

Joon Park

BIOCERAMICS

*Properties, Characterizations,
and Applications*

 Springer

CONTENTS

Preface	vii
1: Introduction	
Problems	5
Definitions	7
References	8
2: Structure of Ceramics and Glasses	
2.1. Atomic Bonding and Arrangement.....	12
2.2. Characterization of Microstructure.....	18
2.3. Quantitative Analysis of Single-Phase Microstructure.....	21
2.4. Microstructure Determination	22
Problems	24
Symbols/Definitions	25
References	27
3: Characterization of Ceramics and Glasses	
3.1. Mechanical Properties	30
3.2. Strengthening of ceramics and Glasses	36
3.3. Weibull Statistics of Brittle Failure	38
3.4. Impact Strength, Hardness, Friction, and Wear Properties	43
3.5. Thermal Properties (Phase Changes).....	47
3.6. Surface Properties.....	59
Problems	63
Symbols/Definitions	66
References	68

4: Glass Formation and Characterization

4.1.	Glass Formation.....	70
4.2.	Nucleation and Glass Formation	71
4.3.	Strength of Glasses	72
4.4.	Static Fatigue of Glasses.....	74
	Problems	77
	Symbols/Definitions	80
	References	81

5: Hard Tissues: Structure, Properties, Healing, Remodeling, and Biocompatibility

5.1.	Structure of Proteins	85
5.2.	Structure–Property Relationships	90
5.3.	Hard Tissue Healing and Remodeling.....	102
5.4.	Biocompatibility	109
	Problems	112
	Symbols/Definitions	113
	References	114

6: Aluminum Oxides (Alumina)

6.1.	Source, Composition, and Structure	118
6.2.	Mechanical Properties	120
6.3.	Fatigue Properties and Service Life.....	124
6.4.	Applications.....	128
6.5.	Further Thoughts	132
	Problems	133
	Symbols/Definitions	136
	References	138

7: Zirconium Oxides (Zirconia)

7.1.	Source and Manufacturing of Zirconia.....	142
7.2.	Structure and Properties of Zirconia.....	142
7.3.	Long-Term Stability and Implant Design.....	149
7.4.	Further Thoughts	161
	Problems	162
	Symbols/Definitions	163
	References	165

8: Glass-Ceramics

8.1.	Formation of Glass-Ceramics	168
8.2.	Properties of Glass-Ceramics	170
8.3.	Coatings and Composites	176
8.4.	Further Thoughts	176
	Problems	177
	Definitions	178
	References	179

9: Hydroxyapatite

9.1.	Source, Composition, and Structure	184
9.2.	Properties of Hydroxyapatite	191
9.3.	Applications	192
9.4.	Further Thoughts	197
	Problems	197
	Definitions	200
	References	201

10: Carbons and Diamond-Like Carbon Coatings

10.1.	Source and Structure of Carbons	206
10.2.	Properties of Carbons	209
10.3.	Manufacture of Carbon Implants	212
10.4.	Diamond-Like Carbon (DLC) Coatings	214
10.5.	Further Thoughts	221
	Problems	221
	Definitions	222
	References	223

11: Sulfates and Titanates

11.1.	Source, Composition, and Structure	228
11.2.	Structure and Properties of Titanates	232
11.3.	Applications	236
11.4.	Further Thoughts	241
	Problems	241
	Symbols/Definitions	243
	References	244

12: Composites, Tissue Substitutes, and Scaffolds

12.1. Fundamentals of Composite Theory.....	248
12.2. Applications of Composites.....	253
12.3. Composite Scaffolds.....	274
12.4. Fabrication of Bone Scaffolds	281
12.5. Biocompatibility of Composite Biomaterials	284
12.6. Further Thoughts	285
Problems	285
Symbols/Definitions	290
References	295

Appendices

Appendix I: Physical Constants and Conversions.....	303
Appendix II: SI Units.....	304
Appendix III: Common Prefixes.....	305
Appendix IV: Properties of Selected Elements	306

Bibliography	307
---------------------------	-----

Name Index	327
-------------------------	-----

Subject Index	339
----------------------------	-----