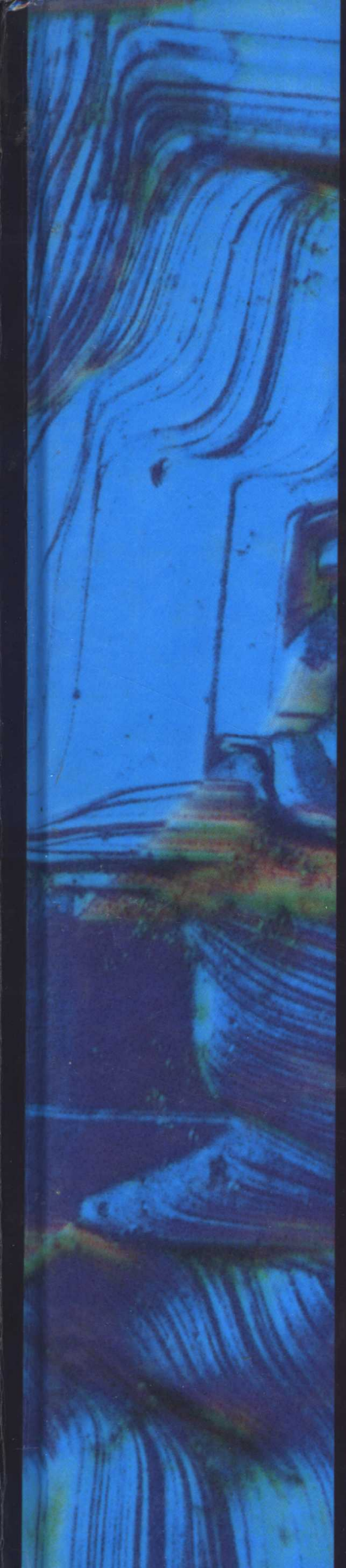

SECOND EDITION

Edited by
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JUN S. PARK

CRC MATERIALS SCIENCE AND ENGINEERING HANDBOOK

SECOND EDITION

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Structure of Materials

ELECTRONIC STRUCTURE OF SELECTED ELEMENTS

At. No.	Element	Sym	Electronic Configuration																	
			1s	2s	2p	3s	3p	3d	4s	4p	4d	4f	5s	5p	5d	5f	6s	6p	6d	7s
1	Hydrogen	H	1																	
2	Helium	He	2																	
3	Lithium	Li	.	1																
4	Beryllium	Be	.	2																
5	Boron	B	.	2	1															
6	Carbon	C	.	2	2															
7	Nitrogen	N	.	2	3															
8	Oxygen	O	.	2	4															
9	Fluorine	F	.	2	5															
10	Neon	N	.	2	6															
11	Sodium	Na	.	.	.	1														
12	Magnesium	Mg	.	.	.	2														
13	Aluminum	Al	.	.	.	2	1													
14	Silicon	Si	.	.	.	2	2													
15	Phosphorus	P	.	.	.	2	3													
16	Sulfur	S	.	.	.	2	4													
17	Chlorine	Cl	.	.	.	2	5													
18	Argon	Ar	.	.	.	2	6													
19	Potassium	K	.	.	.	.	.		1											
20	Calcium	Ca	.	.	.	.	.		2											
21	Scandium	Sc	.	.	.	.	.	1	2											
22	Titanium	Ti	.	.	.	.	.	2	2											
23	Vanadium	V	.	.	.	.	.	3	2											
24	Chromium	Cr	.	.	.	.	.	5	1											
25	Manganese	Mn	.	.	.	.	.	5	2											
26	Iron	Fe	.	.	.	.	.	6	2											
27	Cobalt	Co	.	.	.	.	.	7	2											
28	Nickel	Ni	.	.	.	.	.	8	2											
29	Copper	Cu	.	.	.	.	.	10	1											
30	Zinc	Zn	.	.	.	.	.	10	2											
31	Gallium	Ga	.	.	.	.	.	10	2	1										
32	Germanium	Ge	.	.	.	.	.	10	2	2										
33	Arsenic	As	.	.	.	.	.	10	2	3										
34	Selenium	Se	.	.	.	.	.	10	2	4										
35	Bromine	Br	.	.	.	.	.	10	2	5										
36	Krypton	Kr	.	.	.	.	.	10	2	6										
37	Rubidium	Rb	.	.	.	.	.	.	.	.			1							
38	Strontium	Sr	.	.	.	.	.	.	.	.			2							
39	Yttrium	Y	.	.	.	.	.	.	.	.	1		2							
40	Zirconium	Zr	.	.	.	.	.	.	.	.	2		2							
41	Niobium	Nb	.	.	.	.	.	.	.	.	4		1							
42	Molybdenum	Mo	.	.	.	.	.	.	.	.	5		1							
43	Technetium	Tc	.	.	.	.	.	.	.	.	6		1							
44	Ruthenium	Ru	.	.	.	.	.	.	.	.	7		1							
45	Rhodium	Rh	.	.	.	.	.	.	.	.	8		1							
46	Palladium	Pd	.	.	.	.	.	.	.	.	10									
47	Silver	Ag	.	.	.	.	.	.	.	.	10		1							
48	Cadmium	Cd	.	.	.	.	.	.	.	.	10		2							
49	Indium	In	.	.	.	.	.	.	.	.	10		2	1						
50	Tin	Sn	.	.	.	.	.	.	.	.	10		2	2						
51	Antimony	Sb	.	.	.	.	.	.	.	.	10		2	3						
52	Tellurium	Te	.	.	.	.	.	.	.	.	10		2	5						
53	Iodine	I	.	.	.	.	.	.	.	.	10		2	5						
54	Xenon	Xe	.	.	.	.	.	.	.	.	10		2	6						

Electronic Structure Of Selected Elements (Continued)

At. No.	Element	Sym	Electronic Configuration																
			1s	2s	2p	3s	3p	3d	4s	4p	4d	4f	5s	5p	5d	5f	6s	6p	6d	7s
55	Cesium	Ce	.	.	.	.	.	.	.	.	.		.	.			1			
56	Barium	Ba	.	.	.	.	.	.	.	.	.		.	.			2			
57	Lantium	La	.	.	.	.	.	.	.	.	.		.	.	1		2			
58	Cerium	Ce	.	.	.	.	.	.	.	.	.	2	.	.			2			
59	Praseodymium	Pr	.	.	.	.	.	.	.	.	.	3	.	.			2			
60	Neodymium	Nd	.	.	.	.	.	.	.	.	.	4	.	.			2			
61	Promethium	Pm	.	.	.	.	.	.	.	.	.	5	.	.			2			
62	Samarium	Sm	.	.	.	.	.	.	.	.	.	6	.	.			2			
63	Europium	Eu	.	.	.	.	.	.	.	.	.	7	.	.			2			
64	Gadolinium	Gd	.	.	.	.	.	.	.	.	.	7	.	.	1		2			
65	Terbium	Tb	.	.	.	.	.	.	.	.	.	9	.	.			2			
66	Dysprosium	Dy	.	.	.	.	.	.	.	.	.	10	.	.			2			
67	Holmium	Ho	.	.	.	.	.	.	.	.	.	11	.	.			2			
68	Erbium	Er	.	.	.	.	.	.	.	.	.	12	.	.			2			
69	Thulium	Tm	.	.	.	.	.	.	.	.	.	13	.	.			2			
70	Ytterbium	Yb	.	.	.	.	.	.	.	.	.	14	.	.			2			
71	Lutetium	Lu	.	.	.	.	.	.	.	.	.	14	.	.	1		2			
72	Hafnium	Hf	.	.	.	.	.	.	.	.	.	14	.	.	2		2			
73	Tantalum	Ta	.	.	.	.	.	.	.	.	.	14	.	.	3		2			
74	Tungsten	W	.	.	.	.	.	.	.	.	.	14	.	.	4		2			
75	Rhenium	Re	.	.	.	.	.	.	.	.	.	14	.	.	5		2			
76	Osmium	Os	.	.	.	.	.	.	.	.	.	14	.	.	6		2			
77	Iridium	Ir	.	.	.	.	.	.	.	.	.	14	.	.	9					
78	Platinum	Pt	.	.	.	.	.	.	.	.	.	14	.	.	9		1			
79	Gold	Au	.	.	.	.	.	.	.	.	.	14	.	.	10		1			
80	Mercury	Hg	.	.	.	.	.	.	.	.	.	14	.	.	10		2			
81	Thallium	Tl	.	.	.	.	.	.	.	.	.	14	.	.	10		2	1		
82	Lead	Pb	.	.	.	.	.	.	.	.	.	14	.	.	10		2	2		
83	Bismuth	Bi	.	.	.	.	.	.	.	.	.	14	.	.	10		2	3		
84	Polonium	Po	.	.	.	.	.	.	.	.	.	14	.	.	10		2	4		
85	Asatine	At	.	.	.	.	.	.	.	.	.	14	.	.	10		2	5		
86	Radon	Rn	.	.	.	.	.	.	.	.	.	14	.	.	10		2	6		
87	Francium	Fr	.	.	.	.	.	.	.	.	.	.	.	.	.		.	.		1
88	Radium	Ra	.	.	.	.	.	.	.	.	.	.	.	.	.		.	.		2
89	Actinium	Ac	.	.	.	.	.	.	.	.	.	.	.	.	.		.	.	1	2
90	Thorium	Th	.	.	.	.	.	.	.	.	.	.	.	.	.		.	.	2	2
91	Protoactinium	Pa	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	1	2
92	Uranium	U	.	.	.	.	.	.	.	.	.	.	.	.	.	3	.	.	1	2
93	Neptunium	Np	.	.	.	.	.	.	.	.	.	.	.	.	.	4	.	.	1	2
94	Plutonium	Pu	.	.	.	.	.	.	.	.	.	.	.	.	.	6	.	.		2
95	Americium	Am	.	.	.	.	.	.	.	.	.	.	.	.	.	7	.	.		2
96	Curium	Cm	.	.	.	.	.	.	.	.	.	.	.	.	.	7	.	.	1	2
97	Berkelium	Bk	.	.	.	.	.	.	.	.	.	.	.	.	.	9	.	.		2
98	Californium	Cf	.	.	.	.	.	.	.	.	.	.	.	.	.	10	.	.		2
99	Einsteinium	Es	.	.	.	.	.	.	.	.	.	.	.	.	.	11	.	.		2
100	Fermium	Fm	.	.	.	.	.	.	.	.	.	.	.	.	.	12	.	.		2
101	Mendelevium	Md	.	.	.	.	.	.	.	.	.	.	.	.	.	13	.	.		2
102	Nobelium	No	.	.	.	.	.	.	.	.	.	.	.	.	.	14	.	.		2
103	Lawrencium	Lw	.	.	.	.	.	.	.	.	.	.	.	.	.	14	.	.	1	2

AVAILABLE STABLE ISOTOPES OF THE ELEMENTS

Element	Mass No.	Natural Abundance (%)
Hydrogen	1	99.985
	2	0.015
Helium	3	0.00013
	4	≈100.0
Lithium	6	7.42
	7	92.58
Beryllium	9	100.0
Boron	10	19.78
	11	80.22
Carbon	12	98.89
	13	1.11
Nitrogen	14	99.63
	15	0.37
Oxygen	16	99.76
	17	0.04
	18	0.20
Fluorine	19	100.0
Neon	20	90.92
	21	0.26
	22	8.82
Sodium	23	100.0
Magnesium	24	78.70
	25	10.13
	26	11.17
Aluminum	27	100.0
Silicon	28	92.21
	29	4.70
	30	3.09
Phosphorus	31	100.0
Sulfur	32	95.0
	33	0.76
	34	4.22
	36	0.014
Chlorine	35	75.53
	37	24.47
Argon	36	0.34
	38	0.06
	40	99.60