

Contents

Foreword: Use of this Book for Different Classes	ix
Acknowledgements	xiii
Acknowledgements from the Family of Professor Robert Newnham	xiv
1 Introduction to Bonding, Structure, and Structure–Property Relations	1
2 Raw Materials	4
3 Chemical Bonding and Electronegativity	15
4 Hardness, Melting Points, and Boiling Points	25
5 Planes, Directions, and Morphology	39
6 Crystal Systems and Theoretical Density	54
7 Symmetry, Point Groups, and Stereographic Projections	73
8 Covalent Crystals and Semiconductors	98
9 Ionic Crystals	120
10 Metals and Steel	144
11 Molecular Crystals	169
12 Polymers	189
13 Pauling’s Rules, Bond Valence and Structure-Field Maps	208
14 Crystal Field Theory	224
15 Solid Solutions and Phase Diagrams	237
16 Defects	255

17	Gases and Liquids	272
18	Glasses	289
19	Silica and Silicates	307
20	Phase Transformations	338
21	Cement and Concrete	363
22	Surfaces and Surface Properties	382
23	Neumann's Law and Tensor Properties	401
24	Thermal Properties	412
25	Diffusion and Ionic Conductivity	439
26	Electrical Conductivity	459
27	Optical Properties	492
28	Dielectrics and Ferroelectrics	516
29	Magnetism	541
30	Mechanical Properties	563
31	Appendix A Crystallographic Symbols	595
32	Appendix B Shannon-Prewitt Ionic Radii	596
33	Index	607