Preface

The arrangement of carbon atoms differentiates a pencil lead from pricey diamonds. New carbon materials such as fullerenes, carbon nanotubes, and graphene have attracted tremendous research interest and have led to a Nobel Prize. Clearly, the change of bond hybridization and molecular packing among carbon atoms can make very exciting new materials. Materials in the boron nitride (BN) system are structurally similar to the carbon solids. However, carbon and BN materials have different properties. For instance, graphite is a conductor while hexagonal-BN is an insulator. Hybridization of the carbon and BN phases (boron carbon-nitride, BCN or $B_xC_yN_z$) was predicted to create another series of novel materials with tunable properties intermediate to that of their precursors.

Materials within the B–C–N triangular zone offer new vistas for materials research. They include nanostructures of carbon, boron, and compounds constructed of multiple elements using B, C, and N atoms, the smallest atoms that can form the strongest covalent bonds in solids. Clearly, the ability to control bond hybridization, molecular packing, and composition of these materials is important in the creation of new materials. Significant research efforts have been invested in the B–C–N area in the past decade. However, there is no comprehensive reference available for the scientific community. Since this research area has been growing significantly in the past few years, a group of experts have came together in the making of this reference book on B–C–N nanotubes and related nanostructures.

This is the first book emphasizing the latest research on B–C–N nanomaterials, which will complement the many volumes devoted to carbon nanotubes. The contents cover all possible materials within the B–C–N triangular zone: Carbon, BN, BCN, carbon nitrides (CN), boron, boron carbide (B_xC_y), and doped carbon nanostructures. The first chapter provides fundamental background on all B–C–N materials, which is reviewed in detail in subsequent chapters. The chapter by Wang et al. focuses on multiwalled boron nitride nanotubes (BNNTs). This chapter is followed by a review of single wall BNNTs. The chapter by Arenal and Loiseau also summarizes the latest understanding of single wall nanotubes of BN, CN, B_xC_y, and $B_xC_yN_z$. The chapter by Blasé and Chacham outlines theoretical findings on the electronic properties of BNNTs, nanotubes of $B_xC_yN_z$ and novel heterojunctions of CNTs and BNNTs. The chapter by Wirtz and Rubio complements the chapters by Wang et al., Arenal and Loiseau, and Blasé and Chacham by reviewing the phonon

and optical properties of BNNTs. The chapter by Oku focuses on interesting BN nanostructures such as nanocages and nanohorns. The chapter by Yu and Wang describes experimental efforts on interesting nanostructures of CN and $B_xC_yN_z$, which are different from those discussed in the chapter by Arenal and Loiseau. The chapter by Filho and Terrones summarizes efforts on modified CNTs, an emerging area closely associated with CNTs. Finally, the chapter by Lau et al. reviews both experimental and theoretical efforts on boron and boron carbide materials. All these chapters have been carefully planned to fulfill the goal of providing a comprehensive reference book on B–C–N nanomaterials.

The volume editor acknowledges the superior contributions from all participating authors, which has made the successful and timely completion of this book possible.

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