

CONTENTS

	Page
Introduction	1
1 Types of Carbon Fibers	5
1.1 Classification of Carbon Fibers	6
1.2 Types of Element-Carbon Fibers	9
2 Structure of Carbon Fibers	15
2.1 General Remarks	15
2.2 Structural Models of Carbon Fibers	15
2.3 Structural Features of Element-Carbon Fibers	23
3 Properties of Carbon Fibers	31
3.1 General Considerations	31
3.2 Carbon Fiber Mechanical Properties	33
3.3 Chemical Stability	43
3.4 Thermophysical Properties	45
3.5 Electrical Properties of Carbon Fibers	49
3.6 Properties of Sorption-active Carbon Fibers	59
4 The Cellulose Carbonization Process	75
4.1 General Information	75
4.2 Kinetics of Cellulose Thermal Decomposition	84
4.3 Evaporation of Physically Bound Water	89
4.4 Dehydration of Cellulose	91
4.5 Cellulose Transformations at 230-400 °C	98
4.6 Pyrolysis at Temperatures over 400 °C	103
4.7 Factors Controlling the Cellulose Carbonization Process	107
5 Formation of Element-Carbon Fiber Materials	113
5.1 General Information	113
5.2 Effects of Basic Additives	119
5.3 Effects of Neutral Salt Additives	124
5.4 Effects of Acidic Additives	129
5.5 Effects of Metal Chlorides	134
5.6 Some Features of Cellulose Carbonization in the Presence of Additives at Heat-Treatment Temperatures over 400 °C	140
5.7 Production of PAN-Based Element-Carbon Fibers	146
6 Surface Modification of Carbon Fibers	155
6.1 Introduction of Ionic Groups	155
6.2 Oxidative Treatment	169
6.3 Carbon Fiber Activation to Enhance Adsorption	176
6.4 Ablative Treatment and Other Modes of Surface Modification	199
7 Applications of Carbon Fibers	207
7.1 General Considerations	207
7.2 Application Areas of Carbon Fiber Adsorbents	209
7.3 Element-Carbon Fibers as Catalysts in Chemical Reactions	221
7.4 Application Areas for Composite Materials	225
7.5 Other Application Areas of Element-Carbon Fibers	242
References	247