Preface

Unprecedented growth in the applications of composite materials has been observed in the past 10 years. Many commercial aircraft and passenger cars are now using composite materials. High cost of raw materials, intense labor dependence, and property variations from batch to batch were some of the factors against composite materials in their initial years of development, which are now slowly being overcome to enable many mainstream applications. As a variety of fiber and particle reinforced polymer matrix composites find applications in bulk quantities, the quest for improved next generation composites continues. Composites with nanoscale reinforcement, commonly referred to as nanocomposites, are now a major focus area in academic and industrial research laboratories.

Carbon nanofibers (CNFs) are one-dimensional nanoscale fibers that have outstanding mechanical, thermal, and electrical properties. CNFs have been considered for use in several specialty and commercial applications, including those in the aerospace, automobile, and marine industries. CNFs can be useful in enhancing and tailoring the properties of polymer matrix composites without a significant increase in bulk composite density. Such a consideration is critical for weight-saving structural applications.

The physical properties of polymer composites can be enhanced to a great extent through designed dispersion of CNFs. Such effects correspond to the structure and innate properties of CNFs, as well as how the composite is fabricated and processed. The structure of CNFs can vary depending on the fabrication method, thus resulting in varied strength and stiffness properties. Further processing such as additional heat and chemical treatment can result in further fiber structure and surface tailorability, which can lead to improved polymer composite performance when incorporated. Inclusion of CNFs has also demonstrated unique fracture failure mechanisms under various loading modes, as well as a range of loading rates.

From the vast body of literature on CNFs and their composite materials, it is possible to miss some contributions in the references. We have primarily covered the information available in journal publications. Conference publications and theses/dissertations are referred only if some critical information not available in peer-reviewed journals was taken from them. The field continues to evolve at a

rapid pace. We hope that this brief book will provide a starting point for interested readers to gain a basic understanding about the major material parameters and mechanical properties of CNFs and their nanocomposites. Readers can use the cited references for detailed information.

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