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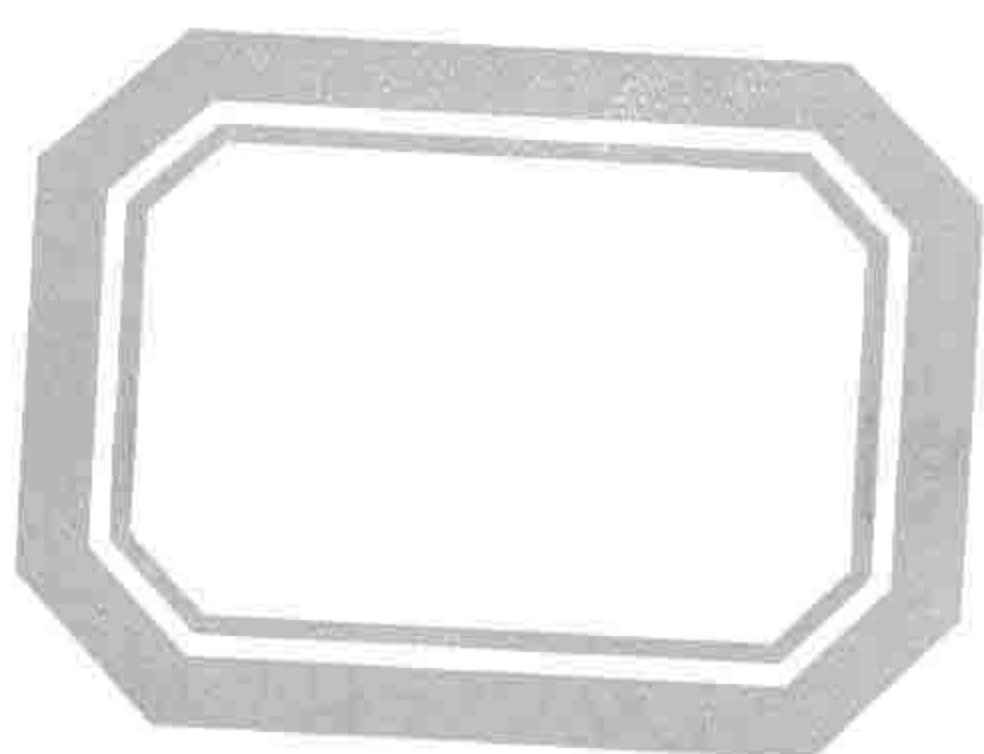
材料科学 与工程基础

Foundations of Materials Science
and Engineering

(美) William F. Smith 著
Javad Hashemi



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Foundations of Materials Science and Engineering

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影 印 前 言

材料科学是阐述材料的内部结构、性能和加工成型过程的基础知识；材料工程是应用这些基础知识使材料转化为社会所需的产品。材料科学与工程就是将两者结合起来，它是基础学科（物理、化学、力学、数学）和各种工程学科（机械、动力、能源、化工、航空等）之间的桥梁。

Smith 是一位有丰富教学经验的教授。他的著作《Structure and Properties of Engineering Alloys》(1981) 已于 1984 年由国内翻译出版。随后他又写了《Principles of Materials Science and Engineering》(1986)，在国内有影印本。这两本书当时在国内受到了广泛关注，并对专业教学产生了一定影响。本书是作者在上述一书的基础上扩充改写而成。

这本书有两个最显著的特点。该书是材料科学与工程专业学生的第一门入门课，它要让初学者先对专业有一个概貌性的了解，并获得一定的基础知识和材料方面的知识。在过去的专业教学中，“材料科学基础”和“材料学”是分课设置，各按学科自成体系。学生在学习过程中，常感“材料科学基础”抽象难学，不知学有何用，而后续课“材料学”又感到繁琐枯燥，缺少理论依托，因而也未能真正理解消化。本书克服了这一缺憾，将材料科学基础与材料学两者有机地结合起来，它以材料为中心，从培养材料工程师着眼，有选择地选取基础知识内容，将本书化解为四个交叉组成部分：①基础知识；②材料制备方法；③各种材料；④材料的力学、物理和化学性能。这种组合方式优点是显而易见的：结构紧凑，内容精炼，完整实用，学生受益。例如，本书第 13 章腐蚀，如有了该章的基础，似乎不必另开一门“金属的腐蚀和防护”，有了第 14、15、16 章的基础知识，似乎也不必另开一门“材料物理性能”来讨论电、磁、光、超导等，而这些知识又和具体材料结合起来，突显出学以致用。值得注意的是，在美国似乎现已趋于这种教学体系。

这本书的另一突出优点，是在每章之后都贯穿有材料选择与设计的专门思考题，这是作者精心设计的，也是他多年教学经验的积累。每个题目都是从工程实际出发，科学地培养学生的研究方法和分析思路，能真正使学生在正确选材的能力上有所提高，也为开发创新材料打下良好的基础。这里我们可略举一些例子。例如，第 2 章原子结构与结合键有思考题：石墨和金刚石都是由碳原子构成，为什么在性能上有如此大的差异？不锈钢中含有大量铬，为什么铬能防止腐蚀？第 3 章晶体结构中有习题：给你一未知材料，你能用哪些方法识别它？通常，在高温高应力下工作的燃气轮机叶片，制备成大的单晶，你认为单晶叶片有什么优点？应选取什么材料？（这两个问题虽然学生暂时不能给予全面正确的答案，但对培养同学思考和下一章的深入学习有帮助。）在第 4 章凝固、晶体缺陷和扩散中有习题：燃气轮机叶片由长的柱状晶组成，试提出实现方向性凝固的方法；从凝固观点解释焊接过程，影响焊接接头的关键因素有哪些？两

出版说明

随着我国加入 WTO，国际间的竞争越来越激烈，而国际间的竞争实际上也就是人才的竞争、教育的竞争。为了加快培养具有国际竞争力的高水平技术人才，加快我国教育改革的步伐，国家教育部出台了倡导高校开展双语教学、引进原版教材的政策。以此为契机，机械工业出版社陆续推出了一系列国外影印版教材，其内容涉及高等学校公共基础课，以及机、电、信息领域的专业基础课和专业课。

引进国外优秀原版教材，在有条件的学校推动开展英语授课或双语教学，自然也引进了先进的教学思想和教学方法，这对提高我国自编教材的水平，加强学生的英语实际应用能力，使我国的高等教育尽快与国际接轨，必将起到积极的推动作用。

为了做好教材的引进工作，机械工业出版社特别成立了由著名专家组成的国外高校优秀教材审定委员会。这些专家对实施双语教学做了深入细致的调查研究，对引进原版教材提出了许多建设性意见，并慎重地对每一本将要引进的原版教材一审再审，精选再精选，确认教材本身的质量水平，以及权威性和先进性，以期所引进的原版教材能适应我国学生的外语水平和学习特点。在引进工作中，审定委员会还结合我国高校教学课程体系的设置和要求，对原版教材的教学思想和方法的先进性、科学性严格把关。同时尽量考虑原版教材的系统性和经济性。

这套教材出版后，我们将根据各高校的双语教学计划，举办原版教材的教师培训，及时地将其推荐给各高校选用。希望高校师生在使用教材后及时反馈意见和建议，使我们更好地为教学改革服务。

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ABOUT THE AUTHORS

William F. Smith is Professor Emeritus of engineering in the Mechanical and Aerospace Engineering Department of the University of Central Florida at Orlando, Florida. He was awarded an M.S. degree in metallurgical engineering from Purdue University and a Sc.D. degree in metallurgy from Massachusetts Institute of Technology. Dr. Smith, who is a registered professional engineer in the states of California and Florida, has been teaching undergraduate and graduate materials science and engineering courses and actively writing textbooks for many years. He is also the author of *Structure and Properties of Engineering Alloys*, Second Edition (McGraw-Hill, 1993).

Javad Hashemi is a Professor of Mechanical Engineering at Texas Tech University, where he has taught introduction to materials science since 1991. Javad received his Ph.D. in Mechanical Engineering from Drexel University in 1988. Dr. Hashemi has been teaching undergraduate and graduate materials and mechanics courses, as well as laboratories at Texas Tech University. He is also the principal developer of the virtual laboratory modules accompanying this textbook as part of a pilot project funded by National Science Foundation. Dr. Hashemi's current research focus is the areas of materials, biomechanics, and education for engineers.

种不同金属接触，会产生一种叫柯肯达尔效应，如何解释这一现象？需要指出的是，这几道习题原本是传统教材中的讲课内容，现延伸为本章的课外作业，在启发学生思考，指导学生自学以后，同样获得了上述知识，显然这种学习方法印象更深，兴趣更大。又如第12章复合材料有习题：用纤维可增加陶瓷材料的韧性，但在这种情况下，纤维与基体的结合应不是很强，试解释这个过程何以能韧化陶瓷材料？该题点出了韧化陶瓷材料的技术关键。本书每章的最后都落脚于材料的选择与设计，在培养学生这方面的能力上，可谓用心良苦。

除了上述两个特点外，该书在内容上也有许多可圈可点之处。例如，在第2章的结合键中对过渡金属和陶瓷材料的混合键有清楚的分析；在第3章晶体结构中，对晶面指数和方向指数的表示作了极详尽的说明，这虽看似简单，但在教学上体会到必须做大量练习才能使学生牢固掌握；特别地，全书自始至终广泛引入现代材料科学的前沿课题，如对智能材料器件、MEMs、纳米材料、超级合金及其在生物医学应用方面等的首次介绍，使学生能够开阔眼界，紧跟潮流；大量精美的插图，强化了相关的内容，尤其是每章均引入压题照片，处处向学生表明材料科学与工程无处不在地应用于现实世界中。

本书可作为材料科学与工程专业教材，也可作为机械、动力类专业相应课程的教学参考书；对材料工程师和科技人员，也是一本有用的工具书。

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TABLE OF CONTENTS

出版说明
影印前言

Preface

CHAPTER 1

Introduction to Materials Science and Engineering 2

- 1.1 Materials and Engineering 3
- 1.2 Materials Science and Engineering 6
- 1.3 Types of Materials 8
 - 1.3.1 Metallic materials 8
 - 1.3.2 Polymeric Materials 10
 - 1.3.3 Ceramic Materials 11
 - 1.3.4 Composite Materials 13
 - 1.3.5 Electronic Materials 15
- 1.4 Competition Among Materials 16
- 1.5 Recent Advances in Materials Science and Technology and Future Trends 18
 - 1.5.1 Smart Materials 18
 - 1.5.2 Nanomaterials 19
- 1.6 Design and Selection 20
- 1.7 Summary 21
- 1.8 Definitions 21
- 1.9 Problems 22
- 1.10 Materials Selection and Design Problems 23

CHAPTER 2

Atomic Structure and Bonding 24

- 2.1 The Structure of Atoms 25
- 2.2 Atomic Numbers and Atomic Masses 26
 - 2.2.1 Atomic Numbers 26
 - 2.2.2 Atomic Masses 26
- 2.3 The Electronic Structure of Atoms 29
 - 2.3.1 The Hydrogen Atom 29
 - 2.3.2 Quantum Numbers of Electrons of Atoms 33

2.4

2.3.3 *Electronic Structure of Multielectron Atoms* 35

2.3.4 *Electronic Structure and Chemical Reactivity* 39

Types of Atomic and Molecular Bonds 41

2.4.1 *Primary Atomic Bonds* 42

2.4.2 *Secondary Atomic and Molecular Bonds* 42

2.5

Ionic Bonding 42

2.5.1 *Ionic Bonding in General* 42

2.5.2 *Interionic Forces for an Ion Pair* 43

2.5.3 *Interionic Energies for an Ion Pair* 46

2.5.4 *Ion Arrangements in Ionic Solids* 47

2.5.5 *Bonding Energies of Ionic Solids* 48

2.6

Covalent Bonding 49

2.6.1 *Covalent Bonding in the Hydrogen Molecule* 49

2.6.2 *Covalent Bonding in Other Diatomic Molecules* 50

2.6.3 *Covalent Bonding by Carbon* 51

2.6.4 *Covalent Bonding in Carbon-Containing Molecules* 53

2.6.5 *Benzene* 53

2.7

Metallic Bonding 55

2.8

Secondary Bonding 59

2.8.1 *Fluctuating Dipoles* 60

2.8.2 *Permanent Dipoles* 61

2.9

Mixed Bonding 62

2.9.1 *Ionic-Covalent Mixed Bonding* 62

2.9.2 *Metallic-Covalent Mixed Bonding* 63

2.9.3 *Metallic-Ionic Mixed Bonding* 64

2.10

Summary 64

2.11

Definitions 65

2.12

Problems 66

2.13

Materials Selection and Design Problems 70

CHAPTER 3**Crystal and Amorphous Structure in Materials 72**

- 3.1** The Space Lattice and Unit Cells 73
- 3.2** Crystal Systems and Bravais Lattices 74
- 3.3** Principal Metallic Crystal Structures 75
 - 3.3.1** *Body-Centered Cubic (BCC) Crystal Structure* 77
 - 3.3.2** *Face-Centered Cubic (FCC) Crystal Structure* 80
 - 3.3.3** *Hexagonal Close-Packed (HCP) Crystal Structure* 81
- 3.4** Atom Positions in Cubic Unit Cells 83
- 3.5** Directions in Cubic Unit Cells 84
- 3.6** Miller Indices for Crystallographic Planes in Cubic Unit Cells 88
- 3.7** Crystallographic Planes and Directions in Hexagonal Crystal Structure 93
 - 3.7.1** *Indices for Crystal Planes in HCP Unit Cells* 93
 - 3.7.2** *Direction Indices in HCP Unit Cells* 94
- 3.8** Comparison of FCC, HCP, and BCC Crystal Structures 96
 - 3.8.1** *FCC and HCP Crystal Structures* 96
 - 3.8.2** *BCC Crystal Structure* 98
- 3.9** Volume, Planar, and Linear Density Unit-Cell Calculations 98
 - 3.9.1** *Volume Density* 98
 - 3.9.2** *Planar Atomic Density* 99
 - 3.9.3** *Linear Atomic Density* 101
- 3.10** Polymorphism or Allotropy 102
- 3.11** Crystal Structure Analysis 103
 - 3.11.1** *X-Ray Sources* 104
 - 3.11.2** *X-Ray Diffraction* 105
 - 3.11.3** *X-Ray Diffraction Analysis of Crystal Structures* 107
- 3.12** Amorphous Materials 113
- 3.13** Summary 114

- 3.14** Definitions 115
- 3.15** Problems 116
- 3.16** Materials Selection and Design Problems 122

CHAPTER 4**Solidification and Crystalline Imperfections 124**

- 4.1** Solidification of Metals 125
 - 4.1.1** *The Formation of Stable Nuclei in Liquid Metals* 127
 - 4.1.2** *Growth of Crystals in Liquid Metal and Formation of a Grain Structure* 132
 - 4.1.3** *Grain Structure of Industrial Castings* 133
- 4.2** Solidification of Single Crystals 134
- 4.3** Metallic Solid Solutions 138
 - 4.3.1** *Substitutional Solid Solutions* 139
 - 4.3.2** *Interstitial Solid Solutions* 141
- 4.4** Crystalline Imperfections 143
 - 4.4.1** *Point Defects* 143
 - 4.4.2** *Line Defects (Dislocations)* 144
 - 4.4.3** *Planar Defects* 147
 - 4.4.4** *Volume Defects* 150
- 4.5** Experimental Techniques for Identification of Microstructure and Defects 151
 - 4.5.1** *Optical Metallography, ASTM Grain Size, and Grain Diameter Determination* 151
 - 4.5.2** *Scanning Electron Microscopy (SEM)* 156
 - 4.5.3** *Transmission Electron Microscopy (TEM)* 158
 - 4.5.4** *High-Resolution Transmission Electron Microscopy (HRTEM)* 159
 - 4.5.5** *Scanning Probe Microscopes and Atomic Resolution* 161
- 4.6** Summary 166
- 4.7** Definitions 166
- 4.8** Problems 168
- 4.9** Materials Selection and Design Problems 170

CHAPTER 5**Thermally Activated Processes and Diffusion in Solids 172**

- 5.1 Rate Processes in Solids 173
- 5.2 Atomic Diffusion in Solids 177
 - 5.2.1 Diffusion in Solids in General 177
 - 5.2.2 Diffusion Mechanisms 177
 - 5.2.3 Steady-State Diffusion 180
 - 5.2.4 Non-Steady-State Diffusion 182
- 5.3 Industrial Applications of Diffusion Processes 184
 - 5.3.1 Case Hardening of Steel by Gas Carburizing 184
 - 5.3.2 Impurity Diffusion into Silicon Wafers for Integrated Circuits 188
- 5.4 Effect of Temperature on Diffusion in Solids 191
- 5.5 Summary 195
- 5.6 Definitions 195
- 5.7 Problems 196
- 5.8 Materials Selection and Design Problems 198

CHAPTER 6**Mechanical Properties of Metals I 200**

- 6.1 The Processing of Metals and Alloys 201
 - 6.1.1 The Casting of Metals and Alloys 201
 - 6.1.2 Hot and Cold Rolling of Metals and Alloys 203
 - 6.1.3 Extrusion of Metals and Alloys 208
 - 6.1.4 Forging 209
 - 6.1.5 Other Metal-Forming Processes 211
- 6.2 Stress and Strain in Metals 212
 - 6.2.1 Elastic and Plastic Deformation 213
 - 6.2.2 Engineering Stress and Engineering Strain 213
 - 6.2.3 Poisson's Ratio 216
 - 6.2.4 Shear Stress and Shear Strain 216
- 6.3 The Tensile Test and the Engineering Stress-Strain Diagram 217
 - 6.3.1 Mechanical Property Data Obtained from the Tensile Test and the Engineering Stress-Strain Diagram 220
 - 6.3.2 Comparison of Engineering Stress-Strain Curves for Selected Alloys 225
 - 6.3.3 True Stress and True Strain 225
- 6.4 Hardness and Hardness Testing 227
- 6.5 Plastic Deformation of Metal Single Crystals 229
 - 6.5.1 Slipbands and Slip Lines on the Surface of Metal Crystals 229
 - 6.5.2 Plastic Deformation in Metal Crystals by the Slip Mechanism 232
 - 6.5.3 Slip Systems 234
 - 6.5.4 Critical Resolved Shear Stress for Metal Single Crystals 235
 - 6.5.5 Schmid's Law 237
 - 6.5.6 Twinning 240
- 6.6 Plastic Deformation of Polycrystalline Metals 242
 - 6.6.1 Effect of Grain Boundaries on the Strength of Metals 242
 - 6.6.2 Effect of Plastic Deformation on Grain Shape and Dislocation Arrangements 244
 - 6.6.3 Effect of Cold Plastic Deformation on Increasing the Strength of Metals 246
- 6.7 Solid-Solution Strengthening of Metals 247
- 6.8 Recovery and Recrystallization of Plastically Deformed Metals 249
 - 6.8.1 Structure of a Heavily Cold-Worked Metal before Reheating 250
 - 6.8.2 Recovery 251
 - 6.8.3 Recrystallization 252
- 6.9 Superplasticity in Metals 257
- 6.10 Nanocrystalline Metals 259
- 6.11 Summary 261
- 6.12 Definitions 262
- 6.13 Problems 263
- 6.14 Materials Selection and Design Problems 268

CHAPTER 7**Mechanical Properties of Metals II 270**

- 7.1** Fracture of Metals 271
 - 7.1.1** Ductile Fracture 272
 - 7.1.2** Brittle Fracture 273
 - 7.1.3** Toughness and Impact Testing 276
 - 7.1.4** Ductile to Brittle Transition Temperature 276
 - 7.1.5** Fracture Toughness 279
- 7.2** Fatigue of Metals 281
 - 7.2.1** Cyclic Stresses 285
 - 7.2.2** Basic Structural Changes that Occur in a Ductile Metal in the Fatigue Process 286
 - 7.2.3** Some Major Factors that Affect the Fatigue Strength of a Metal 287
- 7.3** Fatigue Crack Propagation Rate 288
 - 7.3.1** Correlation of Fatigue Crack Propagation with Stress and Crack Length 288
 - 7.3.2** Fatigue Crack Growth Rate versus Stress-Intensity Factor Range Plots 290
 - 7.3.3** Fatigue Life Calculations 292
- 7.4** Creep and Stress Rupture of Metals 294
 - 7.4.1** Creep of Metals 294
 - 7.4.2** The Creep Test 296
 - 7.4.3** Creep-Rupture Test 297
- 7.5** Graphical representation of Creep- and Stress-Rupture Time-Temperature Data Using the Larsen-Miller Parameter 298
- 7.6** A Case Study in Failure of Metallic Components 300
- 7.7** Recent Advances and Future Directions in Improving the Mechanical Performance of Metals 303
 - 7.7.1** Improving Ductility and Strength Simultaneously 303
 - 7.7.2** Fatigue Behavior in Nanocrystalline Metals 305
- 7.8** Summary 305
- 7.9** Definitions 306

- 7.10** Problems 307

- 7.11** Materials Selection and Design Problems 309

CHAPTER 8**Phase Diagrams 310**

- 8.1** Phase Diagrams of Pure Substances 311
- 8.2** Gibbs Phase Rule 313
- 8.3** Cooling Curves 314
- 8.4** Binary Isomorphous Alloy Systems 315
- 8.5** The Lever Rule 318
- 8.6** Nonequilibrium Solidification of Alloys 322
- 8.7** Binary Eutectic Alloy Systems 326
- 8.8** Binary Peritectic Alloy Systems 333
- 8.9** Binary Monotectic Systems 338
- 8.10** Invariant Reactions 339
- 8.11** Phase Diagrams with Intermediate Phases and Compounds 341
- 8.12** Ternary Phase Diagrams 345
- 8.13** Summary 348
- 8.14** Definitions 349
- 8.15** Problems 351
- 8.16** Materials Selection and Design Problems 355

CHAPTER 9**Engineering Alloys 358**

- 9.1** Production of Iron and Steel 360
 - 9.1.1** Production of Pig Iron in a Blast Furnace 360
 - 9.1.2** Steelmaking and Processing of Major Steel Product Forms 361
- 9.2** The Iron-Iron-Carbide System 363
 - 9.2.1** The Iron-Iron-Carbide Phase Diagram 363
 - 9.2.2** Solid Phases in the Fe-Fe₃C Phase Diagram 363
 - 9.2.3** Invariant Reactions in the Fe-Fe₃C Phase Diagram 364
 - 9.2.4** Slow Cooling of Plain-Carbon Steels 366

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10.2.6	Functionality of a Monomer	476	10.8	Thermosetting Plastics (Thermosets)	521
10.2.7	Structure of Noncrystalline Linear Polymers	476	10.8.1	Phenolics	523
10.2.8	Vinyl and Vinylidene Polymers	478	10.8.2	Epoxy Resins	525
10.2.9	Homopolymers and Copolymers	479	10.8.3	Unsaturated Polyesters	527
10.2.10	Other Methods of Polymerization	482	10.8.4	Amino Resins (Ureas and Melamines)	529
10.3	Industrial Polymerization Methods	484	10.9	Elastomers (Rubbers)	531
10.4	Crystallinity and Stereoisomerism in Some Thermoplastics	486	10.9.1	Natural Rubber	531
10.4.1	Solidification of Noncrystalline Thermoplastics	486	10.9.2	Synthetic Rubbers	534
10.4.2	Solidification of Partly Crystalline Thermoplastics	486	10.9.3	Properties of Polychloroprene Elastomers	536
10.4.3	Structure of Partly Crystalline Thermoplastic Materials	488	10.9.4	Vulcanization of Polychloroprene Elastomers	536
10.4.4	Stereoisomerism in Thermoplastics	489	10.10	Deformation and Strengthening of Plastic Materials	539
10.4.5	Ziegler and Natta Catalysts	490	10.10.1	Deformation Mechanisms for Thermoplastics	539
10.5	Processing of Plastic Materials	491	10.10.2	Strengthening of Thermoplastics	541
10.5.1	Processes Used for Thermoplastic Materials	492	10.10.3	Strengthening of Thermosetting Plastics	545
10.5.2	Processes Used for Thermosetting Materials	496	10.10.4	Effect of Temperature on the Strength of Plastic Materials	545
10.6	General-Purpose Thermoplastics	498	10.11	Creep and Fracture of Polymeric Materials	546
10.6.1	Polyethylene	500	10.11.1	Creep of Polymeric Materials	546
10.6.2	Polyvinyl Chloride and Copolymers	503	10.11.2	Stress Relaxation of Polymeric Materials	547
10.6.3	Polypropylene	505	10.11.3	Fracture of Polymeric Materials	550
10.6.4	Polystyrene	505	10.12	Polymers in Biomedical Applications—Biopolymers	552
10.6.5	Polyacrylonitrile	506	10.12.1	Cardiovascular Applications of Polymers	553
10.6.6	Styrene-Acrylonitrile (SAN)	507	10.12.2	Ophthalmic Applications	554
10.6.7	ABS	507	10.12.3	Drug-Delivery Systems	555
10.6.8	Polymethyl Methacrylate (PMMA)	509	10.12.4	Suture Materials	556
10.6.9	Fluoroplastics	510	10.12.5	Orthopedic Applications	556
10.7	Engineering Thermoplastics	511	10.13	Summary	557
10.7.1	Polyamides (Nylons)	512	10.14	Definitions	558
10.7.2	Polycarbonate	515	10.15	Problems	560
10.7.3	Phenylene Oxide-Based Resins	516	10.16	Materials Selection and Design Problems	570
10.7.4	Acetals	517			
10.7.5	Thermoplastic Polyesters	518			
10.7.6	Polyphenylene Sulfide	519			
10.7.7	Polyetherimide	520			
10.7.8	Polymer Alloys	521			