

Preface

Recently, carbon-based materials have received much attention for their many potential applications. The carbon fibers are very strong, stiff, and lightweight, enabling the carbon materials to deliver improved performance in several applications such as aerospace, sports, automotive, wind energy, oil and gas, infrastructure, defense, and semiconductors. However, the use of carbon fibers in cost-sensitive, high-volume industrial applications is limited because of their relatively high costs. However, its production is expected to increase because of its widespread use in high-volume industrial applications; therefore, the methods used for manufacturing carbon fibers and carbon fiber-reinforced composites and their structures and characteristics need to be investigated.

This book contains eight chapters that discuss the manufacturing methods, surface treatment, composite interfaces, microstructure–property relationships with underlying fundamental physical and mechanical principles, and applications of carbon fibers and their composites.

Chapter 1 provides a brief overview of carbons and carbon fibers, including their origin, history, manufacturing technologies, performance, and global market trends. Chapter 2 introduces the precursors and manufacturing processes of carbon fibers. Chapter 3 lists the various matrices for carbon fiber composites and focuses on the thermosetting resins and thermoplastic resins. Chapter 4 reviews the effect of surface treatment on the properties of carbon fiber composites. The characteristics of carbon fibers were measured using XPS, x-ray diffraction (XRD), EA, Raman spectroscopy, scanning tunneling microscopy (SEM), and atomic force microscopy (AFM) are presented in Chap. 5. The selection of manufacturing processes, matrix type, and molding processes for carbon fiber composites are presented in Chap. 6.

Chapter 7 describes the recent use of carbon fibers for applications such as adsorbents, energy storage, molecular sieves, catalysts, carbon fiber-reinforced composites, and carbon/carbon composites. Lastly, Chap. 8 introduces low-cost techniques for general industries, thin carbon fibers for extreme industries and smart carbon/carbon composites.

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