

## Contents

*Preface*    *xiii*  
*Acknowledgments*    *xv*

<b>Chapter 1</b>	<b>Introduction</b>	<b>1</b>
1.1	Some history	3
1.2	Classification of fibers	4
1.3	Stiff and strong fibers	6
<b>Chapter 2</b>	<b>Fibers and fiber products</b>	<b>8</b>
2.1	Definitions	9
2.2	Some important attributes of fibers	21
2.3	Important fiber types	29
2.4	General applications	31
2.5	Health hazards	35
<b>Chapter 3</b>	<b>Natural polymeric fibers</b>	<b>37</b>
3.1	Structure and properties of polymers	38
3.2	Natural fibers	43
3.3	Applications of natural polymeric fibers	56

Chapter 4	<b>Synthetic polymeric fibers</b>	58
4.1	Brief history of organic fibers	58
4.2	Processing	59
4.3	Environmental effects on polymeric fibers	65
4.4	Some important low modulus synthetic polymeric fibers	66
4.5	Strong and stiff polymeric fibers	73
4.6	Polymeric fibers with unusual characteristics	95
4.7	Applications of synthetic polymeric fibers	100
Chapter 5	<b>Metallic fibers</b>	108
5.1	General characteristics of metals	108
5.2	Processing of metallic filaments	110
5.3	Microstructure and properties of metallic fibers	115
5.4	Applications	129
Chapter 6	<b>Ceramic fibers</b>	132
6.1	Some important ceramics	132
6.2	Creep in ceramics	138
6.3	Natural ceramic fibers	139
6.4	Synthetic ceramic fibers	141
6.5	Ceramic whiskers	180
6.6	Applications	181
Chapter 7	<b>Glass fibers</b>	184
7.1	Basic physics of optical communication	184
7.2	Fabrication	187
7.3	Chemical composition	199
7.4	Structure	202
7.5	Properties	203
7.6	Applications	207
Chapter 8	<b>Carbon fibers</b>	211
8.1	Structure and properties of graphite	211
8.2	Processing of carbon fibers	214
8.3	Structure of carbon fibers	220
8.4	Properties of carbon fibers	221
8.5	High thermal conductivity carbon fibers	227

## Contents

xi

8.6	Hollow carbon fibers	230
8.7	Hazards of carbon fibers	230
8.8	Applications of carbon fibers	231
Chapter 9	<b>Experimental determination of fiber properties</b>	234
9.1	Physical properties	234
9.2	Mechanical properties	242
Chapter 10	<b>Statistical treatment of fiber strength</b>	254
10.1	Variability of fiber strength	256
10.2	Weibull statistics	256
10.3	Weibull distribution of fiber strength	258
10.4	Experimental determination of Weibull parameters for a fiber	262
10.5	Fiber bundle strength	265
	<i>References</i>	269
	<i>Suggested further reading</i>	278
	<b>Appendix A</b> <i>Some important units and conversion factors</i>	281
	<i>Author index</i>	285
	<i>Subject index</i>	290