1	2	3	DAI			73	
939	In	2	Se	3	1.2	300.0		1	2	4	U		BLACK	107	
940	In	1	Se	1	1.285	90.0	−4.20e−04	2	2	3	I I			24	
941	In	1	Se	1	1.357	90.0	−3.00e−04	2	2	3	D I			24	
942	In	1	Se	1	1.12	300.0		2	2	3	I I			711	
943	In	1	Se	1	1.19	300.0		2	1	3	U			15	
944	In	1	Se	1	2.42	300.0		2	2	3	D I			711	
945	In	1	Se	1	1.05	300.0		2	2	4	U			107	
946	In	1	Sb	1	.17	300.0		1	2	3	D D			343	
947	In	1	Sb	1	.235	4.2		2	6	3	D D			715	
948	In	1	Sb	1	.236	4.2	−2.90e−04	2	2	3	U	I.		624	
949	In	1	Sb	1	.175	300.0	−2.90e−04	2	2	3	U	L		624	
950	In	1	Sb	1	.234	4.2		2	8	3	DAD			72	
951	In	1	Sb	1	.236	4.2		2	8	3	U	L		498	
952	In	2	Te	3	.84	300.0	−2.00e−04	1	1	3	IAI			458	
953	In	2	Te	3	1.12	300.0	−2.00e−04	1	1	3	DAI			458	
954	In	2	Te	3	1.15	.0		2	4	3	DAI			375	
955	In	2	Te	3	1.11	300.0		2	2	3	DAI			375	
956	In	2	Te	3	.85	300.0		2	2	3	I I			281	
957	In	2	Te	3	1.026	300.0	−3.50e−04	2	4	4	U			707	
958	In	2	Te	3	1.09	300.0		2	2	4	U			231	VALUE VARIES: 1.04–1.14 EV.
959	In	2	Te	3	1.	300.0		2	0	0	U		BLACK	263	
960	Sn	1	O	2	2.7	300.0		1	2	2	I I		BLACK	585	POLARIZED E ⊥ C.
961	Sn	1	O	2	4.3	300.0		1	2	2	D I		BLACK	585	
962	Sn	1	O	2	3.631	.0		2	2	1	U			603	POLARIZED E ⊥ C.
963	Sn	1	O	2	3.947	.0		2	2	1	U			603	POLARIZED E ∥ C.
964	Sn	1	O	2	3.597	1.8		2	2	3	D D			461	
965	Sn	1	O	2	2.6	77.0		2			I I			351	
966	Sn	1	O	2	2.45	300.0		2	2	3	I I			521	
967	Sn	1	O	2	2.55	300.0		2	2	3	I I			521	POLARIZED E ⊥ C.
968	Sn	1	O	2	3.54	300.0	6.00e 04	2	2	3	U			367	
969	Sn	1	O	2	3.57	300.0		2	1	3	D I			604	POLARIZED E ⊥ C.
970	Sn	1	O	2	3.69	300.0		2	2	3	U			603	POLARIZED E ⊥ C.
971	Sn	1	O	2	3.7	300.0		2	2	3	D I			521	POLARIZED E ⊥ C.
972	Sn	1	O	2	3.71	300.0	−2.00e−04	2	2	3				30	
973	Sn	1	O	2	3.93	300.0		2	1	3	D I			604	POLARIZED ∥ C.
974	Sn	1	O	2	4.1	300.0		2	2	3	D I			521	POLARIZED ∥ C.
975	Sn	1	O	2	3.9	300.0		2	1	4	U	EP		63	
976	Sn	1	S	2	2.07	300.0		1	2	3	I I		YELLOW	182	
977	Sn	1	S	2	2.88	300.0		1	2	3	D I		YELLOW	182	
978	Sn	1	S	1	1.08	300.0		1	2	2	U			441	
979	Sn	1	S	2	2.21	300.0	−8.60e−04	2	2	3	I I		YELLOW	261	
980	Sn	1	S	2	2.6	300.0		2	1	4	U			63	
981	Sn	1	S	1	1.3	300.0		2	1	4	U			63	
982	Sn	1	Cl	2	3.9	300.0		1	1	4	U			63	
983	Sn	1	Se	2	1.97	77.0		1	1	3	DAI			210	
984	Sn	1	Se	2	1.03	290.0		1	2	3	IFI			210	
985	Sn	1	Se	1	.91	300.0		1	2	3	I I		GREY	449	
986	Sn	1	Se	1	1.2	300.0		1	2	3	D I		GREY	449	
987	Sn	1	Se	2	.98	77.0		2	2	3	IFI			210	
988	Sn	1	Se	1	.9	300.0		2	2	2	U			441	
989	Sn	1	Se	2	.97	300.0		2	2	3	I I			182	
990	Sn	1	Se	2	1.	300.0		2	2	3	IFI			396	
991	Sn	1	Se	2	1.	300.0		2	4	3	U			122	
992	Sn	1	Se	2	1.3	300.0		2	2	3	IFI			210	
993	Sn	1	Se	2	1.62	300.0		2	2	3	D I			182	
994	Sn	1	Br	2	3.4	300.0		1	1	4	U			63	
995	Sn	1	Br	2	3.5	300.0		2	2	3	U			601	
996	Sn				.075	300.0		1	2	3	D D		GREY	403	
997	Sn				.092	.0	−5.00e−04	2	7	3	U		GREY	213	
998	Sn				.08	300.0		2	3	3	U		GREY	270	
999	Sn	1	Sb	1		.0		2						363	K(LO) = 147.00, K(HI) = .00.
1000	Sn	1	Te	1	.18	300.0		1	2	3	D D		GREY	180	TRANSITION L6+−> L6−.
1001	Sn	1	Te	1	.33	.0		2	8	2	D D			121	
1002	Sn	1	Te	1	.36	.0	−3.60e−04	2	2	2	D D			121	
1003	Sn	1	Te	1	.3	300.0	−3.00e−04	2	4	3	D D			535	
1004	Sn	1	Te	1	.26	300.0		2	2	2	U			441	
1005	Sn	1	I	4	2.38	300.0		1	2	3	U			601	
1006	Sn	1	I	2	2.4	300.0		1	1	4	U			63	
1007	Sb	2	O	3	3.31	300.0		1	1	4	U			611	
1008	Sb	2	O	3	3.2	300.0		2	1	4	U			659	
1009	Sb	2	O	3	4.2	300.0		2	3	2	U			417	
1010	Sb	1	Si	1	1.9	300.0		1	4	1	U			562	
1011	Sb	1	Si	1	1.9	.0	−1.55e−03	2	3	4	U			471	
1012	Sb	2	S	3	1.7	300.0		1	2	3	U			38	POLARIZED E ⊥ C.

Energy band gaps in elemental and binary compound semiconductors and insulators—Continued

Entry No.	1 2 3 4 Compound	5 E(g) (eV)	6 Temp. (Kelvin)	7 dE/dT (eV/Deg)	8 R	9 By	10 On	11 Tr	12 Effect	13 Color	14 Ref	15 Comment
1013	Sb 2 S 3	1.72	293.2		2	2	3	U			567	
1014	Sb 2 S 3	1.63	298.0	−6.70e−04	2	2	3	U			651	
1015	Sb 2 S 3	1.67	300.0		2	2	3	U			37	POLARIZED E ⊥ C.
1016	Sb 2 S 3	1.69	300.0		2	2	3	U			37	POLARIZED E ∥ C.
1017	Sb 2 S 3	1.7	300.0		2	2	3	U			85	
1018	Sb 2 S 3	1.71	300.0		2	2	3	U			38	POLARIZED E ∥ C.
1019	Sb 2 S 3	1.7	300.0		2	8	5	U			416	
1020	Sb 2 S 3	1.92	300.0		2	1	4	U			611	
1021	Sb As	.009	273.0		1	4	3	U			478	39.5 % ARSENIC, ACTIVATION ENERGY.
1022	Sb As	.125	273.0		2	4	3	U			478	29.0 % ARSENIC, ACTIVATION ENERGY.
1023	Sb 2 Se 3	1.2	300.0	−7.00e−04	1	2	3	U			85	
1024	Sb 2 Se 3	1.4	.0	−7.00e−04	2	4	3	U			85	
1025	Sb 2 Se 3	1.1	293.0		2	2	3	U			575	
1026	Sb 2 Se 3	1.15	300.0		2	2	2	U			202	
1027	Sb	.1	300.0		1	1	3	U		GRAY	571	SEE ALSO PHYS. REV., 133, A1685 (1964).
1028	Sb	.101	4.0		2	1	3	U			185	
1029	Sb 2 Te 3	.3	300.0		1	2	3	U			85	
1030	Sb 2 Te 3	.3	300.0		2	1	3	U			575	SEE ALSO J. PHYS. CHEM. SOLIDS, 23, 1219 (1962).
1031	Sb 2 Te 3	.3	300.0		2	0	0	U			602	
1032	Sb 1 I 3	2.22	300.0		1	9	3	DAD		ORANGE	631	
1033	Sb 1 I 3	2.12	295.0		2	2	3	I I			220	
1034	Sb 1 I 3	2.49	.0	−9.00e−04	2	2	3	DAD		ORANGE	631	
1035	Te 1 O 2	3.	300.0		1	3	2	U			417	VALUE GREATER THAN 3.0 EV.
1036	Te 1 O 2		.0		2	0	3	U			34	K(LO) = 24.90, K(HI) = .00.
1037	Te	.332	300.0		1	2	3	DAD			268	
1038	Te	.35	.0	−3.46e−04	2	4	0	U			273	
1039	Te	.334	4.0		2	6	3	DAD	P		18	POLARIZED E ⊥ C.
1040	Te	.335	4.2		2	2	3	DAD			268	
1041	Te	.334	10.0		2	6	3	DAD			267	
1042	Te	.337	10.0	−6.70e−05	2	2	3	I I			633	POLARIZED E ∥ C.
1043	Te	.334	20.0		2	8	3	U	L		71	
1044	Te	.336	77.0	−6.30e−05	2	2	3	E			633	POLARIZED E ⊥ C.
1045	Te	.343	77.0		2	2	3	DAD			268	
1046	Te	.32	295.0		2	2	3	D D			50	POLARIZED E ⊥ C.
1047	Te	.32	300.0		2	2	3	U			355	
1048	Te	.33	300.0		2	4	4	U			89	
1049	Te 1 I 1	1.1	300.0		1	4	0	U		GREY	7	
1050	I	1.3	300.0		1	2	3	U			527	
1051	I	1.68	80.0		2	2	3	U			100	
1052	I	1.6	100.0		2	4	3	U			323	
1053	I	1.5	290.0		2	2	3	U			100	
1054	Cs 1 F 1	10.	80.0		1	2	2	U			198	ABSORPTION SHOULDER.
1055	Cs 2 S 1		.0		2				P		718	K(LO) = 19.00, K(HI) = .00.
1056	Cs 1 Cl 1	8.1	80.0		1	2	2	D D			503	QUESTIONABLE VALUE.
1057	Cs 1 Cl 1	7.8	80.0		2	2	2	E			503	
1058	Cs 1 Cl 1	7.4	300.0		2	9	6	U			379	K(LO) = 7.20, K(HI) = 2.60.
1059	Cs 3 As 1	.6	300.0		1	0	0	U			554	
1060	Cs 1 Br 1	7.18	80.0		1	9	2	D D			503	TRANSITION G15 −> G1.
1061	Cs 1 Br 1	6.9	300.0		2	9	6	U	T		379	K(LO) = 6.51, K(HI) = 2.78, SEE ALSO J. PHYS. (PARIS), 30, 723 (1969).
1062	Cs 1 Br 1	6.8	80.0		2	2	2	E			503	SEE ALSO PHYS. LETT., 27A, 112 (1968).
1063	Cs 3 Sb 1	1.6	300.0		1	2	2	I I	EPT		170	
1064	Cs 3 Sb 1	1.6	300.0		2	8	2	U	PT		588	
1065	Cs 3 Sb 1	1.6	300.0		2	8	2	D I			321	
1066	Cs 3 Sb 1	1.6	300.0		2	8	2	U	EP		586	
1067	Cs 3 Sb 1	2.25	300.0		2	2	2	E	EPT		170	
1068	Cs 2 Te 1	3.5	300.0		1	0	0	U	P		298	
1069	Cs 1 I 1	6.37	10.0		1	2	2	D D			616	TRANSITION G8− −> G6+.
1070	Cs 1 I 1	6.3	80.0		2	2	3	U			198	ABSORPTION SHOULDER.
1071	Cs 1 I 1	6.4	80.0		2	8	2	U			607	PHOTOELECTRIC EMISSION.
1072	Cs 1 I 1	6.2	300.0		2	9	3	U			379	
1073	Cs 1 Bi 2	.55	300.0		1	2	0	U			145	SEE ALSO ANN. PHYS. (LEIPZIG), 19, 344 (1957).
1074	Cs 3 Bi 1	.55	300.0		1	2	0	U			145	
1075	Cs 3 Bi 1	.7	300.0		2	2	2	U			579	VALUE SMALLER THAN 0.7 EV.
1076	Ba 1 O 1	5.13	300.0	−9.00e−04	1	9	2	U			694	
1077	Ba 1 O 1	3.8	300.0		2	2	3	U	EPT	COLORLESS	635	ABSORPTION EDGE.
1078	Ba 1 O 1	4.8	300.0		2	2	6	U	EPT		391	
1079	Ba 1 F 2	9.06	300.0		1	2	3	E			313	TRANSITION TO LOWEST EXCITON LEVEL.
1080	Ba 1 F 2		.0		2						97	K(LO) = 6.94, K(HI) = 2.15.
1081	Ba 1 S 1	3.88	113.0		1	2	2	U			546	
1082	Ba 1 S 1	3.9	77.0		2	2	2	U	EPT		546	K(LO) = 19.27, K(HI) = .00.
1083	Ba 1 Se 1	3.6	77.0		1	2	2	U			546	

Energy band gaps in elemental and binary compound semiconductors and insulators–Continued

Entry No.	1 2 3 4 Compound	5 E(g) (eV)	6 Temp. (Kelvin)	7 dE/dT (eV/Deg)	8 R	9 By	10 On	11 Tr	12 Effect	13 Color	14 Ref	15 Comment
1084	Ba 1 Se 1	3.58	113.0		2	2	2	U			709	
1085	Ba 1 Te 1	3.4	300.0		1	9	2	U			426	
1086	Ba I		.0		2				PT		641	
1087	La 1 B 6	.08	300.0		1	1	4	U	P		626	
1088	La 1 B 6		.0		2	1	4	U			350	METALLIC.
1089	La 1 B 6	4.9	300.0		2	1	3	U			362	METALLIC.
1090	La 1 B 6	4.1	300.0		2	2	2	U			555	
1091	La 2 O 3	1.05	873.0		1	4	6	U	P	WHITE	473	ACTIVATION ENERGY.
1092	La 2 O 3	2.86	530.0		2						94	
1093	La 1 F 3	6.6	300.0		1	2	3	U			680	ABSORPTION SHOULDER, APPROXIMATE VALUE.
1094	La 1 Al 3		.0		2	0	3	U			672	K(LO) = 24.20, K(HI) = .00.
1095	La 2 S 3	1.32	300.0		1	4	4	U		RED–YELLOW	423	
1096	La 1 S 1		.0		2						706	METALLIC.
1097	La 1 Cl 3		.0		2				PT		75	K(LO) = 9.66, K(HI) = 3.71.
1098	La 2 Se 3	1.97	293.0		1	1	3	D D			691	
1099	La 2 Se 3	1.7	300.0		2	4	4	U			394	
1100	La 1 Se 1		.0		2						706	METALLIC.
1101	La 1 Sb 1	.8	300.0		1	2	2	D D			249	
1102	La 2 Te 3	.1	300.0		1	4	3	U			516	
1103	La 3 Te 4	.43	300.0		1	4	3	U			516	
1104	La 1 Te 1		.0		2						706	METALLIC.
1105	Ce 1 N 1	.7	300.0		1	9	0	U		BRONZE	556	
1106	Ce 1 O 2	2.68	513.0		1	4	4	U			94	ACTIVATION ENERGY.
1107	Ce 1 O 2	2.	.0		2	4	3	U			653	ACTIVATION ENERGY.
1108	Ce 1 O 2	5.5	300.0		2	2	1	U			285	ABSORPTION EDGE, AS INTERPRETED IN SOV. PHYS.–SOLID STATE, 9, 2659 (1968).
1109	Ce 1 O 2	1.1	873.0		2	4	4	U			473	ACTIVATION ENERGY.
1110	Ce 1 F 3	4.85	300.0		1	2	0	U			77	
1111	Ce 2 S 3	1.12	300.0		1						541	
1112	Ce 1 S 1		.0		2						706	METALLIC.
1113	Ce 2 Se 3	1.75	293.0		1	1	3	D D			691	
1114	Ce 2 Se 3	1.62	300.0		2	4	4	U			201	
1115	Ce 2 Se 3	2.	300.0		2	4	4	U			394	
1116	Ce 1 Se 1		.0		2						706	METALLIC.
1117	Ce 2 Te 3	1.4	293.0		1	4	4	U			684	VALUE VARIES: 1.2–1.6 EV.
1118	Ce 1 Te 1		.0		2						706	METALLIC.
1119	Pr 1 B 6	4.9	300.0		1	1	3	U	P		362	K(LO) = .00, K(HI) = 14.90.
1120	Pr 1 O 2	0.66	323.0		1	4	4	U			137	ACTIVATION ENERGY.
1121	Pr 2 O 3	0.84	673.0		1	4	4	U			137	ACTIVATION ENERGY.
1122	Pr 1 O 2	.88	510.0		2						94	ACTIVATION ENERGY.
1123	Pr O	0.55	873.0		2	4	0	U			473	ACTIVATION ENERGY.
1124	Pr 1 F 3	5.9	300.0		1	2	2	U			77	VALUE VARIES: 5.9–6.4 EV.
1125	Pr 1 F 3	5.3	300.0		2	2	2	U			76	
1126	Pr 1 S 1		.0		2						706	METALLIC.
1127	Pr 1 As 1	1.	300.0		1	2	2	DAD			294	
1128	Pr 2 Se 3	1.8	293.0		1	1	3	U			691	
1129	Pr 2 Se 3	1.9	300.0		2	4	3	U			394	
1130	Pr 1 Se 1		.0		2						706	METALLIC
1131	Pr 1 Sb 1	.66	300.0		1	2	2	DAD			294	
1132	Pr 1 Te 2	1.02	300.0		1	2	3	I I			447	
1133	Pr 1 Te 2	1.288	300.0		1	2	3	D I			447	
1134	Pr 2 Te 3	1.3	293.0		1	2	4	U			684	VALUE VARIES: 1.3–1.7 EV.
1135	Pr 1 Te 1		.0		2						706	METALLIC.
1136	Nd 1 B 6	4.9	300.0		1	1	3	U	P		362	K(LO) = .00, K(HI) = 11.60, ENERGY GAP PROBABLY TRANSITION TO HIGHER BANDS.
1137	Nd 1 B 6	3.4	300.0		2	2	2	U			555	
1138	Nd 1 B 6	4.	300.0		2	2	0	U			556	
1139	Nd 2 O 3	0.97	873.0		1	4	4	U			473	ACTIVATION ENERGY.
1140	Nd 2 O 3		.0		2	0	3	U			721	K(LO) = 9.80, K(HI) = .00.
1141	Nd 1 F 3	6.15	300.0		1	2	2	U			77	VALUE VARIES: 5.9–6.4 EV.
1142	Nd 2 S 3	3.	300.0		1	4	3	U			287	
1143	Nd 1 S 1		.0		2						706	METALLIC.
1144	Nd 1 As 1	1.04	300.0		1	2	2	DAD			294	
1145	Nd 2 Se 3	1.7	300.0		1	1	3	D D			691	
1146	Nd 1 Se 1		.0		2						706	METALLIC.
1147	Nd 2 Te 5	.29	300.0		1	4	6	U			6	
1148	Nd 1 Te 2	.3	300.0		1	4	6	U			6	
1149	Nd 4 Te 7	.38	300.0		1	4	6	U			6	
1150	Nd 2 Te 3	1.12	300.0		1	4	6	U			6	
1151	Nd 1 Te 2	.48	300.0		2						22	
1152	Sm 1 B 6	4.9	300.0		1	1	3	U	P		362	K(LO) = .00, K(HI) = 9.38, ENERGY GAP PROBABLY TRANSITION TO HIGHER BANDS.
1153	Sm 2 O 3	1.17	300.0		1	4	4	U			473	ACTIVATION ENERGY.
1154	Sm 2 O 3	2.27	510.0		2						94	
1155	Sm 1 P 1	1.09	300.0		1	2	2	DAD			294	
1156	Sm 1 S 1	.22	300.0		1	4	0	U			248	

Energy band gaps in elemental and binary compound semiconductors and insulators—Continued

Entry No.	1 2 3 4 Compound	5 E(g) (eV)	6 Temp. (Kelvin)	7 dE/dT (eV/Deg)	8 R	9 By	10 On	11 Tr	12 Effect	13 Color	14 Ref	15 Comment
1157	Sm 2 S 3	3.	300.0		1	1	4	U			691	
1158	Sm 1 S 1	.2	300.0		2	2	3	U			332	
1159	Sm 2 S 3	3.	300.0		2	4	3	U			394	
1160	Sm 1 As 1	1.03	300.0		1	2	2	DAD			294	
1161	Sm 1 Se 1	.46	300.0		1	2	3	U			332	
1162	Sm 2 Se 3	2.3	300.0		1	1	4	U			691	
1163	Sm 2 Se 3	2.3	300.0		2	4	3	U			394	
1164	Sm 1 Sb 1	.59	300.0		1	2	2	DAD			294	
1165	Sm 1 Te 1	.62	300.0		1	2	3	U			333	
1166	Eu 1 N 1	1.25	400.0		1	4	4	U			106	
1167	Eu 1 N 1	1.47	300.0		2	9	6	U			556	
1168	Eu 1 O 1	1.122	300.0	−1.40e−04	1	2	3	U			662	
1169	Eu 3 O 4	.6	300.0		1	4	4	U			540	ACTIVATION ENERGY.
1170	Eu 2 O 3	1.7	300.0		1	4	4	U			540	ACTIVATION ENERGY.
1171	Eu 1 O 1	1.115	300.0		2	1	3	U			660	
1172	Eu 1 O 1	1.1	300.0		2	4	4	U	P		540	ACTIVATION ENERGY.
1173	Eu 1 O 1	4.3	300.0		2	3	2	U			196	
1174	Eu 2 O 3	1.84	513.0		2	4	4	U			94	
1175	Eu 3 P 2	1.2	300.0		1	2	2	U			307	
1176	Eu 1 S 1	1.645	300.0	−1.00e−04	1	2	3	U			660	
1177	Eu 3 S 4	.163	300.0		1	4	6	U			101	ACTIVATION ENERGY.
1178	Eu 1 S 1	1.645	300.0		2	2	2	U			125	
1179	Eu 1 S 1	1.65	300.0		2	1	3	U	P		661	
1180	Eu 1 S 1	1.69	300.0		2	2	3	U			662	
1181	Eu 1 S 1	3.1	300.0		2	2	2	D I			196	
1182	Eu 3 As 2	.6	300.0		1	4	3	U			307	
1183	Eu 1 Se 1	1.78	300.0	−1.00e−04	1	1	3	U			660	
1184	Eu 1 Se 1	1.78	300.0		2	2	2	U	CP		125	
1185	Eu 1 Se 1	1.78	300.0		2	1	3	U			661	
1186	Eu 1 Se 1	1.8	300.0		2	3	3	U			663	
1187	Eu 1 Se 1	1.87	300.0		2	2	3	U			662	
1188	Eu 1 Se 1	3.1	300.0		2	2	2	D I			196	
1189	Eu 1 Te 1	1.959	300.0		1	2	3	U			662	
1190	Eu 1 Te 1	2.	300.0	−1.00e−04	2	1	3	U			660	
1191	Eu 1 Te 1	2.	300.0		2	2	2	U			125	
1192	Gd 1 B 6	3.6	300.0		1	2	2	U			555	
1193	Gd 1 N 1	1.54	300.0		1	2	6	U			556	
1194	Gd 2 O 3	1.36	873.0		1	4	6	U	EP		473	ACTIVATION ENERGY.
1195	Gd 2 O 3	2.9	933.0		2	4	4	U			94	
1196	Gd 1 P 1		.0		2						683	METALLIC.
1197	Gd 1 S 1		.0		2	3	2	U			196	
1198	Gd 1 As 1	.63	300.0		1	2	2	D D			294	
1199	Gd 1 Te 1	1.3	300.0		1	0	0	U			254	
1200	Tb 1 O 2	0.5	300.0		1	4	4	U			137	ACTIVATION ENERGY.
1201	Tb 2 O 3	0.95	650.0		1	4	4	U			137	ACTIVATION ENERGY.
1202	Tb 4 O 7	0.4	873.0		1	4	0	U			473	ACTIVATION ENERGY.
1203	Tb 2 O 3	.86	510.0		2						94	
1204	Tb 1 F 3		.0		2				P		381	
1205	Tb 1 P 1		.0		2						683	METALLIC.
1206	Dy 1 B 6	3.3	300.0		1	2	2	U			555	
1207	Dy 1 N 1	2.6	300.0		1	2	2	D D			553	
1208	Dy 1 N 1	2.1	300.0		2	2	0	U			556	
1209	Dy 2 O 3	3.08	593.0		1	4	4	U			94	K(LO) = 11.10, K(HI) = 3.69.
1210	Dy 2 O 3	1.39	0.0		2	4	4	U			473	ACTIVATION ENERGY.
1211	Dy 1 P 1		.0		2						683	METALLIC
1212	Dy 2 S 3	2.91	300.0		1	2	3	U			288	ABSORPTION EDGE.
1213	Dy 2 S 3	3.	300.0		2	4	3	U			287	
1214	Dy 1 As 1	1.	300.0		1	2	2	DAD			294	
1215	Ho 1 N 1	1.88	300.0		1	2	2	U			553	VALUE VARIES: 1.7–1.88 EV.
1216	Ho 1 N 1	1.9	300.0		2	2	2	U			555	
1217	Ho 2 O 3	2.84	573.0		1	4	4	U			94	K(LO) = 3.62, K(HI) = 14.60.
1218	Er 1 B 6	3.5	300.0		1	2	2	U			555	
1219	Er 1 N 1	2.4	300.0		1	2	2	D D			553	
1220	Er 1 N 1	3.	300.0		2	2	0	U			556	
1221	Er 2 O 3	3.26	653.0		1	4	4	U			94	
1222	Er 2 O 3	1.4	0.0		2	4	4	U			473	ACTIVATION ENERGY.
1223	Er 1 Se 2	1.07	300.0		1	4	4	U			275	
1224	Er 2 Se 3	1.66	300.0		1	4	4	U			275	
1225	Er 3 Te 4	.9	300.0		1	4	4	U			276	
1226	Er 1 Te 1	.9	300.0		1	4	4	U			276	
1227	Er 2 Te 3	.9	300.0		1	4	4	U			276	
1228	Tm 1 As 1	1.18	300.0		1	2	2	I I			294	
1229	Yb 2 O 3	2.99	573.0		1	4	4	U			94	K(LO) = 6.60, K(HI) = 3.47.
1230	Yb 2 O 3	1.53	873.0		2	4	0	U			473	ACTIVATION ENERGY.
1231	Yb S	.33	300.0		1	4	4	U			179	
1232	Yb S	.176	500.0		2	4	4	U			158	
1233	Yb 1 As 1	1.02	300.0		1	2	2	DAD			294	
1234	Yb 1 Sb 1	1.	300.0		1	2	2	DAD			294	
1235	Lu 2 O 3	3.94	733.0		1	4	4	U			94	K(LO) = 16.20, K(HI) = 3.54.
1236	Hf 1 O 2	5.55	300.0		1	1	4	U			68	

Energy band gaps in elemental and binary compound semiconductors and insulators—Continued

Entry No.	1 2 3 4 Compound	E(g) (eV)	Temp. (Kelvin)	dE/dT (eV/Deg)	8 R	9 By	10 On	11 Tr	12 Effect	13 Color	14 Ref	15 Comment
1237	Hf 1 S 2	1.96	300.0	−4.30e−04	1	2	3	I I		DK RED	261	
1238	Hf 1 S 3	2.8	300.0	−5.50e−04	1	2	3	U		OCHER	265	
1239	Hf 1 S 2	2.9	300.0		1	1	3	D I			261	IDENTIFIED AS BAND GAP IN J. PHYS. D, 2, 1507 (1969).
1240	Hf 1 S 3	2.85	300.0		2	3	3	U		OCHER	265	
1241	Hf 1 Se 2	1.13	300.0	−6.80e−04	1	2	3	I I		DK RED	261	
1242	Hf 1 Se 2	2.2	300.0		1	1	3	D I			261	IDENTIFIED AS BAND GAP IN J. PHYS. D, 2, 1507 (1969).
1243	Ta N	2.3	300.0		1	2	2	D D			151	VALUE VARIES: 1.95–2.60 EV.
1244	Ta 2 O 5	4.6	300.0		1	3	2	U			28	ABSORPTION EDGE.
1245	Ta 1 S 2	.1	300.0		1	4	0	U			542	
1246	W 1 O 3	2.8	300.0	9.00e−04	1	2	3	U			327	POLARIZED ∥ A.
1247	W 1 O 3	2.7	273.0		2	2	3	U			301	
1248	W 1 O 3	2.9	300.0	6.50e−04	2	2	3	U			327	POLARIZED ∥ C.
1249	W 1 Si 2		.0		2						466	METALLIC.
1250	W 1 S 2	1.1	300.0		1	8	0	U			390	
1251	W 1 S 2	0.45	400.0		2	4	3	U			272	ACTIVATION ENERGY.
1252	W 1 Se 2	1.35	295.0	−4.60e−04	1	2	3	U			640	
1253	W 1 Se 2	1.49	.0	−4.60e−04	2	2	3	U			640	
1254	W 1 Se 2	1.45	77.0	−4.60e−04	2	2	3	U			640	
1255	W 1 Se 2	1.35	295.0		2	0	0	U			250	
1256	W 1 Se 2	1.57	300.0		2	2	3	U			226	ABSORPTION EDGE.
1257	W 1 Te 2	.05	100.0		1	4	3	U			340	
1258	W 1 Te 2	.075	100.0		2	4	3	U			340	
1259	Re 1 O 3		.0		1	1	3				216	METALLIC.
1260	Re 1 O 3	2.3	300.0		1	1	3	U		RED	216	METALLIC, VALUE IS PLASMA EDGE.
1261	Re 1 Si 2	.12	300.0		1	4	4	U			467	
1262	Re 1 S 2	1.1	300.0		1	3	4	U			390	
1263	Re 1 Se 2	.99	250.0		1	4	4	U			723	
1264	Os 1 P 2	1.2	300.0		1	1	4	U			310	
1265	Os 1 S 2	2.	300.0		1	1	4	U			311	
1266	Os 1 As 2	.9	300.0		1	1	4	U			310	
1267	Os 1 Sb 2	.2	300.0		1	4	4	U			337	VALUE GREATER THAN 0.2 EV.
1268	Os 1 Te 2	.3	300.0		1	4	4	U			337	VALUE GREATER THAN 0.3 EV.
1269	Ir 1 S 2	.9	300.0		1	2	0	U			312	APPROXIMATE VALUE.
1270	Ir 1 Se 2	1.	300.0		1	2	0	U			312	APPROXIMATE VALUE.
1271	Ir 1 Te 2		.0		2						312	METALLIC.
1272	Pt 1 O 2	.2	300.0		1	4	4	U			559	ACTIVATION ENERGY.
1273	Pt 1 P 2	.8	300.0		1	4	4	U			337	VALUE GREATER THAN 0.8 EV.
1274	Pt 1 P 2	.6	300.0		2	4	0	U			311	VALUE GREATER THAN 0.6 EV.
1275	Pt 1 S 1	.8	300.0		1	2	3	U			309	
1276	Pt 1 S 2	.75	300.0		1						271	APPROXIMATE VALUE.
1277	Pt 1 As 2	.55	300.0		1	4	3	U			219	
1278	Pt 1 As 2	.5	300.0		2	4	0	U			311	
1279	Pt 1 Se 2	.1	300.0		1						271	APPROXIMATE VALUE.
1280	Pt 1 Sb 2	.11	77.0		1	2	3	I I			476	
1281	Pt 1 Sb 2	.11	.0		2	4	3	U			525	
1282	Pt 1 Sb 2	.112	.0		2	4	3	U			206	
1283	Pt 1 Sb 2	.11	10.0		2	2	3	DI			525	
1284	Pt 1 Sb 2	.07	.0		2	4	3	U			165	
1285	Pt 1 Te 2		.0		2						271	SEMIMETALLIC.
1286	Pt 1 Bi 2		300.0		2	4	3	U			337	A–PHASE IS SEMIMETALLIC.
1287	Au Cl		.0		2				P		551	
1288	Au 1 Ga 2		.0		2	1	3	U			654	
1289	Au 1 In 2		.0		2	1	3	U			654	
1290	Hg 1 O 1	2.48	300.0		1	1	4	U			611	
1291	Hg 1 O 1	2.214	300.0		2	1	4	U			659	
1292	Hg 1 O 1	1.02	373.0		2	4	0	U		YELLOW	440	
1293	Hg 1 O 1	1.18	373.0		2	4	0	U		RED	440	
1294	Hg 1 O 1		.0		2	9	0	U			386	K(LO)=15.00, K(HI)=.00.
1295	Hg 1 S 1	.54	300.0	7.70e−04	1	2	1	U			565	B–PHASE, CUBIC.
1296	Hg 1 S 1	1.998	310.0	−6.80e−04	1	2	3	I I			80	A–PHASE, HEXAGONAL.
1297	Hg 1 S 1	2.183	20.4	−6.80e−04	2	2	3	I I			80	A–PHASE, HEXAGONAL.
1298	Hg 1 S 1	2.160	77.0		2	2	3	I I			80	A–PHASE, HEXAGONAL.
1299	Hg 1 S 1	2.095	283.0		2	9	3	I I	C	RED	472	A–PHASE, HEXAGONAL.
1300	Hg 1 S 1	.7	300.0		2	1	3	U			378	B–PHASE, CUBIC.
1301	Hg 1 S 1	−.15	300.0		2	1	4			OPAQUE	693	B–PHASE, CUBIC.
1302	Hg 1 S 1	2.21	300.0		2	1	4	U			611	
1303	Hg 2 Cl 2	3.5	300.0	−1.70e−03	1	1	3	U			204	
1304	Hg 2 Cl 2	3.8	10.0		2	1	3	U			204	
1305	Hg 2 Cl 2	2.84	300.0		2	2	3	U			601	
1306	Hg 1 Cl 2	4.45	300.0		2	2	3	U			689	ABSORPTION EDGE.
1307	Hg 1 Se 1	.24	4.2		1	7	3	D D			674	
1308	Hg 1 Se 1	.6	297.0	−4.30e−04	2	1	3	D D			133	
1309	Hg 1 Se 1	.07	300.0		2	8	3	U	P		283	BAND OVERLAP.
1310	Hg 1 Se 1	.1	300.0		2	4	0	U			360	
1311	Hg 2 Br 2	2.6	300.0		1	2	3	U			601	
1312	Hg 1 Br 2	3.59	300.0		1	2	4	U			689	ABSORPTION EDGE.

Energy band gaps in elemental and binary compound semiconductors and insulators—Continued

Entry No.	1 2 3 4 Compound	5 E(g) (eV)	6 Temp. (Kelvin)	7 dE/dT (eV/Deg)	8 R	9 By	10 On	11 Tr	12 Effect	13 Color	14 Ref	15 Comment
1313	Hg 1 Te 1	.175	300.0	−8.50e−04	1	4	3	D D			511	TRANSITION G6 -> G8, BAND OVERLAP.
1314	Hg 1 Te 1	.303	1.5		2	7	3	D D			506	TRANSITION G6 -> G8, BAND OVERLAP.
1315	Hg 1 Te 1	.266	77.0		2	7	3	D D			506	TRANSITION G6 -> G8, BAND OVERLAP.
1316	Hg 1 Te 1	.283	30.0		2	7	3	U			269	TRANSITION G6 -> G8, BAND OVERLAP.
1317	Hg 1 Te 1	.15	300.0		2	1	3	D D			650	
1318	Hg 1 Te 1	.19	300.0		2	8	3	U			510	TRANSITION G6 -> G8, BAND OVERLAP.
1319	Hg 1 I 2	2.13	298.0	−1.40e−03	1	1	3	U		RED	118	TETRAGONAL.
1320	Hg 1 I 2	2.33	.0	−4.00e−04	2	2	3	U		RED	566	
1321	Hg 1 I 2	2.47	.0	−4.00e−04	2	2	3	U		ORANGE	566	
1322	Hg 1 I 2	2.322	20.0		2	2	3	E	EP		253	
1323	Hg 1 I 2	2.29	77.0		2	5	3	U			168	
1324	Hg 1 I 2	2.29	87.0		2	1	3	U		RED	118	TETRAGONAL.
1325	Hg 1 I 2	3.045	90.0	−2.40e−03	2	1	3	U		YELLOW	118	ORTHORHOMBIC.
1326	Hg 1 I 2	2.795	204.0	−2.40e−03	2	1	3	U		YELLOW	118	ORTHORHOMBIC.
1327	Hg 1 I 2	2.095	280.0		2	3	3	U		RED	118	TETRAGONAL.
1328	Hg 1 I 2	2.11	300.0	−4.00e−04	2	2	3	U		RED	566	
1329	Hg 1 I 2	2.35	300.0	−4.00e−04	2	2	3	U		ORANGE	566	
1330	Hg 1 I 2	2.315	403.0	−2.40e−03	2	1	3	U		YELLOW	118	ORTHORHOMBIC.
1331	Hg 1 I 2	2.19	300.0		2	2	3	U			689	ABSORPTION EDGE.
1332	Hg 2 I 2	2.37	300.0		2	2	3	U			601	
1333	Tl 1 N 3	3.58	77.0		1	2	2	E			172	
1334	Tl 2 O 3	1.4	300.0		1	2	2	I I			235	
1335	Tl 2 O 3	2.25	300.0		1	2	2	D I			235	
1336	Tl 1 F 1		.0		2						568	K(LO) = 35.00, K(HI) = .00.
1337	Tl 1 S 1	1.36	300.0		1	1	3	I I			345	
1338	Tl S	.98	300.0		2	4	0	U			65	50 % SULFUR.
1339	Tl 2 S 1	.59	250.0		2	3	6	U			657	
1340	Tl 2 S 1	.19	300.0		2	3	3	U			214	ACTIVATION ENERGY.
1341	Tl 1 Cl 1	3.56	300.0		1	2	3	U			430	
1342	Tl 1 Cl 1	3.468	80.0		2	2	3	E			108	
1343	Tl 1 Cl 1	3.46	300.0		2	2	3	U			292	
1344	Tl 1 Cl 1	3.5	300.0		2	2	1	U			634	
1345	Tl 1 Se 1	.73	300.0	−4.50e−04	1	2	3	I I			505	
1346	Tl 1 Se 1	.57	.0	−3.90e−04	2	9	3	U			13	
1347	Tl 1 Se 1	.96	77.0	−4.50e−04	2	2	3	I I			505	
1348	Tl 1 Se 1	.67	300.0	−3.90e−04	2	3	3	U			13	
1349	Tl 1 Se 1	.7	300.0	−3.90e−04	2	2	3	U			13	
1350	Tl Se	.84	300.0		2	4	0	U			65	50 % SELENIUM.
1351	Tl 1 Se 1	.74	300.0		2	1	3	I I			345	
1352	Tl 1 Br 1	3.05	300.0		1	1	3	E			292	
1353	Tl 1 Br 1	3.115	4.2		2	2	3	D D			397	
1354	Tl 1 Br 1	3.073	80.0		2	2	3	E			108	
1355	Tl 1 Br 1	3.1	300.0		2	2	3	U	P		634	
1356	Tl 2 Te 3	.7	303.0	−2.68e−04	1	2	3	U			155	
1357	Tl 2 Te 1	.5	300.0		1	4	4	U			347	ACTIVATION ENERGY.
1358	Tl 2 Te 3	.69	250.0		2	4	3	U			156	
1359	Tl 2 Te 3	.48	77.0		2	4	3	U			432	
1360	Tl 2 Te 3	.2	300.0		2	4	0	U			222	
1361	Tl 1 I 1	2.67	300.0		1	2	3	U			689	ABSORPTION EDGE.
1362	Tl 1 I 1	2.88	4.7		2	2	2	E	EP		46	ORTHORHOMBIC.
1363	Pb 1 N 6	3.02	300.0		1	2	2	E			176	
1364	Pb 1 N 6	2.98	295.0		2	3	3	D D			177	
1365	Pb 1 O 1	1.936	300.0	−1.00e−04	1	2	3	I I		RED	644	TETRAGONAL.
1366	Pb 1 O 1	2.76	300.0	−1.00e−03	1	2	3	IAI	T	YELLOW	320	ORTHORHOMBIC, POLARIZED E ‖ B.
1367	Pb 1 O 1	2.84	300.0		1	2	3	DFI		RED	644	TETRAGONAL.
1368	Pb 2 O 3	1.67	300.0		1	2	4	U			353	ABSORPTION EDGE.
1369	Pb 1 O 2	1.7	300.0		1						445	B–PHASE, TETRAGONAL.
1370	Pb 1 O 2	2.	300.0		1						445	A–PHASE, ORTHORHOMBIC.
1371	Pb 3 O 4	2.12	300.0		1	2	4	U			353	ABSORPTION EDGE.
1372	Pb 1 O 1	2.88	4.2		2	2	3	I I		YELLOW	277	ORTHORHOMBIC.
1373	Pb 1 O 1	2.86	77.0		2	2	3	I I		YELLOW	277	ORTHORHOMBIC.
1374	Pb 1 O 1	2.66	300.0		2	2	3	I I		YELLOW	277	ORTHORHOMBIC.
1375	Pb 1 O 1	2.73	300.0	−1.00e−03	2	2	3	IFI	T	YELLOW	320	ORTHORHOMBIC. POLARIZED E ‖ A.
1376	Pb 1 O 2	1.4	300.0		2	2	2	U			445	B–PHASE, TETRAGONAL.
1377	Pb 1 O 2	1.45	300.0		2	2	2	U			445	A–PHASE, ORTHORHOMBIC.
1378	Pb 1 O 2	1.5	300.0		2						393	
1379	Pb 1 O 1	2.	300.0		2	2	2	U			550	
1380	Pb 1 O 2	2.	300.0		2						393	
1381	Pb 1 O 1	2.6	300.0		2	2	2	U			550	
1382	Pb 1 O 1	2.73	300.0		2	1	4	U			611	
1383	Pb 1 O 1	3.18	300.0		2	8	2	D I	EPT	RED	377	
1384	Pb 1 O 1	3.36	300.0		2	8	2	D I	EPT	YELLOW	377	

Energy band gaps in elemental and binary compound semiconductors and insulators—Continued

Entry No.	1 2 3 4 Compound	E(g) (eV)	Temp. (Kelvin)	dE/dT (eV/Deg)	R	By	On	Tr	Effect	Color	Ref	Comment
1385	Pb 1 F 2		.0		2					COLORLESS	43	K(LO) = 26.30, K(HI) = 2.99.
1386	Pb 1 S 1	.41	300.0		1	1	1	D D			163	
1387	Pb 1 S 1	.286	4.2		2	6	1	D D			163	
1388	Pb 1 S 1	.307	77.0		2	6	1	D D			163	
1389	Pb 1 S 1	.285	300.0		2	1	3	D D			484	
1390	Pb 1 S 1	.44	373.0		2	1	1	D D			163	
1391	Pb 1 S 1	.281	4.2		2	8	3	U	L		314	
1392	Pb 1 S 1	.3	77.0		2	8	3	U	L		139	
1393	Pb 1 S 1	.37	300.0		2	2	3	I I			549	
1394	Pb 1 S 1	.41	300.0		2	2	3	D I			549	
1395	Pb 1 S 1	.307	77.0		2	6	1	D D			487	
1396	Pb 1 Cl 2	3.82	300.0		1	2	3	U			652	
1397	Pb 1 Cl 2	3.94	300.0		2	2	3	U	PT		689	ABSORPTION EDGE.
1398	Pb 1 Cl 2	4.1	300.0		2	1	4	U			611	
1399	Pb 1 Se 1	.27	300.0		1	1	1	D D			702	
1400	Pb 1 Se 1	.165	4.2	4.10e−04	2	6	3	D D		GREY	450	
1401	Pb 1 Se 1	.165	4.2		2	6	1	D D			163	
1402	Pb 1 Se 1	.165	77.0	4.50e−04	2	2	1	U			595	
1403	Pb 1 Se 1	.176	77.0	4.10e−04	2	6	3	D D		GREY	450	
1404	Pb 1 Se 1	.176	77.0		2	6	1	D D			163	
1405	Pb 1 Se 1	.26	300.0		2	2	3	I I			549	
1406	Pb 1 Se 1	.27	300.0		2	1	1	D D			163	
1407	Pb 1 Se 1	.275	300.0	4.50e−04	2	2	1	U			595	
1408	Pb 1 Se 1	.29	300.0		2	2	3	D I			549	
1409	Pb 1 Se 1	.31	373.0		2	1	1	D D			163	
1410	Pb 1 Se 1	.14	4.2		2	8	3	U	L		314	
1411	Pb 1 Br 2	3.2	300.0		1	2	3	U			652	ABSORPTION EDGE.
1412	Pb 1 Br 2	3.5	77.0		2	2	3	U			652	ABSORPTION EDGE.
1413	Pb 1 Br 2	3.23	300.0		2	2	4	U		COLORLESS	689	ABSORPTION EDGE.
1414	Pb 1 Br 2	3.31	300.0		2	1	4	U			611	
1415	Pb 1 Te 1	.31	300.0		1	1	1	D D			163	
1416	Pb 1 Te 1	.185	.0		2	3	3	D D		WHITE	389	
1417	Pb 1 Te 1	.19	.0	4.10e−04	2	2	3	IAI			613	
1418	Pb 1 Te 1	.19	4.2		2	6	1	D D			163	
1419	Pb 1 Te 1	.21	77.0		2	1	3	I I	EPT		129	
1420	Pb 1 Te 1	.21	77.0	4.85e−04	2	3	3	D D		WHITE	389	
1421	Pb 1 Te 1	.217	77.0		2	6	1	D D			163	
1422	Pb 1 Te 1	.19	300.0		2	1	3	D D			484	
1423	Pb 1 Te 1	.29	300.0		2	1	3	I I	EPT		129	
1424	Pb 1 Te 1	.31	300.0	4.85e−04	2	3	3	D D		WHITE	389	
1425	Pb 1 Te 1	.34	373.0		2	1	1	D D			163	
1426	Pb 1 Te 1	.191	4.2		2	8	3	U	L		314	
1427	Pb 1 Te 1	.29	300.0		2	2	3	I I			549	
1428	Pb 1 Te 1	.32	300.0		2	2	3	D I			549	
1429	Pb 1 I 2	2.32	300.0		1	2	3	U			189	
1430	Pb 1 I 2	2.41	.0		2	8	3	U	P		190	
1431	Pb 1 I 2	2.535	.0	−9.95e−04	2	2	3	U			189	
1432	Pb 1 I 2	3.01	.0		2	2	3	E			627	
1433	Pb 1 I 2	2.32	300.0		2	2	3	U	P	YELLOW	689	
1434	Pb 1 I 2	2.36	300.0		2	1	4	U			611	
1435	Bi 2 O 3	2.6	300.0		1	2	2	I I			241	
1436	Bi 2 O 3	2.91	300.0		1	2	2	D I			241	
1437	Bi 2 O 3	3.1	77.0	−1.10e−03	2	2	2	U			431	
1438	Bi 2 O 3	2.15	300.0		2	4	2	D D			241	
1439	Bi 2 O 3	2.58	300.0	−1.00e−03	2	3	2	IAI			242	
1440	Bi 2 O 3	2.85	300.0	−1.10e−03	2	2	2	U			431	
1441	Bi 2 O 3	2.86	300.0		2	1	4	U			611	
1442	Bi 2 O 3	2.07	400.0	−1.10e−03	2	4	2	U			431	
1443	Bi 2 O 3	2.85	300.0	−1.40e−03	2	3	2	D I			242	
1444	Bi 1 F 3		.0		2					GREY	386	K(LO) = 20.00, K(HI) = .00.
1445	Bi 2 S 3	1.2	300.0	−8.00e−04	1	2	3	U			237	
1446	Bi 2 S 3	1.4	77.0	−8.00e−04	2	2	3	U			237	
1447	Bi 2 S 3	1.3	293.0		2	2	4	U			575	
1448	Bi 2 S 3	.72	300.0		2	4	2	U			237	
1449	Bi 2 S 3	1.3	300.0		2	2	4	U			85	
1450	Bi 2 Se 3	.21	300.0	−1.00e−04	1	2	3	U			243	
1451	Bi 2 Se 3	.4	77.0	−2.00e−04	2	2	3	U			85	
1452	Bi 2 Se 3	.35	293.0		2	2	3	U			575	
1453	Bi 2 Se 3	.35	300.0	−2.00e−04	2	2	3	U			85	
1454	Bi 2 Se 3	.161	300.0		2	2	3	I I			260	
1455	Bi 1 Br 3	2.66	300.0		1	2	4	U			689	ABSORPTION EDGE, PRESSURE DEPENDENCE OF.
1456	Bi 1 Sb 1	.023	4.2		2	7	0	U			620	15 % ANTIMONY.
1457	Bi Sb	.008	80.0		2	8	3	U			685	3 % ANTIMONY.
1458	Bi Sb	.022	80.0		2	8	3	U			685	10 % ANTIMONY.
1459	Bi Sb	.024	300.0		2	8	3	U			110	15 % ANTIMONY.
1460	Bi Sb	.007	300.0		2	4	3	U			329	8 % ANTIMONY.
1461	Bi Sb	.007	300.0		2	4	3	U			329	30 % ANTIMONY.
1462	Bi Sb	.008	300.0		2	4	3	U			329	20 % ANTIMONY.
1463	Bi Sb	.01	300.0		2	4	3	U			329	15 % ANTIMONY.

Energy band gaps in elemental and binary compound semiconductors and insulators—Continued

Entry No.	1 2 3 4 Compound	5 E(g) (eV)	6 Temp. (Kelvin)	7 dE/dT (eV/Deg)	8 R	9 By	10 On	11 Tr	12 Effect	13 Color	14 Ref	15 Comment
1464	Bi Sb	.01	300.0		2	4	3	U			329	9 % ANTIMONY.
1465	Bi Sb	.011	300.0		2	4	3	U	P		191	8 % ANTIMONY.
1466	Bi Sb	.012	300.0		2	4	3	U			329	10 % ANTIMONY.
1467	Bi 1 Sb 1	.014	300.0		2	7	3	U			621	10 % ANTIMONY.
1468	Bi Sb	.014	300.0		2	4	3	U			329	12 % ANTIMONY.
1469	Bi Sb	.015	300.0		2	4	3	U	P		191	10 % ANTIMONY.
1470	Bi Sb	.018	300.0		2	4	3	U	P		191	13 % ANTIMONY.
1471	Bi 1 Sb 1	.022	300.0		2	7	3	U			621	15 % ANTIMONY.
1472	Bi 2 Te 3	.145	300.0	−1.00e−04	1	2	3	I I			260	
1473	Bi 2 Te 3	.15	.0		2	4	3	U			558	
1474	Bi 2 Te 3	.13	300.0	−9.50e−05	2	2	3	I I			41	
1475	Bi 2 Te 3	.14	300.0		2	4	3	U			558	
1476	Bi 2 Te 3	.16	.0	−9.00e−05	2	4	3	U			85	
1477	Bi 2 Te 3	.15	300.0	−9.00e−05	2	2	3	U			85	
1478	Bi 2 Te 3	.153	300.0		2	4	3	U			387	
1479	Bi 2 Te 3	.171	300.0		2	4	3	U			400	
1480	Bi 2 Te 3	.2	300.0		2	8	3	U			545	
1481	Bi 1 I 3	1.73	293.0	−9.20e−04	1	2	3	I I	P		646	
1482	Bi 1 I 3	2.195	293.0		1			D I			647	
1483	Bi 1 I 3	2.03	.0	−3.50e−04	2	2	3	D D			631	
1484	Bi 1 I 3	2.029	20.4	−9.20e−04	2	2	3	I I	P		646	
1485	Bi 1 I 3	1.922	85.0	−9.20e−04	2	2	3	I I	P		646	
1486	Bi 1 I 3	1.81	295.0		2	2	3	D D			220	
1487	Bi 1 I 3	1.93	300.0	−3.50e−04	2	2	3	D D			631	
1488	Bi 1 I 3	2.52	.0		2	4	4	U			220	
1489	Bi	.015	4.2		1	7	3	U			114	
1490	Bi	.024	4.2		2	6	3	D D			208	
1491	Bi	.006	77.4		2	4	0	U			582	VALUE AT 15 KBAR, METALLIC AT TEMPERATURES ABOVE 150 deg. k.
1492	Th 1 C 1		9.0		2	0	0	U			149	SUPERCONDUCTOR.
1493	Th 1 O 2	5.75	300.0		1						529	
1494	Th 1 O 2	3.5	300.0		1	2	2	U	PT	WHITE	91	
1495	Th 1 O 2	2.56	300.0		2	4	0	U			671	
1496	Th 1 O 2	3.3	300.0		2	2	3	U		RED	167	ABSORPTION EDGE.
1497	Th 1 O 2	5.02	300.0		2	2	3	U			62	ABSORPTION EDGE.
1498	Th 1 O 2	3.2	000.0		2	4	4	U			166	ACTIVATION ENERGY.
1499	Th 1 O 2	3.3	300.0		2	1	4	U			659	
1500	U O	1.5	300.0		1	4	4	U			704	U3−O8.
1501	U 1 O 2	2.18	300.0		1	2	3	U			20	
1502	U O	.6	473.0		2	4	4	U			705	U1−O2.
1503	U 1 O 2	1.3	100.0		2	4	4	U			460	ACTIVATION ENERGY.
1504	U 1 P 2		300.0		2	4	3	U			289	

Bibliographic References

1 Abagyan, S. A.; Subashiev, V. K.: Sov. Phys.–Solid State, 6, 2529 (1965).
2 Abdullaev, G. B.; Aliyarova, Z. A.; Asadov, G. A.: Phys. Status Solidi, 21, 461 (1967).
3 Abdullaev, G. B.; Guseinova, E. S.; Tagiev, B. G.: Phys. Status Solidi, 20, 421 (1967).
4 Abraham, A.: Czech. J. Phys., 15, 138 (1965).
5 Abrikosov, N. K.; Tomtiev, D. S.; Shakhtakhtinskii, M. G.; Kuliev, A. A.: Inorg. Mater., 2, 4 (1966).
6 Abrikosov, N. K.; Zargaryan, V. S.: Inorg. Mater., 3, 251 (1967).
7 Abrikosov, N. K.; Zobnina, A. N.: Compounds of Tellurium and Antimony with Iodine, All Union Conference on Semiconductor Materials, Proceedings of the 4th, Abrikosov, N. K., 88–99, Consultants Bureau, New York (1961).
8 Adachi, E.: J. Phys. Soc. Jap., 24, 1178 (1968).
9 Adanowica, W.; Wojakowski, A.: Phys. Status Solidi, 16, K129 (1966).
10 Adirovich, E. I.; Goldshtein, I. M.: Sov. Phys.–Semicond., 3, 194 (1969).
11 Adler, D.: Rev. Mod. Phys., 40, 714 (1968).
12 Akhundov, G. A.; Abdullayev, G. B.; Aliyeva, M. K.; Efetdinov, G. A.: Preparation and Investigation of the Semiconducting Compounds AgTe, AgSe, SnTe, and CdTe, All Union Conference on Semiconductor Materials, Proceedings of the 4th, 83–84, Abriksov, N. K., Consultants Bureau, New York.
13 Akhundov, G. A.; Abdullayev, G. B.; Guseinov, G. D.; Mekhtiev, R. F.; Aliyeva, M. K.: Preparation and Investigation of A III B VI Single Crystals, Physics of Semiconductors, Proceedings of the 7th International Conference, 1277–1282, Dunod, Academic Press, New York and London (1964).
14 Akhundov, G. A.; Aksyanov, I. G.; Gasumov, G. M.: Sov. Phys.–Semicond., 3, 767 (1969).
15 Akhundov, G. A.; Kerimova, T. G.; Gasanova, N. A.: Sov. Phys.–Semicond., 3, 85 (1969).
16 Aleshin, V. G.; Smirnov, V. P.; Gantsevich, B. V.: Sov. Phys.–Solid State, 10, 2282 (1969).
17 Ali, M.; Fridman, M.; Denayer, M.; Nagels, P.: Phys. Status Solidi, 28, 193 (1968).
18 Alpert, Y.; Rigaux, C.: Solid State Commun., 5, 391 (1967).
19 Altwein, M.; Finkenrath, H.; Konak, C.; Stuke, J.; Zimmerer, G.: Phys. Status Solidi, 29, 203 (1968).
20 Amelenckx, S.: Physical Properties of Uranium Dioxide Single Crystals, Rept. No. 814, Contract No. 063–61–10, N65–30646, 58p, European Atomic Energy Community (1963).
21 Anderson, D. E.; Laponsky, A. B.; Peria, W. T.: Contract AF 33(657)–10475, IR–3, AD–439716, 254p, Wright–Patterson AFB, Ohio, Electron. Technol. Lab.
22 Andrellos, J. C.: Solid–State Electron., 5, 414 (1962).
23 Andres, K.; Kuebler, N. A.; Robin, M. B.: J. Phys. Chem. Solids, 27, 1747 (1966).
24 Andriyashik, M. V.; Sakhnovskii, M. Y.; Timofeev, V. B.; Yakimova, A. S.: Phys. Status Solidi, 28, 277 (1968).
25 Antonini, J. F.; Brun, R.: Nuovo Cimento, 35, 956 (1965).
26 Antonova, E. A.; Vorobev, V. G.; Kalyuzhnaya, G. A.; Sobolev, V. V.: Sov. Phys.–Semicond., 3, 777 (1969).
27 Aoyagi, K.; Misu, A.; Kuwabara, G.; Nishina, Y.; Kurita, S.; Fukuroi, T.; Akimoto, O.; Hasegawa, H.; Shinada, M.; Sugano, S.: J. Phys. Soc. Jap., Suppl., 21, 174 (1966).
28 Apker, L.; Taft, E. A.: Phys. Rev., 88, 58 (1952).
29 Appel, J.: Z. Naturforsch., 10a, 530 (1955).
30 Arai, T.: J. Phys. Soc. Jap., 15, 916 (1960).
31 Arakawa, E. T.; Williams, M. W.: J. Phys. Chem. Solids, 29, 735 (1968).
32 Aramu, F.; Manca, P.: Nuovo Cimento, 33, 1025 (1964).
33 Archer, R. J.; Koyama, R. Y.; Loebner, E. E.; Lucas, R. C.: Phys. Rev. Lett., 12, 538 (1964).
34 Arlt, G.; Schweppe, H.: Solid State Commun., 6, 783 (1968).
35 Asanabe, S.; Okazaki, A.: J. Phys. Soc. Jap., 15, 989 (1960).
36 Au–Yang, M. Y.; Cohen, M. L.: Phys. Rev., 178, 1358 (1969).
37 Audzionis, A. I.; Batarunas, J.; Karpus, A. S.; Kudzmauskas, S.: Litov. Fiz. Sb., 5, 481 (1965).
38 Audzionis, A. I.; Karpus, A. S.: Sov. Phys.–Solid State, 11, 859 (1969).
39 Aulich, E.; Brebner, J. L.; Mooser, E.: Phys. Status Solidi, 31, 129 (1969).
40 Austin, I. G.; Springthorpe, A. J.; Smith, B. A.: Phys. Lett., 21, 20 (1966).
41 Austin, I. G.: Proc. Phys. Soc., London, 72, 545 (1958).
42 Aven, M.; Marple, D. T.; Segall, B.: J. Appl. Phys., Suppl. 32, 2261 (1961).
43 Axe, J. D.; Gaglianello, J. W.; Scardefield, J. E.: Phys. Rev., 139, A1211 (1965).
44 Azizov, T. K.: Izv. Akad. Nauk Azerb. SSR, Fiz.–Tekh. Mat. Nauk, 3, 26 (1968).
45 Bachrach, R. Z.: Phys. Lett., 30a, 318 (1969).
46 Bachrach, R. Z.: Solid State Commun., 7, 1023 (1969).
47 Baer, W. S.: J. Phys. Chem. Solids, 28, 677 (1967).
48 Baer, Y.; Busch, G.; Frohlich, C.; Steigmeier, E.: Z. Naturforsch., 17a, 886 (1962).
49 Bagaev, V. S.; Paduchikh, L. I.: Sov. Phys.–Solid State, 11, 1832 (1970).
50 Bagduev, G. B.; Adzhimuradov, Z. A.: Sov. Phys.–Semicond., 2, 1533 (1969).
51 Bahl, S. K.; Chopra, K. L.: J. Appl. Phys., 41, 2196 (1970).
52 Bahl, S. K.; Chopra, K. L.: J. Vac. Sci. Technol., 6, 561 (1969).
53 Bailey, L. G.: J. Phys. Chem. Solids, 27, 1593 (1966).
54 Baldini, G.; Bosacchi, B.: Phys. Rev., 166, 863 (1968).
55 Baldini, G.; Bosacchi, B.: Phys. Status Solidi, 38, 325 (1970).
56 Baldini, G.; Pollini, I.; Spinolo, G.: Phys. Status Solidi, 27, 95 (1968).
57 Balkanski, M.; Aziza, A.; Amzallag, E.: Phys. Status Solidi, 31, 323 (1969).
58 Balkanski, M.; Waldron, R. D.: Phys. Rev., 112, 123 (1958).
59 Barbe, D. F.; Herman, D. S.: J. Appl. Phys., 41, 3116 (1970).
60 Bashuk, R. P.; Bilen'Kii, B. F.; Pashkovs'Kii, M. V.: Ukr. Fiz. Zh., 11, 430 (1966).
61 Basov, N. G.; Bogdankevich, O. V.; Pechenov, A. N.; Abdulaev, G. B.; Akhundov, G. A.; Salaev, E. Y.: Sov. Phys.–Dokl., 10, 329 (1965).
62 Bates, J. L.: Absorption Spectra of Thorium Dioxide, Contract AT(45–1)–1830, Dep. CFSTI, 16p, Battelle–Northwest, Richland, Washington, Pacific Northwest Lab. (July, 1967).
63 Batsanov, S. S.; Derbeneva, S. S.; Shestakova, N. A.: Inorg. Mater., 2, 1945 (1966).
64 Becker, W. M.; Ramdas, A. K.; Fan, H. Y.: J. Appl. Phys., Suppl. 32, 2094 (1961).
65 Belashchenko, D. K.; Magidson, I. A.; Lyapunova, L. G.: Izv. Vyssh. Ucheb. Zaved., Tsvet. Met., 9, 82 (1966).
66 Belle, M. L.; Gasanova, N. A.: Opt. Spectrosc., 18, 412 (1965).
67 Belle, M. L.; Kolomiets, B. T.; Pavlov, B. V.: Sov. Phys.–Semicond., 2, 1210 (1969).
68 Bendoraitis, J. G.; Salomon, R. E.: J. Phys. Chem., 69, 3666 (1965).
69 Benoit a La Guillaume, C.; Debever, J. M.: C. R. Acad. Sci., 259, 2200 (1964).
70 Benoit a La Guillaume, C.; Debever, J. M.: Solid State Commun., 2, 145 (1964).
71 Benoit a La Guillaume, C.; Debever, J. M.: Solid State Commun., 3, 19 (1965).
72 Benoit a La Guillaume, C.; Lavallard, P.: Radiative Recombination in Indium Antimonide, Report of the International Conference on the Physics of Semiconductors, the Institute of Physics and the Physical Society, London (1962).
73 Borcha, D. M.; Borets, A. N.; Stakhyra, I. M.; Tovstyuk, K. D.: Phys. Status Solidi, 21, 769 (1967).
74 Berglund, C. N.; Guggenheim, H. J.: Phys. Rev., 185, 1022 (1969).
75 Berreman, D. W.; Unterwald, F. C.: Phys. Rev., 174, 791 (1968).
76 Bertulis, K.; Tolutis, V.: Lietuvos Tsr Aukstosios Mokyklos, 4, 381 (1964).
77 Bertulis, K.; Tolutis, V.: Lietuvos Tsr Aukstosius Mokyklos, 5, 387 (1965).
78 Beun, J. A.; Goldsmith, G. J.: Helv. Phys. Acta, 33, 508 (1960).
79 Bevan, D. J.; Shelton, J. P.; Anderson, J. S.: J. Chem. Soc., 1729 (1948).
80 Bilen'Kii, B. F.; Dovgii, Y. O.: Ukr. Fiz. Zh., 11, 1109 (1966).
81 Birkholz, U.; Schelm, J.: Phys. Status Solidi, 27, 413 (1968).
82 Birkholz, U.; Schelm, J.: Phys. Status Solidi, 34, K177 (1969).
83 Bishop, S. G.; Moore, W. J.; Swiggard, E. M.: Appl. Phys. Lett., 15, 12 (1969).
84 Bishop, S. G.; Moore, W. J.; Swiggard, E. M.: Appl. Phys. Lett., 16, 459 (1970).
85 Black, J.; Conwell, E. M.; Seigle, L.; Spencer, C. W.: J. Phys. Chem. Solids, 2, 240 (1957).
86 Blechschmidt, D.; Klucker, R.; Skibowski, M.: Phys. Status Solidi, 36, 625 (1969).
87 Bleha, W. P.: Photoluminescent Properties of Vacuum Deposited Cadmium Sulfide Films, Rept. No. R454, Contract DAAB 07–67–C 0199, 147p, Coord. Sci. Lab., University of Illinois, Urbana, Illinois (January, 1970).
88 Bleha, W. P.: Photoluminescent Properties of Vacuum Deposited Cadmium Sulfide Films, Rept. No. R454, Contract DAAB 07–67–C– 0199, 147p, Coord. Sci. Lab., University of Illinois, Urbana, Illinois (January, 1970).
89 Blum, F. A.; Deaton, B. C.: Phys. Rev., 137, A1410 (1965).

90 Blunt, R. F.; Frederikse, H. P. R.; Hosler, W. R.: Phys. Rev., 100, 663 (1955).
91 Bodine, J. H.; Thiess, F. B.: Bull. Amer. Phys. Soc., 30, 9 (1955).
92 Bodo, Z.; Hevesi, I.: Phys. Status Solidi, 20, K45 (1967).
93 Bogdankevich, O. V.; Zverev, M. M.; Krasilnikov, A. I.; Pechenov, A. N.: Phys. Status Solidi, 19, K5 (1967).
94 Bogoroditskii, N. P.; Pasynkov, V. V.; Basili, R. R.; Volokobinskii, Y. M.: Sov. Phys.–Dokl., 10, 85 (1965).
95 Borchert, W.; Dietz, W.; Herrmann, H.: Z. Angew. Phys., 19, 485 (1965).
96 Borisov, B. S.; Koretskaya, S. T.; Mokerov, V. G.; Rakov, A. V.; Solov'Ev, S. G.: Sov. Phys.–Solid State, 12, 1763 (1971).
97 Bosomworth, D. R.: Phys. Rev., 157, 709 (1967).
98 Brahms, S.; Cardona, M.: Solid State Commun., 6, 733 (1968).
99 Brahms, S.; Nikitine, S.; Dahl, J. P.: Phys. Lett., 22, 31 (1966).
100 Braner, A. A.; Chen, R.: Phys. Chem. Solids, 24, 135 (1963).
101 Bransky, I.; Tallan, N. M.; Hed, A. Z.: J. Appl. Phys., 41, 1787 (1970).
102 Bransky, I.; Tallan, N. M.: J. Chem. Phys., 49, 1243 (1968).
103 Brau, M. J.: Semiannual Technical Summary Report for Long Wavelength Intrinsic Materials Research, Report No. 06–66–24, Contract No. 33–615–3218, AD 482–422, Texas Instruments Inc. (August, 1965–February, 1966).
104 Brebner, J. L.; Fischer, G.: Can. J. Phys., 41, 561 (1963).
105 Brebner, J. L.; Fischer, G.: Optical Properties of the Layered Structures GaTe, GaSe, GaS, Report of the International Conference on the Physics of Semiconductors, the Institute of Physics and the Physical Society, London (1962).
106 Breckenridge, R. G.: Thermoelectric Materials, Final Rept., Contract No. Norrs–77066, ASTIA AD–294–688, Union Carbide Corp. Parma Res. Lab. (January, 1959–July, 1960).
107 Brice, J. C.; Newman, P. C.; Wright, H. C.: Brit. J. Appl. Phys., 9, 110 (1958).
108 Brothers, A. D.; Lynch, D. W.: Phys. Rev., 180, 911 (1969).
109 Brown, D. M.; Gray, P. V.; Heumann, F. K.; Philipp, H. R.; Taft, E. A.: J. Electrochem. Soc., 115, 311 (1968).
110 Brown, D. M.; Silverman, S. J.: Phys. Rev., 136, A290 (1964).
111 Brown, F. C.; Masumi, T.; Tippins, H. H.: J. Phys. Chem. Solids, 22, 101 (1961).
112 Brown, F. C.: Electronic Properties of the Alkali Silver and Thallium Halides, University of Illinois, Department of Physics, Urbana, Illinois, International Conference on Nonmetallic Crystal, New Delhi, India (January, 1969).
113 Brown, F. C.: J. Phys. Chem., 66, 2368 (1962).
114 Brown, R. N.; Mavroides, J. G.; Lax, B.: Phys. Rev., 129, 2055 (1963).
115 Bruck, A.; Tannhauser, D. S.: J. Appl. Phys., 37, 3647 (1966).
116 Brungs, R. A.; Jacobsmeyer, V. P.: J. Phys. Chem. Solids, 25, 701 (1964).
117 Rube, R. H.; Lind, E. I.: Phys. Rev., 115, 1159 (1959).
118 Bube, R. H.: Phys. Rev., 106, 703 (1957).
119 Budenstein, P. P.: Breakdown in Thin Films of Silicon Monoxide, Magnesium Fluoride, Calcium Fluoride, Cerium Fluoride, Cerium Dioxide and Teflon, N68–17300, University of Auburn, Alabama Phys. Dept. (February, 1968).
120 Burdukov, Y. M.; Zotova, N. V.; Khalilov, K. A.: Sov. Phys.–Semicond., 4, 138 (1970).
121 Burke, J. R.; Riedl, H. R.: Phys. Rev., 184, 830 (1969).
122 Busch, G.; Frohlich, C.; Hulliger, F.; Steigmeier, E.: Helv. Phys. Acta, 34, 359 (1961).
123 Busch, G.; Hulliger, F.; Winkler, U.: Helv. Phys. Acta, 27, 249 (1954).
124 Busch, G.; Junod, P.; Katz, U.; Winkler, U.: Helv. Phys. Acta, 27, 193 (1954).
125 Busch, G.; Wachter, P.: Z. Angew. Phys., 26, 1 (1968).
126 Bylander, E. G.: Electro–Technol., 72, 123 (1963).
127 Canina, V. G.: C. R. Acad. Sci., 248, 1488 (1959).
128 Cardona, M.; Greenaway, D. L.: Phys. Rev., 131, 98 (1963).
129 Cardona, M.; Greenaway, D. L.: Phys. Rev., 133, A1685 (1964).
130 Cardona, M.; Harbeke, G.: Optical Properties of Wurtzite–Type Crystals in the Fundamental Absorption Region, Physics Of Semiconductors, Proceedings of the 7th International Conference, P. 217, Dunod, Academic Press, New York and London (1964).
131 Cardona, M.; Pollak, F. H.; Shaklee, K. L.: Phys. Rev. Lett., 16, 644 (1966).
132 Cardona, M.; Shaklee, K. L.; Pollak, F. H.: Phys. Rev., 154, 696 (1967).
133 Cardona, M.: J. Appl. Phys., Suppl. 32, 2151 (1961).
134 Cardona, M.: Phys. Rev., 129, 69 (1963).
135 Caspari, M. E.: Properties of Semiconductors, Quarterly Scientific Report No. 5, Contract No. AF–33–616–3376, ASTIA AD–209–883, University of Pennsylvania (March, 1958–May, 1958).
136 Caspari, M. E.: Properties of Semiconductors, Quarterly Scientific Report No. 6, Contract No. AF–33–616–3376, ASTIA AD–209–805, University of Pennsylvania (June, 1958–August, 1958).
137 Chandrashekhar, G. V.; Mehrotra, P. N.; Subba Rao, G. V.; Subbarao, E. C.; Rao, C. N.: Trans. Faraday Soc., 63, 1295 (1967).
138 Chandrashekhar, G. V.; Won Choi, Q.; Moyo, J.; Honig, J. M.: Mater. Res. Bull., 5, 999 (1970).
139 Chashchin, S. P.; Aver'Yanov, I. S.; Baryshev, N. S.; Kudryashov, V. A.; Markina, N. P.; Shuba, Y. A.: Sov. Phys.–Semicond., 3, 1055 (1970).
140 Chevillot, J. P.; Brenet, J.: C. R. Acad. Sci., 248, 776 (1959).
141 Choyke, W. J.; Hamilton, D. R.; Patrick, L.: Phys. Rev., 133, A1163 (1964).
142 Choyke, W. J.; Patrick, L.: Absorption of Light in Alpha Silicon Carbide Near the Band Edge, Silicon Carbide, a High Temperature Semi–Conductor, Proc., O'Connor, J. R. 3 Smiltens, J., 306–311, Pergamon Press, New York (1960).
143 Chrenko, R. M.; Rodbell, D. S.: Phys. Lett., 24a, 211 (1967).
144 Clark, C. D.; Dean, P. J.; Harris, P. V.: Proc. Roy. Soc., London, 277, 312 (1964).
145 Clerc, H. G.; Wallis, G.: Z. Naturforsch., 11a, 1040 (1956).
146 Cline, C. F.; Stephens, D. R.: J. Appl. Phys., 36, 2869 (1965).
147 Companion, A. L.: J. Phys. Chem. Solids, 25, 357 (1964).
148 Connell, G. A.; Wilson, J. A.; Yoffe, A. D.: J. Phys. Chem. Solids, 30, 287 (1969).
149 Costa, P.; Lallement, R.: Phys. Lett., 7, 21 (1963).
150 Cox, G. A.; Cummins, D. O.; Kawabe, K.; Tredgold, R. H.: J. Phys. Chem. Solids, 28, 543 (1967).
151 Coyne, H. J.; Tauber, R. N.: J. Appl. Phys., 39, 5585 (1968).
152 Crawford, J. A.; Vest, R. W.: J. Appl. Phys., 35, 2413 (1964).
153 Cronemeyer, D. C.: Phys. Rev., 87, 876 (1952).
154 Crowther, P. A.; Dean, P. J.: J. Phys. Chem. Solids, 28, 1113 (1967).
155 Cruceanu, E.; Sladaru, St.; Botila, T.: Phys. Status Solidi, 30, K149 (1968).
156 Cruceanu, E.; Sladaru, St.: J. Mater. Sci., 4, 410 (1969).
157 Cueilleron, J.; Hillel, R.: Bull. Soc. Chim. Fr., 2973 (1967).
158 Cutler, M.: High Temperature Broad Band Semiconductors, Gacd–2741, Contract No. NOBS–77144, ASTIA AD–275–127, Gen. Dynamics Corp., Gen. Atomic Div. (July–September, 1961).
159 D'Amboise, M.; Handfield, G.; Bourgon, M.: Can. J. Chem., 46, 3545 (1968).
160 Dalven, R.; Gill, R.: Phys. Rev., 143, 666 (1966).
161 Dalven, R.; Gill, R.: Phys. Rev., 159, 645 (1967).
162 Dalven, R.: Bull. Amer. Phys. Soc., 14, 1165 (1969).
163 Dalven, R.: Infrared Phys., 9, 141 (1969).
164 Dalven, R.: Phys. Rev. Lett., 16, 311 (1966).
165 Damon, D. H.; Miller, R. C.; Sagar, A.: Phys. Rev., 138, A636 (1965).
166 Danforth, W. E.; Morgan, F. H.: Phys. Rev., 79, 142 (1950).
167 Danforth, W. E.: Studies in Mixed Conduction in Solids, Contract No. DA 36–034–ORD–1487rd, ASTIA AD–110–902, Franklin Inst., Barton Res. Foundation (August, 1956).
168 Daunois, A.; Deiss, J. L.; Nikitine, S.: Phys. Lett., 28a, 274 (1968).
169 Dawson, D. K.; Creamer, R. H.: Brit. J. Appl. Phys., 16, 1643 (1965).
170 De'Munari, G. M.; Guisiano, F.; Mambriani, G.: Phys. Status Solidi, 29, 341 (1968).
171 Deb, S. K.; Chopoorian, J. A.: J. Appl. Phys., 37, 4818 (1966).
172 Deb, S. K.; Yoffe, A. D.: Proc. Roy. Soc., Ser. A, 256, 514 (1960).
173 Deb, S. K.: Proc. Roy. Soc., Ser. A, 304, 211 (1968).
174 Deb, S. K.: Trans. Faraday Soc., 62, 3032 (1966).
175 Deb, S. K.: Trans. Faraday Soc., 65, 3074 (1969).
176 Deb, S. K.: Trans. Faraday Soc., 65, 3187 (1969).
177 Dedman, A. J.; Lewis, T. J.: Trans. Faraday Soc., 62, 881 (1966).
178 Denham, P.; Lightowlers, E. C.; Dean, P. J.: Phys. Rev., 161, 762 (1967).
179 Didchenko, R.; Gortsema, F. P.: J. Phys. Chem. Solids, 24, 863 (1963).
180 Dimmock, J. O.; Melngailis, I.; Strauss, A. J.: Phys. Rev. Lett., 16, 1193 (1966).
181 Dismukes, J. P.; White, J. G.: Inorg. Chem., 3, 1220 (1964).
182 Domingo, G.; Itoga, R. S.; Kannewurf, C. R.: Phys. Rev., 143, 536 (1966).

183 Dovgii, Y. O.; Pidzyrailo, N. S.; Brilinskii, M. I.; Kudryavets, S. P.: Ukr. Fiz. Zh., 14, 1804 (1969).
184 Doyle, W. P.: Phys. Chem. Solids, 4, 144 (1958).
185 Dresselhaus, M. S.; Mavroides, J. G.: Phys. Rev. Lett., 14, 259 (1965).
186 Druilhe, R.; Suchet, J. P.: Czech. J. Phys. B, 17, 337 (1967).
187 Dudkin, L. D.; Vaidanich, V. I.: Sov. Phys.–Solid State, 2, 1384 (1961).
188 Duffy, M. T.; Wang, C. C.; Waxman, A.; Zaininger, K. H.: J. Electrochem. Soc., 116, 234 (1969).
189 Dugan, A. E.; Henisch, H. K.: J. Phys. Chem. Solids, 28, 1885 (1967).
190 Dugan, A. E.; Henisch, H. K.: Phys. Rev., 171, 1047 (1968).
191 Dugue, M.: Phys. Status Solidi, 11, 149 (1965).
192 Duncanson, A.; Stevenson, R. W. H.: Proc. Roy. Soc. London, 72, 1001 (1958).
193 Dzhamagidze, S. Z.; Shvangiradze, R. R.; Mal'Tsev, Y. A.; Gvilava, M. F.: Sov. Phys.–Solid State, 7, 1259 (1965).
194 Dzhanelidze, R. B.; Purtseladze, I. M.; Khitarishvili, L. S.; Chikovani, R. I.; Shkol'Nik, A. L.: Sov. Phys.–Solid State, 7, 2082 (1966).
195 Dzhioeva, S. G.; Ivanov, V. S.; Stopachinskii, V. B.: Sov. Phys.–Semicond., 3, 1096 (1970).
196 Eastman, D. E.; Holtzberg, F.; Methfessel, S.: Phys. Rev. Lett., 23, 226 (1969).
197 Ebina, A.; Koda, T.; Shionoya, S.: J. Phys. Chem. Solids, 26, 1497 (1965).
198 Eby, J. E.; Teegarden, K. J.; Dutton, D. B.: Phys. Rev., 116, 1099 (1959).
199 Edmond, J. T.: Brit. J. Appl. Phys., 17, 979 (1966).
200 Edwards, J.; Kawabe, K.; Stevens, G.; Tredgold, R. H.: Solid State Commun., 3, 99 (1965).
201 Efendiev, G. K.; Karaev, Z. S.; Nasibov, I. O.: Bull. Acad. Sci. USSR, Phys. Ser., 28, 1004 (1964).
202 Efstathiou, A.; Hoffman, D. M.; Levin, E. R.: J. Vac. Sci. Technol., 6, 383 (1969).
203 Efstathiou, A.; Levin, E. R.: J. Opt. Soc. Amer., 58, 373 (1968).
204 Ejder, E.: J. Phys. Chem. Solids, 31, 453 (1970).
205 Eliseev, P. G.; Ismailov, I.; Mikhailina, L. I.: Sov. Phys.–Semicond., 3, 799 (1970).
206 Elliott, C. T.; Hiscocks, S. E.: J. Mater. Sci., 3, 174 (1968).
207 Enck, R. C.; Honig, A.: Phys. Rev., 177, 1182 (1969).
208 Engeler, W. E.: Phys. Rev., 129, 1509 (1963).
209 Erasova, N. A.; Kaidanov, V. I.; Chernik, I. A.; Sysoeva, L. M.; Lev, E. Y.; Kolomoets, N. V.: Sov. Phys.–Semicond., 3, 1075 (1970).
210 Evans, B. L.; Hazelwood, R. A.: J. Phys. D, 2, 1507 (1969).
211 Evans, B. L.; Young, P. A.: Phys. Status Solidi, 25, 417 (1968).
212 Evans, B. L.; Young, P. A.: Proc. Roy. Soc., Ser. A, 284, 402 (1965).
213 Ewald, A. W.: Helv. Phys. Acta, 41, 795 (1968).
214 Ewald, A. W.: Phys. Rev., 81, 607 (1951).
215 Feinleib, J.; Paul, W.: Phys. Rev., 155, 841 (1967).
216 Feinleib, J.; Scouler, W. J.; Ferretti, A.: Phys. Rev., 165, 765 (1968).
217 Feinstein, L.: Research on Dielectrics for Microwave Electron Devices, QPR No. 2, Contract No. DA-36-039 SC-90856, DDC AD-405 767, Stanford Research Institute (October–December, 1962).
218 Felty, E. J.; Lucovsky, G.; Myers, M. B.: Solid State Commun., 5, 555 (1967).
219 Fermor, J. H.; Furuseth, S.; Kjekshus, A.: J. Less-Common Metals, 11, 376 (1966).
220 Fischer, G.: Helv. Phys. Acta, 34, 827 (1961).
221 Fischer, T. E.: Phys. Rev., 139, A1228 (1965).
222 Flicker, P.; Grass, F.: Z. Metallk., 57, 641 (1966).
223 Fomichev, V. A.; Zhukova, I. I.; Polushina, I. K.: J. Phys. Chem. Solids, 29, 1025 (1968).
224 Fortin, E.; Weichman, F. L.: Phys. Status Solidi, 5, 515 (1964).
225 Frindt, R. F.; Yoffe, A. D.: Proc. Roy. Soc., Ser. A, 273, 69 (1963).
226 Frindt, R. F.: J. Phys. Chem. Solids, 24, 1107 (1963).
227 Frohlich, D.; Staginnus, B.: Phys. Rev. Lett., 19, 496 (1967).
228 Frova, A.; Boddy, P. J.; Chen, Y. S.: Phys. Rev., 157, 700 (1967).
229 Frova, A.; Penchina, C. M.: Phys. Status Solidi, 9, 767 (1965).
230 Garlick, G. F.; Springford, M.; Checinska, H.: Proc. Phys. Soc., London, 82, 16 (1963).
231 Gasson, D. B.; Holmes, P. J.; Jennings, I. C.; Parrott, E.; Penn, A. W.: Proc. Intern. Conf. Semiconductor Phys. Prague, 1032–6, (1961).
232 Gavaleshko, N. P.; Kurik, M. V.; Savchuk, A. I.: Sov. Phys.–Semicond., 1, 920 (1968).
233 Gershenzon, M.; Thomas, D. G.; Dietz, R. E.: Radiative Transitions Near the Band Edge of Gallium Phosphide, Report of The International Conference on the Physics of Semiconductors, the Institute of Physics and the Physical Society, London (1962).
234 Geserich, H. P.; Suppanz, W.: Phys. Status Solidi, 35, 381 (1969).
235 Geserich, H. P.: Phys. Status Solidi, 25, 741 (1968).
236 Getov, G.; Kandilarov, B.; Simidtchieva, P.; Andreytchin, R.: Phys. Status Solidi, 13, K97 (1966).
237 Gildart, L.; Kline, J. M.; Mattox, D. M.: J. Phys. Chem. Solids, 18, 286 (1961).
238 Glascock, H. H.; Hensley, E. B.: Phys. Rev., 131, 649 (1963).
239 Glazov, V. M.; Glagoleva, N. N.: Inorg. Mater., 1, 989 (1965).
240 Glazova, V. V.; Kornilov, I. I.: Inorg. Mater., 1, 1656 (1965).
241 Gobrecht, H.; Seeck, S.; Bergt, H. E.; Martens, A.; Kossmann, K.: Phys. Status Solidi, 33, 599 (1969).
242 Gobrecht, H.; Seeck, S.; Bergt, H. E.; Martens, A.; Kossmann, K.: Phys. Status Solidi, 34, 569 (1969).
243 Gobrecht, H.; Seeck, S.; Klose, T.: Z. Phys., 190, 427 (1966).
244 Gobrecht, H.; Tausend, A.: On the Band-Structure of Hexagonal Selenium, Recent Advances in Selenium Physics, 17–28, Pergamon Press, London (June, 1964).
245 Gobrecht, R.: Ann. Phys., 20, 262 (1967).
246 Gobrecht, R.: Phys. Status Solidi, 13, 429 (1966).
247 Golikova, O. A.; Dzhafarov, E. O.; Avgustinik, A. I.; Klimashin, G. M.: Sov. Phys.–Solid State, 10, 124 (1968).
248 Golubkov, A. V.; Goncharova, E. V.; Zhuze, V. P.; Manoilova, I. G.: Sov. Phys.–Solid State, 7, 1963 (1966).
249 Goncharova, E. V.; Zhuze, V. P.; Lukirskii, D. P.: Sov. Phys.–Solid State, 10, 1784 (1968).
250 Goodenough, J. B.: Mater. Res. Bull., 3, 409 (1968).
251 Goodman, A. M.: Appl. Phys. Lett., 13, 275 (1968).
252 Gorban, I. S.; Dashlovskaya, R. A.: Sov. Phys.–Solid State, 6, 1895 (1965).
253 Gorban, I. S.; Rudko, S. N.: Opt. Spectrosc., 12, 339 (1962).
254 Goryunova, N. A.; Grigoreva, V. S.; Konovalenko, B. M.; Ryvkin, S. M.: Zhur. Tekh. Fiz., 25, 1675 (1955).
255 Goryunova, N. A.; Orlov, V. M.; Sokolova, V. I.; Shpenkov, G. P.; Tsvetkova, E. V.: Phys. Status Solidi, 25, 513 (1968).
256 Goto, T.; Ueta, M.: J. Phys. Soc. Jap., 22, 488 (1967).
257 Gramatskii, V. I.; Mushinskii, V. P.: Materials, 73–79, Nasledov, D. N. 3 Gorunova, N. A., Consultants Bureau, New York (1965).
258 Gramatskii, V. I.; Mushinskii, V. P.: Photoelectric and Optical Properties of Thin Gallium Telluride Films, Soviet Res. In New Semiconductor Materials, 73–79, Masledov, D. N. 3 Gorunova, N. A., Consultants Bureau, New York (1965).
259 Gramatskii, V. I.; Mushinskii, V. P.: Sov. Phys.–Solid State, 6, 2784 (1965).
260 Greenaway, D. L.; Harbeke, G.: J. Phys. Chem. Solids, 26, 1585 (1965).
261 Greenaway, D. L.; Nitsche, R.: J. Phys. Chem. Solids, 26, 1445 (1965).
262 Greener, E. H.; Whitmore, D. H.; Fine, M. E.: J. Chem. Phys., 34, 1017 (1961).
263 Grigoreva, V. S.: Sov. Phys.–Tech. Phys., 3, 1539 (1958).
264 Grimmeiss, H. G.; Kischio, W.; Rabenau, A.: J. Phys. Chem. Solids, 16, 302 (1960).
265 Grimmeiss, H. G.; Rabenau, A.; Hahn, H.; Ness, P.: Z. Elektrochem., 65, 776 (1961).
266 Gross, E. F.; Kreingold, F. I.: Sov. Phys.–Jetp, 4, 282 (1966).
267 Grosse, P.; Winzer, K.: Phys. Status Solidi, 26, 139 (1968).
268 Grosse, P.: Springer Tracts in Modern Physics, 48 (1969).
269 Groves, S. H.; Brown, R. N.; Pidgeon, C. R.: Phys. Rev., 161, 779 (1967).
270 Groves, S. H.; Paul, W.: Band Structure of Gray Tin, International Conference on Semiconductor Phys., Proc., 7th, Hulin, M., 21–48, Academic Press, New York (1964).
271 Guggenheim, J.; Hulliger, F.; Muller, J.: Helv. Phys. Acta, 34, 408 (1961).
272 Guhathakurta, S. R.: Indian J. Phys., 41, 99 (1967).
273 Gupta, S. C.: Phys. Lett., 30a, 19 (1969).
274 Gusatinskii, A. N.; Nemnonov, S. A.: Phys. Status Solidi, 12, 749 (1965).
275 Haase, D. J.; Steinfink, H.: J. Appl. Phys., 36, 3490 (1965).
276 Haase, D. J.; Steinfink, H.: J. Appl. Phys., 37, 2246 (1966).
277 Hadj, A. B.; Berge, P.: C. R. Acad. Sci., Ser. B, 266, 714 (1968).
278 Haidemenakis, E. D.; Mavroides, J. G.; Dresselhaus, M. S.; Kolesar, D. F.: Solid State Commun., 4, 65 (1966).
279 Halpern, J.; Lax, B.: J. Phys. Chem. Solids, 26, 911 (1965).

280 Harbeke, G.; Lautz, G.: Abhandl. Braunschweig. Wiss. Ges., 7, 36 (1955).
281 Harbeke, G.; Lautz, G.: Z. Naturforsch., 13a, 557 (1958).
282 Harbeke, G.; Lautz, G.: Z. Naturforsch., 13a, 775 (1958).
283 Harman, T. C.; Strauss, A. J.: J. Appl. Phys., Suppl. 32, 2265 (1961).
284 Harrop, P. J.; Creamer, R. H.: Brit. J. Appl. Phys., 14, 335 (1963).
285 Hass, G.; Ramsey, J. B.; Thun, R.: J. Opt. Soc. Amer., 48, 324 (1958).
286 Hauschild, E. A.; Kannewurf, C. R.: J. Phys. Chem. Solids, 30, 353 (1969).
287 Henderson, J. R.; Muramoto, M.; Loh, E.; Gruber, J. B.: Bull. Am. Phys. Soc., 14, 310 (1969).
288 Henderson, J. R.; Muramoto, M.; Loh, E.; Gruber, J. B.: J. Chem. Phys., 47, 3347 (1967).
289 Henkie, Z.; Trzebiatowski, W.: Phys. Status Solidi, 35, 827 (1969).
290 Henrion, W.; Osswald, R.: Phys. Status Solidi, 33, K147 (1969).
291 Henrion, W.: Phys. Status Solidi, 12, K113 (1965).
292 Hinson, D. C.; Stevenson, J. R.: Phys. Rev., 159, 711 (1967).
293 Hiscocks, S. E.; Elliott, C. T.: J. Mater. Sci., 4, 784 (1969).
294 Hiscocks, S. E.; Mullin, J. B.: J. Mater. Sci., 4, 962 (1969).
295 Hochuli, U. E.: Phys. Rev., 133, A486 (1964).
296 Hoffmann, B.: Z. Phys., 206, 293 (1967).
297 Hoffmann, B.: Z. Phys., 219, 354 (1969).
298 Homonoff, H.; Ruby, S.: Study of Materials for Thermionic Converters, Summary Rept. No. 2, Contract No. NONR-3385-00, ARA-T-9159-2, ASTIA AD-400-734, Aracon Labs (December, 1962).
299 Honig, J. M.; Reed, T. B.: Phys. Rev., 174, 1020 (1968).
300 Honig, J. M.: Rev. Mod. Phys., 40, 748 (1968).
301 Horie, T.; Kawabe, K.; Iwai, T.: Ann. Rept. Sci. Works, Fac. Sci. Osaka Univ., 4, 45 (1956).
302 Hoschl, P.: Phys. Status Solidi, 13, K101 (1966).
303 Howard, W. E.; Tsu, R.: Phys. Rev. B, 1, 4709 (1970).
304 Huffman, D. R.; Wild, R. L.: Phys. Rev., 156, 989 (1967).
305 Huggett, G. R.; Teegarden, K.: Phys. Rev., 141, 797 (1966).
306 Huldt, L.; Boija, S.: Solid State Commun., 8, 699 (1970).
307 Hulliger, F.; Vogt, O.: Solid State Commun., 8, 771 (1970).
308 Hulliger, F.: Helv. Phys. Acta, 32, 615 (1959).
309 Hulliger, F.: J. Phys. Chem. Solids, 26, 639 (1965).
310 Hulliger, F.: Nature, 198, 1081 (1963).
311 Hulliger, F.: Nature, 200, 1064 (1963).
312 Hulliger, F.: Nature, 204, 644 (1964).
313 Hunter, W. R.; Malo, S. A.: J. Phys. Chem. Solids, 30, 2739 (1969).
314 Hurwitz, C. E.; Calawa, A. R.; Rediker, R. H.: IEEE J. Quantum Electron., Qe-1, 102 (1965).
315 Hurwitz, C. E.; Keyes, R. J.: Appl. Phys. Lett., 5, 139 (1964).
316 Hurwitz, C. E.: Appl. Phys. Lett., 9, 420 (1966).
317 Hurwitz, C. E.: Solid State Device Research Conference, Chicago, Illinois (1966).
318 Ichimescu, A.; Suciu, P.: Rev. Roum. Phys., 12, 917 (1967).
319 Ido, T.; Oshima, S.; Saji, M.: Jap. J. Appl. Phys., 7, 1141 (1968).
320 Iinuma, K.; Seki, T.; Wada, M.: Mater. Res. Bull., 2, 527 (1967).
321 Imarura, S.: J. Phys. Soc. Jap., 14, 1497 (1959).
322 Ing, S. W.; Chiang, Y. A.; Haas, W.: J. Electrochem. Soc., 114, 761 (1967).
323 Interarithi, T.: Resistivity Measurements of Iodine Single Crystals by an AC Technique, AF 33-608-1284, AD 480-638, Texas A and M University (August, 1965).
324 Iskenderov, R. N.; Drabkin, I. A.; Emel'Yanova, L. T.; Ksendzov, Y. M.: Sov. Phys.-Solid State, 10, 2031 (1969).
325 Ivanova, V. A.; Abdinov, D.; Aliev, G. M.: Dokl. Phys. Chem., 182, 748 (1968).
326 Ivanova, V. A.; Abdinov, D.; Aliev, G. M.: Phys. Status Solidi, 24, K145 (1967).
327 Iwai, T.: J. Phys. Soc. Jap., 15, 1596 (1960).
328 Jacob, L.; Noble, R.; Yee, H.; Fraenkel, B.: K-Absorption of Boron in Boron Trioxide, Soft X-Ray Band Spectra Electron. Struct. Metals Mater., Fabian, 81-91, Derek J. Acad. Press, London, England (1968).
329 Jain, A. L.: Phys. Rev., 114, 1518 (1959).
330 Jan, J. P.; Vishnubhatla, S. S.: Can. J. Phys., 45, 2505 (1967).
331 Janninck, R. F.; Whitmore, D. H.: J. Phys. Chem. Solids, 27, 1183 (1966).
332 Jayaraman, A.; Narayanamurti, V.; Bucher, E.; Maines, R. G.: Phys. Rev. Lett., 25, 1430 (1970).
333 Jayaraman, A.; Narayanamurti, V.; Bucher, E.; Maines, R. G.: Phys. Rev. Lett., 25, 368 (1970).
334 Joesten, B. L.; Brown, F. C.: Phys. Rev., 148, 919 (1966).
335 Johnson, E. J.; Fan, H. Y.: Phys. Rev., 139, A1991 (1965).
336 Johnson, P. D.: Phys. Rev., 94, 845 (1954).
337 Johnston, W. D.; Miller, R. C.; Damon, D. H.: J. Less-Common Metals, 8, 272 (1965).
338 Jung, W.: J. Appl. Phys., 36, 2422 (1965).
339 Junginger, H. G.; Van Haeringen, W.: Phys. Status Solidi, 37, 709 (1970).
340 Kabashima, S.: J. Phys. Soc. Jap., 21, 945 (1966).
341 Kaidanov, V. I.; Lyakhina, L. S.; Tselishchev, V. A.; Voronov, B. K.; Trusova, N. N.; Dudkin, L. D.: Sov. Phys.-Semicond., 1, 926 (1968).
342 Kaidanov, V. I.; Tselishchev, V. A.; Iesalniek, I. K.; Dudkin, L. D.; Voronov, B. K.; Trusova, N. N.: Sov. Phys.-Semicond., 2, 382 (1968).
343 Kane, E. O.: J. Phys. Chem. Solids, 1, 249 (1957).
344 Kannewurf, C. R.; Cashman, R. J.: Phys. Chem. Solids, 22, 293 (1961).
345 Kannewurf, C. R.; Itoga, R. S.: Northwestern University Materials Research Center (1969).
346 Karaman, M. I.; Mushinskii, V. P.: Sov. Phys.-Semicond., 4, 359 (1970).
347 Katilene, E. R.; Regel', A. R.: Sov. Phys.-Solid State, 6, 2284 (1965).
348 Kauer, E.; Rabenau, A.: Z. Naturforsch., 12a, 942 (1957).
349 Kauer, E.; Rabenau, A.: Z. Naturforsch., 13a, 531 (1958).
350 Kauer, E.: Phys. Lett., 7, 171 (1963).
351 Kawasaki, B. S.; Garside, B. K.; Shewchun, J.: Proc. IEEE, 58, 179 (1970).
352 Kawate, Y.; Kaifu, Y.: J. Phys. Soc. Jap., 21, 1847 (1966).
353 Keester, K. L.; White, W. B.: Mater. Res. Bull., 4, 757 (1969).
354 Kekelidze, G. P.; Evans, B. L.: J. Phys. D, 2, 855 (1969).
355 Keller, H.; Stuke, J.: Phys. Status Solidi, 8, 831 (1965).
356 Kemmey, P. J.; Townsend, P. D.; Levy, P. W.: J. Phys. C, 2, 1125 (1969).
357 Kenny, N.; Kannewurf, C. R.; Whitmore, D. H.: J. Phys. Chem. Solids, 27, 1237 (1966).
358 Kessler, F. R.; Sutter, E.: Phys. Status Solidi, 23, K25 (1967).
359 Kharakhorin, F. F.; Boyarintsev, P. K.: Inorg. Mater., 5, 1421 (1969).
360 Kharakhorin, F. F.; Petrov, V. M.: Sov. Phys.-Semicond., 1, 112 (1967).
361 Kierzek-Pecold, E.; Kolodziejczak, J.; Pracka, I.: Phys. Status Solidi, 29, K183 (1968).
362 Kierzek-Pecold, E.: Phys. Status Solidi, 33, 523 (1969).
363 Kir'Iashkina, Z. I.; Popov, F. M.; Bilenko, D. N.; Kir'Iashkin, V. I.: Sov. Phys.-Tech. Phys., 2, 69 (1957).
364 Kischio, W.: Z. Anorg. Allg. Chem., 328, 187 (1964).
365 Kischio, W.: Z. Naturforsch., 21a, 1733 (1966).
366 Kline, J. S.; Pollak, F. H.; Cardona, M.: Helv. Phys. Acta, 41, 968 (1968).
367 Kohnke, E. E.: J. Phys. Chem. Solids, 23, 1557 (1962).
368 Kolomiets, B. T.; Pavlov, B. V.: Sov. Phys.-Semicond., 1, 350 (1967).
369 Kolomiets, B. T.; Romanov, V. G.; Khodosevich, P. K.: Sov. Phys.-Solid State, 7, 2042 (1966).
370 Kolomoets, N. V.; Popova, E. A.: Sov. Phys.-Solid State, 2, 1758 (1961).
371 Komenou, K.; Yamashita, T.; Onodera, Y.: Phys. Lett., 28a, 335 (1968).
372 Komiya, H.; Masumoto, K.; Fan, H. Y.: Phys. Rev., 133, A1679 (1964).
373 Korshunov, V. A.; Geld, P. V.: Phys. Metals Metallogr., 11, 118 (1961).
374 Kosek, F.; Tauc, J.: Czech. J. Phys., 20, 94 (1970).
375 Koshkin, V. M.; Karas', V. R.; Gal'Chinetskii, L. P.: Sov. Phys.-Semicond., 3, 1186 (1970).
376 Kosicki, B. B.; Powell, R. J.; Burgiel, J. C.: Phys. Rev. Lett., 24, 1421 (1970).
377 Kramarenko, N. L.; Miloslavskii, V. K.; Naboikin, Y. V.: Opt. Spectrosc., 24, 521 (1968).
378 Kreingold, F. I.: Sov. Phys.-Solid State, 4, 408 (1962).
379 Krolikowski, W. F.: Photoemission Studies of the Noble Metals, the Cuprous Halides, and Selected Alkali Halides, TR No. 5218-1, N68-15118, 405p, Stanford University, Solid-State Elec. Lab (May, 1967).
380 Kruglov, V. I.; Zimkina, T. M.: Sov. Phys.-Solid State, 10, 170 (1968).
381 Krupke, D. C.; Guggenheim, H. J.: J. Chem. Phys., 51, 4006 (1969).
382 Ksendzov, Y. M.; Drabkin, I. A.: Sov. Phys.-Solid State, 7, 1519 (1965).
383 Ku, S. M.: J. Electrochem. Soc., 13, 813 (1966).
384 Kunz, A. B.; Miyakawa, T.; Oyama, S.: Phys. Status Solidi, 34, 581 (1969).

385 Kurdyumova, R. N.; Sviridov, D. T.: Sov. Phys.–Crystallogr., 12, 643 (1968).
386 Kurtz, S. K.: IEEE J. Quantum Electron., Qe–4, 578 (1968).
387 Kutasov, V. A.; Moizhes, B. Y.; Smirnov, I. A.: Sov. Phys.–Solid State, 7, 854 (1965).
388 Ladd, L. A.; Paul, W.: Solid State Commun., 7, 425 (1969).
389 Laff, R. A.: J. Appl. Phys., 36, 3324 (1965).
390 Lagrenaudie, J.: J. Phys. Radium, 15, 209 (1954).
391 Lander, J. J.: Survey of Semiconductor Chemistry, Semiconductors, Hannay, N. B., 50–86, Reinhold Publishing Co., New York (1959).
392 Lanyon, H. P.: J. Appl. Phys., 35, 1516 (1964).
393 Lappe, F.: J. Phys. Chem. Solids, 23, 1563 (1962).
394 Lashkarev, G. V.; Paderno, Y. B.: Inorg. Mater., 1, 1620 (1965).
395 Laude, L.; Brincourt, G.; Sorbier, J. P.; Gaal, S.; Martinuzzi, S.: C. R. Acad. Sci., Ser. B, 270, 285 (1970).
396 Lee, P. A.; Said, G.: J. Phys. D, 1, 837 (1968).
397 Lefkowitz, I.; Lowndes, R. P.; Yoffe, A. D.: J. Phys. Chem. Solids, 26, 1171 (1965).
398 Lepetit, A.: J. Phys., 26, 175 (1965).
399 Levshin, V. L.; Mikhailin, V. V.; Dianova, I. M.; Kulman, L. K.: Opt. Spectrosc., 21, 45 (1965).
400 Li, C. Y.; Ruoff, A. L.; Spencer, C. W.: J. Appl. Phys., 32, 1733 (1961).
401 Liang, W. Y.; Yoffe, A. D.: Proc. Royal Soc., Ser. A, 300, 326 (1967).
402 Lider, K. F.; Solov'Ev, L. E.: Sov. Phys.–Solid State, 4, 1102 (1962).
403 Lindquist, R. E.; Ewald, A. W.: Phys. Rev., 135, A191 (1964).
404 Lipson, H. G.; Kahan, A.: Phys. Rev., 133, A800 (1964).
405 Loh, E.: Solid State Commun., 2, 269 (1964).
406 Longuet–Higgins, H. C.; Roberts, M. De V.: Proc. Roy. Soc., London, 224, 336 (1954).
407 Lorenz, M. R.; Chicotka, R.; Pettit, G. D.; Dean, P. J.: Solid State Commun., 8, 693 (1970).
408 Lott, L. A.; Lynch, D. W.: Phys. Rev., 141, 681 (1966).
409 Ludeke, R.; Paul, W.: Growth and Optical Properties of Epitaxial Thin Films of Some II–VI Compounds, II–VI Semiconducting Compounds 1967 International Conference, Thomas, D. G., 123–135, W. A. Benjamin, Inc., New York (1967).
410 Lukes, F.; Schmidt, E.: Phys. Lett., 23, 413 (1966).
411 Lukes, F.: Czech. J. Phys., 18b, 784 (1968).
412 Lukes, F.: Czech. J. Phys., 6, 359 (1956).
413 Lyubchenko, V. A.; Lebedeva, N. N.: Ukr. Fiz. Zh., 12, 497 (1967).
414 Macfarlane, G. G.; Mclean, T. P.; Quarrington, J. E.; Roberts, V.: Phys. Rev., 108, 1377 (1957).
415 Macfarlane, G. G.; Mclean, T. P.; Quarrington, J. E.; Roberts, V.: Phys. Rev., 111, 1245 (1958).
416 Makedonskii, V. I.; Pustovoit, A. K.: Sov. Phys.–Solid State, 4, 1490 (1963).
417 Makedonskiy, V. L.: Radio Eng. Electron. Phys., 10, 440 (1965).
418 Makovskii, F. A.; Martyshev, R. S.; Usachev, E. P.: Sov. Phys.–Semicond., 3, 223 (1969).
419 Maltz, M.; Dresselhaus, M. S.: Phys. Rev. Lett., 20, 919 (1968).
420 Maltz, M.; Dresselhaus, M. S.: Phys. Rev., 182, 741 (1969).
421 Manca, P.; Saut, G.: C. R. Acad. Sci., Ser. B, 262, 1621 (1966).
422 Manca, P.; Suchet, J. P.; Fatseas, G. A.: Ann. Phys., 1, 621 (1966).
423 Marchenko, V. I.; Samsonov, G. V.: Sov. Powder Met. Metal Ceram., 2, 135 (1963).
424 Marinace, J. C.: Phys. Rev., 96, 593 (1954).
425 Marshall, R.; Mitra, S. S.: J. Appl. Phys., 36, 3882 (1965).
426 Martin, F. E.; Hensley, E. B.: Phys. Rev., 163, 219 (1967).
427 Maruska, H. P.; Tietjen, J. J.: Appl. Phys. Lett., 15, 327 (1969).
428 Masumoto, K.; Komiya, H.: Nippon Kinzoku Gakkaishi, 2, 273 (1964).
429 Matsui, A.; Walker, W. C.: J. Opt. Soc. Amer., 60, 358 (1970).
430 Matsuoka, M.: J. Phys. Soc. Jap., 23, 1028 (1967).
431 Mattox, D. M.; Gildart, L.: J. Phys. Chem. Solids, 18, 215 (1961).
432 Mavlonov, S.; Karimov, S.; Glazov, V. M.: Inorg. Mater., 5, 1396 (1969).
433 Mayata, T.: J. Phys. Soc. Jap., 27, 266 (1969).
434 Mclaren, A. C.; Rogers, G. T.: Proc. Roy. Soc., Ser. A, 240, 484 (1957).
435 Mcnatt, J. L.: Phys. Rev. Lett., 23, 915 (1969).
436 Mead, C. A.; Spitzer, W. G.: Phys. Rev. Lett., 11, 358 (1963).
437 Mead, C. A.: J. Appl. Phys., 35, 2460 (1964).
438 Mead, C. A.: Phys. Lett., 11, 212 (1964).
439 Merz, J. L.; Lynch, R. T.: J. Appl. Phys., 39, 1988 (1968).
440 Mikhail, H.; Hanafy, Z.; Salem, T. M.: J. Chem. Phys., 35, 1185 (1961).
441 Mikolaichuk, A. G.; Freik, D. M.: Sov. Phys.–Solid State, 11, 2033 (1970).
442 Miller, E.; Ermanis, F.; Cadoff, I. B.: Materials for Thermoelectric Generators, Final Rept., Contract No. Af 19–604–3902, AD 264–375, New York U. Coll. of Engineering, New York (1961).
443 Miller, L. C.; Kannewurf, C. R.: J. Phys. Chem. Solids, 31, 849 (1970).
444 Minden, H. T.: Appl. Phys. Lett., 17, 358 (1970).
445 Mindt, W.: J. Electrochem. Soc., 116, 1076 (1969).
446 Mirgalovskaya, M. S.; Skudnova, E. V.: Izv. Akad. Nauk Sssr, Otd. Tekh. Nauk, Met. Topl., 148 (1959).
447 Mirgalovskaya, M. S.; Skudnova, E. V.: Russ. J. Inorg. Chem., 4, 506 (1959).
448 Mirlin, D. N.: Sov. Phys.–Solid State, 10, 2938 (1969).
449 Mitchell, D. L.; Levinstein, H.: Bull. Amer. Phys. Soc., 4, 133 (1959).
450 Mitchell, D. L.; Palik, E. D.; Zemel, J. N.: Magneto–Optical Band Studies of Epitaxial PbS, PbSe and PbTe, Physics Of Semiconductors, Proceedings of the 7th International Conference, 325–333, Paris (1964).
451 Mittendorf, H.: Z. Phys., 183, 113 (1965).
452 Moldovanova, M.: Effect of Oxygen and Nitrogen on the Main Features of Some Semiconductors, Khim. Svyaz Krist., Sirota, 327–330 (1969).
453 Mollwo, E.; Stumpp, R.: Z. Phys., 184, 286 (1965).
454 Moorjani, K.; Feldman, C.: Solid State Commun., 6, 473 (1968).
455 Morin, F. J.: Phys. Rev., 83, 1005 (1951).
456 Morris, R. G.; Redin, R. D.; Danielson, G. C.: Phys. Rev., 109, 1909 (1958).
457 Moss, T. S.: Proc. Phys. Soc., London, 63b, 982 (1950).
458 Mushinskaya, K. M.; Tyrziu, V. G.: Sov. Phys.–Semicond., 3, 825 (1970).
459 Mushinskii, V. P.; Mushinskaya, K. M.: Inorg. Mater., 1, 1340 (1965).
460 Myers, H. P.; Jonsson, T.; Westin, R.: Solid State Commun., 2, 321 (1964).
461 Nagasawa, M.; Shionoya, S.: Solid State Commun., 7, 1731 (1969).
462 Nahory, R. E.; Fan, H. Y.: Phys. Rev., 156, 825 (1967).
463 Narita, S.; Sugiyama, S.: J. Phys. Soc. Jap., 20, 153 (1965).
464 Neeley, V. I.; Kemp, J. C.: J. Phys. Chem. Solids, 24, 1301 (1963).
465 Nelson, D. F.; Johnson, L. F.; Gershenzon, M.: Phys. Rev., 135, A1399 (1964).
466 Neshpor, V. S.; Samsonov, G. V.: Inorg. Mater., 1, 599 (1965).
467 Neshpor, V. S.; Samsonov, G. V.: Phys. Metals Metallogr., 11, 146 (1961).
468 Nicoll, F. H.: Appl. Phys. Lett., 9, 13 (1966).
469 Nigara, Y.: Jap. J. Appl. Phys., 7, 404 (1968).
470 Nikitin, E. N.; Tarasov, V. I.; Andreev, A. A.; Shumilova, L. N.: Sov. Phys.–Solid State, 11, 2757 (1970).
471 Nitsche, R.; Merz, W. J.: J. Phys. Chem. Solids, 13, 154 (1960).
472 Noblanc, J. P.; Loudette, J.; Duraffourg, G.: Solid State Commun., 5, 803 (1967).
473 Noddack, W.; Walch, H.: Z. Elektrochem., 63, 269 (1959).
474 Nottingham, W. B.: Induction and Decay of Luminance as a Function of Excitation, in Preparation and Characteristics Of Solid Luminescent Materials, 301–310, Wiley, New York (1948).
475 O'Keeffe, M.; Valigi, M.: J. Phys. Chem. Solids, 31, 947 (1970).
476 O'Shaughnessy, J.; Smith, C.: Solid State Commun., 8, 481 (1970).
477 Ogorelec, A.: Croat. Chem. Acta, 37, 49 (1965).
478 Ohyama, M.: J. Phys. Soc. Jap., 21, 1126 (1966).
479 Okamoto, H.; Aso, T.: Jap. J. Appl. Phys., 6, 779 (1967).
480 Okinaka, H.; Nagasawa, K.; Kosuge, K.; Bando, Y.; Kachi, S.; Takada, T.: J. Phys. Soc. Jap., 28, 798 (1970).
481 Okinaka, H.; Nagasawa, K.; Kosuge, K.; Bando, Y.; Kachi, S.; Takada, T.: J. Phys. Soc. Jap., 28, 803 (1970).
482 Ormont, B. F.: Russ. J. Inorg. Chem., 4, 988 (1959).
483 Osipov, Y. V.: Izv. Vyssh. Ucheb. Zaved., Fiz., 10, 82 (1967).
484 Overhof, H.; Rossler, U.: Phys. Status Solidi, 37, 691 (1970).
485 Page, L. J.; Hygh, E. H.: Phys. Rev. B, 1, 3472 (1970).
486 Pajasova, L.: Czech. J. Phys., 19, 1265 (1969).
487 Palik, E. D.; Mitchell, D. L.; Zemel, J. N.: Phys. Rev., 135, A763 (1964).

488 Panish, M. B.; Casey, H. C.: J. Appl. Phys., 40, 163 (1969).
489 Pankove, J. I.; Maruska, H. P.; Berkeyheiser, J. E.: Appl. Phys. Lett., 17, 197 (1970).
490 Panus, V. R.; Ksendzov, Y. M.; Borisova, Z. U.: Inorg. Mater., 4, 778 (1968).
491 Paparoditis, C.: J. Phys., 25, 226 (1964).
492 Papazian, H. A.: J. Appl. Phys., 27, 1252 (1956).
493 Park, Y. S.; Chan, F. L.: J. Appl. Phys., 36, 800 (1965).
494 Park, Y. S.; Litton, C. W.; Collins, T. C.; Reynolds, D. C.: Phys. Rev., 143, 512 (1966).
495 Park, Y. S.: Phys. Rev., 132, 2450 (1963).
496 Pastrnak, J.; Roskovocova, L.: Phys. Status Solidi, 26, 591 (1968).
497 Patrick, L.; Hamilton, D. R.; Choyke, W. J.: Phys. Rev., 143, 526 (1966).
498 Phelan, R. J.; Rediker, R. H.: Appl. Phys. Lett., 6, 70 (1965).
499 Philipp, H. R.; Taft, E. A.: Intrinsic Optical Absorption in Single Crystal Silicon Carbide, Silicon Carbide, a High Temperature Semi-Conductor, Proc., O'Connor, J. R. 3 Smiltens, J., 366-371, Pergamon Press, New York (1960).
500 Philipp, H. R.; Taft, E. A.: Phys. Rev., 127, 159 (1962).
501 Phillips, J. C.: Phys. Rev., 136, A1705 (1964).
502 Phillips, J. C.: Phys. Rev., 136, A1714 (1964).
503 Phillips, J. C.: Phys. Rev., 136, A1721 (1964).
504 Phipps, P. B.; Kroger, F. A.: J. Phys. Chem. Solids, 30, 1435 (1969).
505 Pickar, P. B.; Tiller, H. D.: Phys. Status Solidi, 29, 153 (1968).
506 Pidgeon, C. R.; Groves, S. H.: Low Temperature Reflection and Electroreflection Studies of Interband Magneto-Optical Transitions in Hg Te, II-VI Semiconducting Compounds, 1967 International Conference, Thomas, D. G., 1080-1089, W. A. Benjamin, Inc., New York (1967).
507 Pidgeon, C. R.; Mitchell, D. L.; Brown, R. N.: Phys. Rev., 154, 737 (1967).
508 Pigon, K.: Bull. Acad. Pol. Sci., Ser. Sci. Chim., 9, 751 (1961).
509 Pigon, K.: Helv. Phys. Acta, 41, 1104 (1968).
510 Piotrzkowski, R.; Porowski, S.; Dziuba, Z.; Ginter, J.; Giriat, W.; Sosnowski, L.: Phys. Status Solidi, 8, K135 (1965).
511 Piotrzkowski, R.; Porowski, S.: Temperature Dependence of the Band Structure of Hg Te From Pressure Measurements, II-Vi Semiconducting Compounds, 1967 International Conference, Thomas, D. G., 1090-1102, W. A. Benjamin, Inc., New York (1967).
512 Prosser, V.; Henisch, H. K.: Mater. Res. Bull., 1, 283 (1966).
513 Pryor, A. W.: the Electrical Conductivity of Beryllium Oxide, Conf-281-21, Australian Atomic Energy Commission, From International Conference on Beryllium Oxides, Sydney (October, 1963).
514 Ramamurti, J.; Teegarden, K.: Phys. Rev., 145, 698 (1966).
515 Ramoin, M.; Sorbier, J. P.; Bretzner, J. F.; Martinuzzi, S.: C. R. Acad. Sci., Ser. B, 268, 1097 (1969).
516 Ramsey, T. H.; Steinfink, H.; Weiss, E. J.: J. Appl. Phys., 36, 548 (1965).
517 Rand, M. J.; Roberts, J. F.: J. Electrochem. Soc., 115, 423 (1968).
518 Rao, K. V.; Smakula, A.: J. Appl. Phys., 36, 2031 (1965).
519 Rau, J. W.; Kannewurf, C. R.: Bull. Amer. Phys. Soc., 15, 31 (1970).
520 Rau, J. W.; Kannewurf, C. R.: J. Phys. Chem. Solids, 27, 1097 (1966).
521 Reddaway, S. F.; Wright, D. A.: Brit. J. Appl. Phys., 16, 195 (1965).
522 Redin, R. D.; Morris, R. G.; Danielson, G. C.: Phys. Rev., 109, 1916 (1958).
523 Rehwald, W.; Harbeke, G.: J. Phys. Chem. Solids, 26, 1309 (1965).
524 Reilly, M. H.: J. Phys. Chem. Solids, 31, 1041 (1970).
525 Reynolds, R. A.; Brau, M. J.; Chapman, R. A.: J. Phys. Chem. Solids, 29, 755 (1968).
526 Riccius, H. D.; Turner, R.: J. Phys. Chem. Solids, 29, 15 (1968).
527 Riggleman, B. M.; Drickamer, H. G.: J. Chem. Phys., 38, 2721 (1963).
528 Roberts, G. G.; Tutihasi, S.; Keezer, R. C.: Phys. Rev., 166, 637 (1968).
529 Rodine, E. T.: Thermoluminescence of Thorium Oxide Single Crystals, Order No. 71-3654, 140p, University of Nebraska (1970).
530 Roessler, D. M.; Lempka, H. J.: Brit. J. Appl. Phys., 17, 1553 (1966).
531 Roessler, D. M.; Walker, W. C.; Loh, E.: J. Phys. Chem. Solids, 30, 157 (1969).
532 Roessler, D. M.; Walker, W. C.: J. Phys. Chem. Solids, 28, 1507 (1967).
533 Roessler, D. M.; Walker, W. C.: Phys. Rev., 159, 733 (1967).
534 Roessler, D. M.; Walker, W. C.: Phys. Rev., 166, 599 (1968).
535 Rogers, L. M.: J. Phys. D, 1, 845 (1968).
536 Rossi, C. E.: the Preparation of Nickel Oxide Thin Films for Use in Optical Measurements in the Visible and Ultraviolet, Tech. Report No. HP-18-ARPA-TR-29, AD 682-932, 163p, Harvard University, Cambridge, Massachusetts, Div. of Eng. 3 Appl. Phys. (October, 1968).
537 Ruppel, W.; Rose, A.; Gerritsen, H. J.: Helv. Phys. Acta, 30, 238 (1957).
538 Rustamov, P. G.; Cherstvova, V. B.; Alidzhanov, M. A.: Inorg. Mater., 4, 1186 (1968).
539 Rustamov, P. G.; Mamedaliev, F. D.; Alidzhanov, M. A.: Inorg. Mater., 5, 313 (1967).
540 Samokhvalov, A. A.; Bamburov, V. G.; Volkenshtein, N. V.; Zotov, T. D.; Ivakin, A. A.; Morozov, Y. N.; Simonova, M. I.: Bull. Acad. Sci. USSR, 30, 1027 (1966).
541 Samsonov, G. V.; Marchenko, V. I.: Dokl. Phys. Chem., 152, 854 (1963).
542 Samsonov, G. V.; Oganesyan, V. K.: Inorg. Mater., 2, 1515 (1966).
543 Samsonov, G. V.: J. Struct. Chem., 4, 362 (1963).
544 Sandrock, R.: Phys. Rev., 169, 642 (1968).
545 Satterthwaite, C. B.; Ure, R. W.: Phys. Rev., 108, 1164 (1957).
546 Saum, G. A.; Hensley, E. B.: Phys. Rev., 113, 1019 (1959).
547 Saut, G.: C. R. Acad. Sci., Ser. B, 263, 1174 (1966).
548 Savitskii, A. V.; Kurik, M. V.; Tovstyuk, K. D.: Opt. Spectrosc., 19, 59 (1964).
549 Scanlon, W. W.: J. Phys. Chem. Solids, 8, 423 (1959).
550 Schottmiller, J. C.: J. Appl. Phys., 37, 3505 (1966).
551 Schwab, C.; Martin, J.; Sieskind, M.; Nikitine, S.: C. R. Acad. Sci., 264, 1739 (1967).
552 Sclar, N.: J. Appl. Phys., 33, 2999 (1962).
553 Sclar, N.: J. Appl. Phys., 35, 1534 (1964).
554 Sclar, N.: Q. Rept. No. 1, Contract No. NOBSR-77591, ASTIA AD-233-582. Nuclear Corp. of America (May-August, 1959).
555 Sclar, N.: Unijunction Devices Made From Rare Earth Semiconductors, Final Report, Contract No. DA 36-039-SC-87392, Nucl. Corp. of America (1961).
556 Sclar, N.: Unijunction Devices Made From Rare Earth Semiconductors, Qr No. 1, Contract No. DA 36-039-SC-87392, ASTIA AD-257-796, Nuclear Corp. of America, Central Electronic Manuf. Div. (April, 1960).
557 Scop, P. M.: Phys. Rev., 139, A934 (1965).
558 Shadrichev, E. V.; Smirnov, I. A.; Kutasov, V. A.: Sov. Phys.-Solid State, 11, 1626 (1970).
559 Shannon, R. D.: Solid State Commun., 7, 257 (1969).
560 Shaw, W. C.; Hudson, D. E.; Danielson, G. C.: Phys. Rev., 107, 419 (1957).
561 Shay, J. L.: Phys. Rev. B, 2, 803 (1970).
562 Sheftal', R. N.; Zhdan, A. G.; Nikitin, K. V.; Artobolevskaya, E. S.: Sov. Phys.-Solid State, 11, 2158 (1970).
563 Shestatskii, S. N.; Sobolev, V. V.: Phys. Status Solidi, 28, K131 (1968).
564 Shinoda, D.; Asanabe, S.; Sasaki, Y.: J. Phys. Soc. Jap., 19, 269 (1964).
565 Siemsen, K. J.; Riccius, H. D.: Phys. Status Solidi, 37, 445 (1970).
566 Sieskind, M.; Nikitine, S.: the Exciton Spectra of the Mercury Iodides, Advances in Molecular Spectroscopy, 689-694, Pergamon Press (1962).
567 Skubenko, A. F.; Lapshii, S. V.: Sov. Phys.-Solid State, 4, 327 (1962).
568 Smakula, A.: a Study of the Physical Properties of High-Temperature Single Crystals, FTR No. 11, Contract No. Af 19-628-395 iiip AD 663-734, M. I. T. Cambridge Massachusetts, Crystal Phys. Lab. (September, 1967).
569 Smith, D. K.; Newkirk, H. W.; Kahn, J. S.: the Crystal Structure and Polarity of Beryllium Oxide, Contract No. W-7405-ENG-48, University of California, Lawrence Radiation Laboratory, Livermore, California (October, 1962).
570 Sobolev, V. V.; Popov, Y. V.: Inorg. Mater., 5, 1285 (1969).
571 Sobolev, V. V.; Shutov, S. D.: Inorg. Mater., 3, 416 (1967).
572 Sobolev, V. V.; Syrbu, N. N.; Shutov, S. D.: Inorg. Mater., 2, 866 (1966).
573 Sobolev, V. V.; Syrbu, N. N.: Inorg. Mater., 2, 861 (1966).
574 Sobolev, V. V.; Syrbu, N. N.: Phys. Status Solidi, 43, K87 (1971).
575 Sobolev, V. V.: Inorg. Mater., 2, 47 (1966).
576 Sobolev, V. V.: Inorg. Mater., 3, 142 (1967).
577 Sobolev, V. V.: Opt. Spectrosc., 16, 40 (1964).

578 Sommer, A. H.; Mccarroll, W. H.: J. Appl. Phys., 37, 174 (1966).
579 Sommer, A. H.; Spicer, W. E.: J. Appl. Phys., 32, 1036 (1961).
580 Sorokin, G. P.; Papshev, Y. M.; Oush, P. T.: Sov. Phys.–Solid State, 7, 1810 (1966).
581 Sorokin, G. P.; Paradenko, A. P.: Izv. Vyssh. Ucheb. Zaved. Fiz., 9, 91 (1966).
582 Souers, P. C.; Jura, G.: Semiconducting Region of Bismuth I, Contract W-7405-ENG-48, 13p, California Univ., Berkeley, Lawrence Radiation Lab. and Department of Chemistry (September, 1963).
583 Sparks, J. T.; Komoto, T.: Phys. Lett., 25a, 398 (1967).
584 Spear, W. E.; Adams, A. R.: J. Phys. Chem. Solids, 27, 281 (1966).
585 Spence, W.: J. Appl. Phys., 38, 3767 (1967).
586 Spicer, W. E.; Sommer, A. H.: Phys. Chem. Solids, 8, 437 (1959).
587 Spicer, W. E.: J. Appl. Phys., 31, 2077 (1960).
588 Spicer, W. E.: Phys. Rev., 112, 114 (1958).
589 Spitzer, W. G.; Mead, C. A.: Phys. Rev., 133, A872 (1964).
590 Springford, M.: Proc. Phys. Soc., London, 82, 1020 (1965).
591 Springthorpe, A. J.: Mater. Res. Bull., 4, 125 (1969).
592 Stella, A.; Lynch, D. W.: J. Phys. Chem. Solids, 25, 1253 (1964).
593 Stephan, G.; Le Calvez, Y.; Lemonier, J. C.; Robin, S.: J. Phys. Chem. Solids, 30, 601 (1969).
594 Stephan, G.; Robin, S.: C. R. Acad. Sci., Ser. B, 267, 1286 (1968).
595 Strauss, A. J.: Phys. Rev., 157, 608 (1967).
596 Street, G. B.; Gill, W. D.: Phys. Status Solidi, 18, 601 (1966).
597 Stukel, D. J.: Phys. Rev. B, 1, 3458 (1970).
598 Stukel, D. J.: Phys. Rev. B, 2, 1852 (1970).
599 Sturge, M. D.: Phys. Rev., 127, 768 (1962).
600 Subashiev, V. K.; Chalikyan, G. A.: Sov. Phys.–Semicond., 3, 1216 (1970).
601 Suchan, H. L.; Drickamer, H. G.: J. Phys. Chem. Solids, 11, 111 (1959).
602 Suchet, J. P.: Phys. Chem. Solids, 16, 265 (1960).
603 Summitt, R.; Borrelli, N. F.: J. Appl. Phys., 37, 2200 (1966).
604 Summitt, R.; Marley, J. A.; Borrelli, N. F.: J. Phys. Chem. Solids, 25, 1465 (1964).
605 Sutter, E.: Phys. Status Solidi, 33, 749 (1969).
606 Svechkarev, I. V.: Sov. Phys.–Jetp, 20, 643 (1965).
607 Taft, E. A.; Philipp, H. R.: J. Phys. Chem. Solids, 3, 1 (1957).
608 Talukdar, M. I.; Baker, E. H.: Solid State Commun., 7, 309 (1969).
609 Tandon, S. P.; Gupta, J. P.: Indian J. Pure Appl. Phys., 7, 829 (1969).
610 Tandon, S. P.; Gupta, J. P.: Phys. Status Solidi, 37, 43 (1970).
611 Tandon, S. P.; Gupta, J. P.: Phys. Status Solidi, 38, 363 (1970).
612 Tatsuyama, C.; Watanabe, Y.; Hamaguchi, C.; Nakai, J.: J. Phys. Soc. Jap., 29, 150 (1970).
613 Tauber, R. N.; Machonis, A. A.; Cadoff, I. B.: J. Appl. Phys., 37, 4855 (1966).
614 Tauc, J.; Grigorovici, R.; Vancu, A.: Phys. Status Solidi, 15, 627 (1966).
615 Taylor, M. A.: Physica, 39, 327 (1968).
616 Teegarden, K.; Baldini, G.: Phys. Rev., 155, 896 (1967).
617 Thomas, D. G.; Hopfield, J. J.: Phys. Rev., 116, 573 (1959).
618 Thompson, A. G.; Cardona, M.; Shaklee, K. L.: Phys. Rev., 146, 601 (1966).
619 Thornber, K. K.; Mead, C. A.: J. Phys. Chem. Solids, 26, 1489 (1965).
620 Tichovolsky, E. J.; Mavroides, J. G.; Kolesar, D. F.: Electronic Band Structure and Electronic Properties, Magneto-Optical Investigation of Bi-Sb Alloys, ES Dtr-68-353, Lincoln Lab MIT (December, 1968).
621 Tichovolsky, E. J.; Mavroides, J. G.: Solid State Commun., 7, 927 (1969).
622 Tippins, H. H.: J. Phys. Chem. Solids, 27, 1069 (1966).
623 Tippins, H. H.: Phys. Rev., 140, A316 (1965).
624 Title, R. S.; Plaskett, T. S.: J. Appl. Phys., 41, 334 (1970).
625 Tomiki, T.; Miyata, T.; Tsukamoto, H.: J. Phys. Soc. Jap., 27, 791 (1969).
626 Tsarev, B. M.; Illarionov, S. V.: Sov. Phys.–Solid State, 4, 1908 (1963).
627 Tubbs, M. R.: J. Phys. Chem. Solids, 29, 1191 (1968).
628 Turner, W. J.; Fischler, A. S.; Reese, W. E.: Electrical and Optical Properties of P-Type CdSb, Proc. Intern. Conf. Semiconductor Phys., 1080-3, Intern. Business Machines Corp., Poughkeepsie, New York (1960).
629 Turner, W. J.; Fischler, A. S.; Reese, W. E.: Phys. Rev., 121, 759 (1961).
630 Turner, W. J.; Reese, W. E.; Pettit, G. D.: Phys. Rev., 136, A1467 (1964).
631 Turyanitsya, I. D.; Chepur, D. V.: Ukr. Fiz. Zh., 12, 500 (1967).
632 Tutihasi, S.; Chen, I.: Phys. Rev., 158, 623 (1967).
633 Tutihasi, S.; Roberts, G. G.; Keezer, R. C.; Drews, R. E.: Phys. Rev., 177, 1143 (1969).
634 Tutihasi, S.: Phys. Chem. Solids, 12, 344 (1960).
635 Tyler, W. W.; Sproull, R. L.: Phys. Rev., 83, 548 (1951).
636 Ugai, Y. A.; Averbakh, E. M.: Sov. Phys.–Solid State, 5, 940 (1963).
637 Ugai, Y. A.; Gordin, V. L.; Anokhin, V. Z.: Russ. J. Inorg. Chem., 9, 119 (1964).
638 Ugai, Y. A.; Zyubina, T. A.: Inorg. Mater., 1, 790 (1965).
639 Ugai, Y. A.; Zyubina, T. A.: Inorg. Mater., 2, 7 (1966).
640 Upadhyayula, L. C.; Loferski, J. J.; Wold, A.; Giriat, W.; Kershaw, R.: J. Appl. Phys., 39, 4736 (1968).
641 Vaidanich, V. I.; Liskovich, O. B.; Maksimovich, K. K.; Chornii, Z. P.: Ukr. Fiz. Zh., 13, 538 (1968).
642 Vainshtein, V. M.; Fistul', V. I.: Sov. Phys.–Semicond., 1, 104 (1967).
643 Van Con, K.; Suchet, J. P.: C. R. Acad. Sci., 256, 2823 (1963).
644 Van Den Broek, J.: Philips Res. Rep., 22, 36 (1967).
645 Van Dong, N.; Tung, P. N.: Phys. Status Solidi, 30, 557 (1968).
646 Vashchenko, V. I.; Timofeev, V. B.: Sov. Phys.–Solid State, 9, 1242 (1967).
647 Vashchenko, V. I.: Optical Properties of Bismuth Iodide Single Crystals, Proceedings of the International Conference On Luminescence, Szigeti, G., 873-876, Akademiai Kiado, Budapest (1968).
648 Vazquez, F.; Forman, R. A.; Cardona, M.: Phys. Rev., 176, 905 (1968).
649 Vennik, J.; Callaerts, R.: C. R. Acad. Sci., 260, 496 (1965).
650 Verie, C.; Decamps, E.: Phys. Status Solidi, 9, 797 (1965).
651 Verkhovskaya, K. A.; Grigas, I. P.; Fridkin, V. M.: Sov. Phys.–Solid State, 10, 1583 (1969).
652 Verwey, J. F.; Westerink, N. G.: Physica, 42, 293 (1969).
653 Vinokurov, I. V.; Zonn, Z. N.; Ioffe, V. A.: Sov. Phys.–Solid State, 9, 2659 (1968).
654 Vishnubhatla, S. S.; Jan, J. P.: Phil. Mag., 16, 45 (1967).
655 Vlasov, A. N.; Kozina, G. S.; Fedorova, O. B.: Sov. Phys.–Jetp, 25, 283 (1967).
656 Volynets, F. K.; Dronova, G. N.: Sov. Phys.–Solid State, 11, 1504 (1970).
657 Von Hippel, A.; Chesley, F. G.; Denmark, H. S.; Ulin, P. B.; Rittner, E. S.: J. Chem. Phys., 14, 355 (1946).
658 Vorobev, V. G.; Sobolev, V. V.; Sorokin, G. P.: Inorg. Mater., 3, 140 (1967).
659 Vratny, F.; Kokalas, J. J.: Appl. Spectrosc., 16, 176 (1962).
660 Wachter, P.: Helv. Phys. Acta, 41, 1249 (1968).
661 Wachter, P.: Phys. Kondens. Mater., 8, 80 (1968).
662 Wachter, P.: Solid State Commun., 7, 693 (1969).
663 Wachter, P.: Solid State Commun., 8, 473 (1970).
664 Waff, H. S.; Park, K.: Phys. Lett., 32a, 109 (1970).
665 Wang, C. C.; Cardona, M.; Fischer, A. G.: Rca Rev., 25, 159 (1964).
666 Ware, R. M.: Proc. Inst. Elec. Eng., 3, 178 (1964).
667 Warschauer, D.: J. Appl. Phys., 34, 1853 (1963).
668 Watanabe, O.; Tamaki, S.: Electrochim. Acta, 13, 11 (1968).
669 Weiher, R. L.; Dick, B. G.: J. Appl. Phys., 35, 3511 (1964).
670 Weiher, R. L.; Ley, R. P.: J. Appl. Phys., 37, 299 (1966).
671 Weinreich, O. A.: Electrical Conduction and Thermoinic Emission in Semi-Conductors, Interim Rept., Contract No. NONR-628-00, ASTIA AD-291, Franklin Inst., Barton Res. Foundation (September, 1952).
672 Westphal, W. B.: Dielectric Constant and Loss Measurements on High Temperature Materials, Rept. No. TR 182, Contract No. AF 33-616-8353, DDC AD-423-686, Mass. Inst. of Technol., Lab. for Insulation Res. (October, 1963).
673 Whited, R. C.; Walker, W. C.: Phys. Rev., 188, 1380 (1969).
674 Whitsett, C. R.: Phys. Rev., 138, A829 (1965).
675 Wiedemeier, H.; Sigai, A. G.: J. Electrochem. Soc., 117, 551 (1970).
676 Wieder, H. H.: J. Vac. Sci. Technol., 8, 210 (1971).
677 Wiff, D. R.; Keown, R.: J. Chem. Phys., 47, 3113 (1967).
678 Williams, M. W.; Macrae, R. A.; Arakawa, E. T.: J. Appl. Phys., 38, 1701 (1967).
679 Winkler, U.: Helv. Phys. Acta, 28, 633 (1955).
680 Wirick, M. P.: Appl. Opt., 5, 1966 (1966).
681 Wood, C.; Harrap, V.; Kane, W. M.: Phys. Rev., 121, 978 (1961).
682 Wright, D. K.; Tubbs, M. R.: Phys. Status Solidi, 37, 551 (1970).

683 Yaguchi, K.: J. Phys. Soc. Jap., 21, 1226 (1966).
684 Yarembash, E. I.; Vigileva, E. S.; Eliseev, A. A.; Kalitin, V. I.: Bull. Acad. Sci. USSR, Phys. Ser., 28, 1004 (1964).
685 Yazaki, T.: J. Phys. Soc. Jap., 25, 1054 (1968).
686 Young, D. A.: Brit. J. Appl. Phys., 15, 499 (1964).
687 Young, P. A.: Thin Solid Films, 4, 25 (1969).
688 Yu, R. M.: J. Phys. Chem. Solids, 30, 63 (1969).
689 Zahner, J. C.; Drickamer, H. G.: Phys. Chem. Solids, 11, 92 (1959).
690 Zaitsev, V. K.; Nikitin, E. N.; Tkalenko, E. N.: Sov. Phys.–Solid State, 11, 3000 (1970).
691 Zalevskii, B. K.; Lashkarev, G. V.; Sobolev, V. V.; Sirbu, N. N.: Ukr. Fiz. Zh., 11, 638 (1966).
692 Zallen, R.; Paul, W.: Phys. Rev., 134, A1628 (1964).
693 Zallen, R.; Slade, M.: Solid State Commun., 8, 1291 (1970).
694 Zalm, P.: Advan. Electron. Electron. Phys., 25, 211 (1968).
695 Zanmarchi, G.: J. Phys. Chem. Solids, 28, 2123 (1967).
696 Zavetova, M.: Czech. J. Phys. B, 14, 615 (1964).
697 Zavetova, M.: Phys. Status Solidi, 5, K19 (1964).
698 Zdanowicz, W.; Wojakowski, A.: Phys. Status Solidi, 10, K93 (1965).
699 Zdanowicz, W.; Wojakowski, A.: Phys. Status Solidi, 16, K129 (1966).
700 Zdanowicz, W.; Wojakowski, A.: Phys. Status Solidi, 8, 569 (1965).
701 Zdanowicz, W.: Electrical Properties of Cadmium Arsenide, International Conference of Semiconductor Physics, Proceedings, Academic Press, New York (1961).
702 Zemel, J. N.; Jensen, J. D.; Schoolar, R. B.: Phys. Rev., 140, A330 (1965).
703 Zhukova, I. I.; Fomichev, V. A.; Vinogradov, A. S.; Zimkina, T. M.: Sov. Phys.–Solid State, 10, 1097 (1968).
704 Zhukovskii, V. M.; Vlasov, V. G.; Lebedev, A. G.: Phys. Metals Metallogr., 14, 139 (1962).
705 Zhukovskii, V. M.; Vlasov, V. G.; Lebedev, A. G.: Phys. Metals Metallogr., 14, 149 (1962).
706 Zhuze, V. P.; Golubkov, A. V.; Goncharova, E. V.; Sergeeva, V. M.: Sov. Phys.–Solid State, 6, 205 (1964).
707 Zhuze, V. P.; Zaslavskii, A. I.; Petrusevic, V. A.; Sergeeva, V. M.; Smirnov, I. A.; Selykh, A. I.: Semiconductor Physics, Conference, 871–81, Prague (1960).
708 Ziomek, J. S.; Pickar, P. B.: Phys. Status Solidi, 21, 271 (1967).
709 Zollweg, R. J.: Phys. Rev., 111, 113 (1958).
710 Zolyan, T. S.; Regel', A. R.: Sov. Phys.–Solid State, 6, 1189 (1964).
711 Zorina, E. L.; Velichkova, V. B.; Guliev, T.: Opt. Spectrosc., 22, 498 (1967).
712 Zorina, E. L.: Opt. Spectrosc., 20, 157 (1966).
713 Zorina, E. L.: Opt. Spectrosc., 27, 168 (1969).
714 Zorina, E. L.: Sov. Phys.–Solid State, 7, 269 (1965).
715 Zwerdling, S.; Kleiner, W. H.; Theriault, J. P.: J. Appl. Phys., Suppl. 32, 2118 (1961).
716 Zwerdling, S.; Lax, B.; Roth, L. M.; Button, K. J.: Phys. Rev., 114, 80 (1959).
717 Basic Studies on Thermoelectric Materials, Quarterly Rept. No. 13, Contract O. BS90444, AD–622 382, Westinghouse Research Labs, Pittsburgh, Pennsylvania (September–December, 1964).
718 High Temperature Broad Band Semiconductors, Rept. No. Ga–1377, Q. Tech. Summary, Contract No. BS–77144, ASTIA AD–245–051, Gen. Atomic Div., Gen. Dynamics Corp. (April, 1960).
719 International Conference on Nonmetallic Crystals, New Delhi (1969).
720 Khim. Svyaz Poluprov. Inst. Fiz. Tverd. Telakh, Poluprov. Akad. Nauk Beloruss., 229 (1966).
721 Molecular Circuit Development, Qr No. 11, Contract No. Now 60–0362–C, DDC AD–400–119, Melpar, Inc. (1963).
722 Research in Physics of Electron Emission and Electron Tube Technology, Fifth Interim Report, Contract No. AF–33–057–10475, University of Minnesota (October, 1964–April, 1965).
723 Research Program on Semiconducting Compounds for Thermo–Electric Power Generation At High Temperatures, Final Report, Contract No. NOBS–78664, DDC AD–265–950, Chrysler Corp., Eng. Div. (August, 1961).

Author Index