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Preface

The field of nanocomposites involves the study of multiphase material where at least one of the constituent phases has one dimension less than 100 nm. The promise of nanocomposites lies in their multifunctionality, the possibility of realizing unique combinations of properties unachievable with traditional materials. The challenges in reaching this promise are tremendous. They include control over the distribution in size and dispersion of the nanosize constituents, tailoring and understanding the role of interfaces between structurally or chemically dissimilar phases on bulk properties. Large scale and controlled processing of many nanomaterials has yet to be achieved. Our mentor as we make progress down this road is mother Nature and her quintessential nanocomposite structures, for example, bone.

We realize that a book on a subject of such wide scope is a challenging endeavour. The recent explosion of research in this area introduces another practical limitation. What is written here should be read from the perspective of a dynamic and emerging field of science and technology. Rather than covering the entire spectrum of nanocomposite science and technology, we have picked three areas that provide the basic concepts and generic examples that define the overall nature of the field. In the first chapter we discuss nanocomposites based on inorganic materials and their applications. In the second chapter polymer based nanoparticle filled composites are detailed with an emphasis on interface engineering to obtain nanocomposites with optimum performance. The third chapter is about naturally occurring systems of nanocomposites and current steps towards naturally inspired synthetic nanocomposites. Finally a short chapter contributed by our colleagues highlights the possibility of using theoretical models and simulations for understanding nanocomposite properties. We hope our readers will find the book of value to further their research interests in this fascinating and fast evolving area of nanocomposites.

Troy, July 2003

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